Health Risk Realization Versus Warning: Impact on Lifestyle Behaviours

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Motivation

- Healthier lifestyle $\rightarrow$ improved living quality (lifespan and quality).
  - Treat and reverse chronic diseases: obesity, heart disease and diabetes.
  - Latter two are in top 10 global causes of death (WHO, 2020)
- Lifestyle behaviours: diet, exercise, smoking, alcohol consumption
- Yet, in the UK, about 20% of deaths are preventable (ONS, 2019)
  - Top 7 causes of preventable mortality: high blood pressure, smoking, cholesterol, obesity, poor diet, physical inactivity and alcohol consumption (UK Department of Health, 2014)

Motivation

- Why do people not undertake healthier behaviours?
  - Rational decision: aware of consequences, yet rational reasons to choose unhealthy behaviours (e.g. immediate benefits).
  - Behavioural explanation: want to change but not successful.
  - **Misinformed**: noisy signal about current health status (less healthy than currently believe).

Motivation

- Why do some individuals successfully change when most do not?
- Characteristics associated with successfully changing lifestyle behaviours (Lanza et al., 2001; Lunn et al., 2014)
  - Education
  - Social support
  - Certain types of personality characteristics
  - **Negative health event** $\rightarrow$ this paper
- Literature: lifestyle behaviour changes after a neg. health event details
  - Do people change? $\rightarrow$ mixed (medical lit.)
  - Which behaviours change? $\rightarrow$ mixed (medical + econ lit.)

Motivation + Contribution

1. Determine if individuals respond to a negative health event

2. Explore heterogeneity of response to precision of health status signal:
   - Diagnosis of realized health risk (realization, more precise)
   - Diagnosis of risk factors (warning, less precise)

What is a Negative Health Event?

- Learning about one's health status or experiencing a medical event
  - Experiencing heart attack or angina (chest pain)
  - Diagnosis of diabetes or high blood pressure

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- Negative Health Event: diagnosis of heart attack and/or diabetes
  - Allow concurrent diagnosis of high blood pressure (hbp) and/or angina

Secondary Analysis

- Realization: heart attack and/or diabetes *without* hbp or angina
- Warning: only high blood pressure and/or angina

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Primary Analysis

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Secondary Analysis

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Research Agenda

Research question:

- What is the impact of a negative health event on lifestyle behaviours?

Focusing on:

- Negative Health Event
  - Individuals more informed about current health status
  - Higher motivation for lifestyle changes after such an event
- Multiple lifestyle behaviours
  - Individuals may change some but not all behaviours
  - Changes may differ across individuals
    (by sex, age, education, health risk warning vs realization, etc.)

Data

- UK panel data: *Understanding Society*
- Started in 2009, currently 11 waves available
- Timeline
  - Wave 2 and 5 – lifestyle behaviours (diet, exercise, smoking, alcohol)
  - Wave 3 and 4 – neg. health event (heart attack, diabetes, hbp, angina)

Lifestyle Behaviours and their Variables

1. Diet
   - Daily servings of fruit and vegetables consumed
2. Exercise (walking)
   - Number of days walked at least 10 minutes, per month
   - Number of days walked at least 30 minutes, per month
3. Smoking
   - Smoking status
   - Daily number of cigarettes smoked
4. Drinking Alcohol
   - Drinking status
   - Number of days drank in past 7 days
   - Number of drinks on heaviest drinking day in past 7 days

Healthy Lifestyle Behaviour Index

- Outcome: Individual-level healthy lifestyle behaviour index
- The four lifestyle behaviours (diet, exercise, smoking and drinking alcohol) are combined equally into an index
- Each index component is standardized, mean zero and variance one

Details

Empirical Approach

Goal: How does negative health event change individual's lifestyle index?

$$\Delta Index_{it} = \beta NegHealthEvent_{it} + u_{it}$$

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Solution: Match similar treated and control using propensity score

- Propensity score: probability receive negative health event given selected observables
- Observables: ethnicity, education and risk factors: age, sex, high blood pressure and pre-treatment outcomes: fruit/veg, walking and smoking

Matched T&C graph Matched T&C table Common support

Descriptive Statistics

	count	mean	sd
Demographics			
Education: GCSE or other school qualification	15,853	0.28	0.45
Education: A-level etc	15,853	0.18	0.38
Education: Bachelor's degree or above	15,853	0.44	0.50
Non-white	15,853	0.11	0.31
Female	15,853	0.59	0.49
Age	15,853	47.84	16.07
Health Behaviours (pre-treatment)			
Number of servings of fruit/veg consumed per day	15,853	3.38	1.58
Number of days walked at least 10 minutes, past 4 weeks	15,853	15.43	10.80
Number of days walked at least 30 minutes, past 4 weeks	15,853	9.47	10.12
Does not smoke	15,853	0.81	0.39
Number of cigarettes smoked per day (for all)	15,853	2.38	6.20
Number of cigarettes smoked per day (for smokers)	3,234	11.69	8.94
Does not drink (at least in past 12 months)	15,853	0.12	0.32
Total drinks on heaviest drinking day, past 7 days (for all)	15,853	2.82	3.66
Total drinks on heaviest drinking day, past 7 days (for drinkers)	14,311	3.12	3.73
Number days did not drink, past 7 days (for all)	15,853	5.04	2.08
Number days did not drink, past 7 days (for drinkers)	14,311	4.83	2.08

T vs C

Main Analysis: Impact of Negative Health Event

Main Analysis

ATT of Negative Health Event on Change in Lifestyle Index

	Index	Fruit/Veg	Walk 10	Walk 30	Smoke	Nr Cigs	Drink	Heavy	Days
Neg. Health Event	0.227**								
	(0.111)								
Observations	15,853								

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, $^{+}$ $p < 0.05$ using a Hochberg correction with FDR of 0.1 (correction not applicable for index coefficient)

- Interpretation: increase behaviour(s) cumulatively by 0.227 Std Dev., E.g.:
  - Increase fruit/veg by 0.36 daily servings
  - Increase days per month walk 10 minutes by 4.90 days
  - Increase fruit/veg by 0.18 servings and days walk 10 mins by 2.45 days

Main Analysis

ATT of Negative Health Event on Change in Lifestyle Index and Components

	Index	Fruit/Veg	Walk 10	Walk 30	Smoke	Nr Cigs	Drink	Heavy	Days
Neg. Health Event	0.227**	0.222*	-1.489*	-1.326*	0.0361*	4.525***$^{+}$	0.0632**$^{+}$	0.174	0.0836
	(0.111)	(0.122)	(0.853)	(0.736)	(0.0193)	(1.582)	(0.0254)	(0.223)	(0.129)
Observations	15,853	15,853	15,853	15,853	15,853	3,234	15,853	14,311	14,311

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, $^{+}$ $p < 0.05$ using a Hochberg correction with FDR of 0.1 (correction not applicable for index coefficient)

- Statistically significant responses:
  - 20% reduction in number of cigarettes smoked
  - 1.6 p.p. increase in probability to quit drinking

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- Statistically significant responses:
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- Weakly statistically significant responses:
  - 5-7% *decrease* in days walking
  - 7% increase in fruit/veg consumption
  - 1.9 p.p. increase in probability to quit smoking

Wave | Ha vs D | Graphically

Heterogeneous Effects

Index

- Sex: No difference
- Age: Younger individuals respond ($<$62 years), older ones do not
- Education: Lower educated respond (less than bachelor degree), higher educated do not

Sex Age Education

Components

- Women increase probability to quit smoking and to quit drinking
- Women appear to make larger changes to index components
  - Including a few worsening components
  - Most differences not statistically significant between men and women

Details

Secondary Analysis: Health Risk Realization vs Warning

Secondary Analysis: Health Risk Realization versus Warning

- Impact of realized health risk versus risk factor on behaviour change
  - Realized health risk: only heart attack or diabetes diagnosis
  - Risk factor diagnosis: only high blood pressure or angina diagnosis
  - No diagnosis/control: none of the four diagnoses

  - *Recall*: Main analysis: Realized health risk but allows also getting risk factor diagnosis

- Risk factor diagnoses are precursors for realized health risks
  - But not everyone who gets a risk factor diagnosis gets a realized health risk later on

Secondary Analysis: Realized Health Risk Effects

ATT of Realized Health Risk Only on Change in Lifestyle Index

	Lifestyle Index
Realized Risk Only	0.534***
	(0.194)
Observations	12,339

- More than twice as large an effect compared to main analysis (0.227)
- E.g. increase of 0.84 servings of fruits/veg (0.36 in main analysis)

Secondary Analysis: Risk Factor Diagnosis Effects

ATT of Risk Factor Diagnosis on Change in Lifestyle Index

	Lifestyle Index
Risk Factor Diagnosis Only	0.0856
	(0.0865)
Observations	12,701

- Effect magnitude: more than six times smaller than realized risk

Recap Findings/Conclusions

Main Analysis

- Significant effect of negative health event on healthy lifestyle index
- Drivers: less cigarettes smoked & increased probability to quit drinking
- Men and women make similar size changes *on average*
  - Heterogeneity among behaviours.
  - Women respond more, but also with some negative changes; men respond much less.

Secondary Analysis

- Realized Health Risk
  - Highly significant effect
  - More than six times larger magnitude than for risk factor diagnosis
- Risk Factor Diagnosis
  - Little to no effect

Thank You!

Literature

Lifestyle behaviour changes after negative health event? $\rightarrow$ Mixed evidence

In general (medical literature):

- No – Intended lifestyle changes often not successfully maintained (Brownell & Cohen, 1995)
  - Even after a recent neg. health event (Condon & McCarthy, 2006)
- Maybe – Minimal changes after health event (Chong et al., 2017)
- Yes – Cases of successful large changes in lifestyle behaviours (Esselstyn et al., 1995; Ornish et al., 1998)

Literature

Lifestyle behaviour changes after negative health event? $\rightarrow$ Mixed evidence

Specific behaviours:

- Diet: mixed evidence[1,2,3,4]
- Exercise: no effect[2,3]
- Smoking: Some or no effect[2,3]
- Alcohol: Some or no effect[2,4]

Econ: 1. Hut & Oster (2022); 2. Bhalotra et al. (2020)

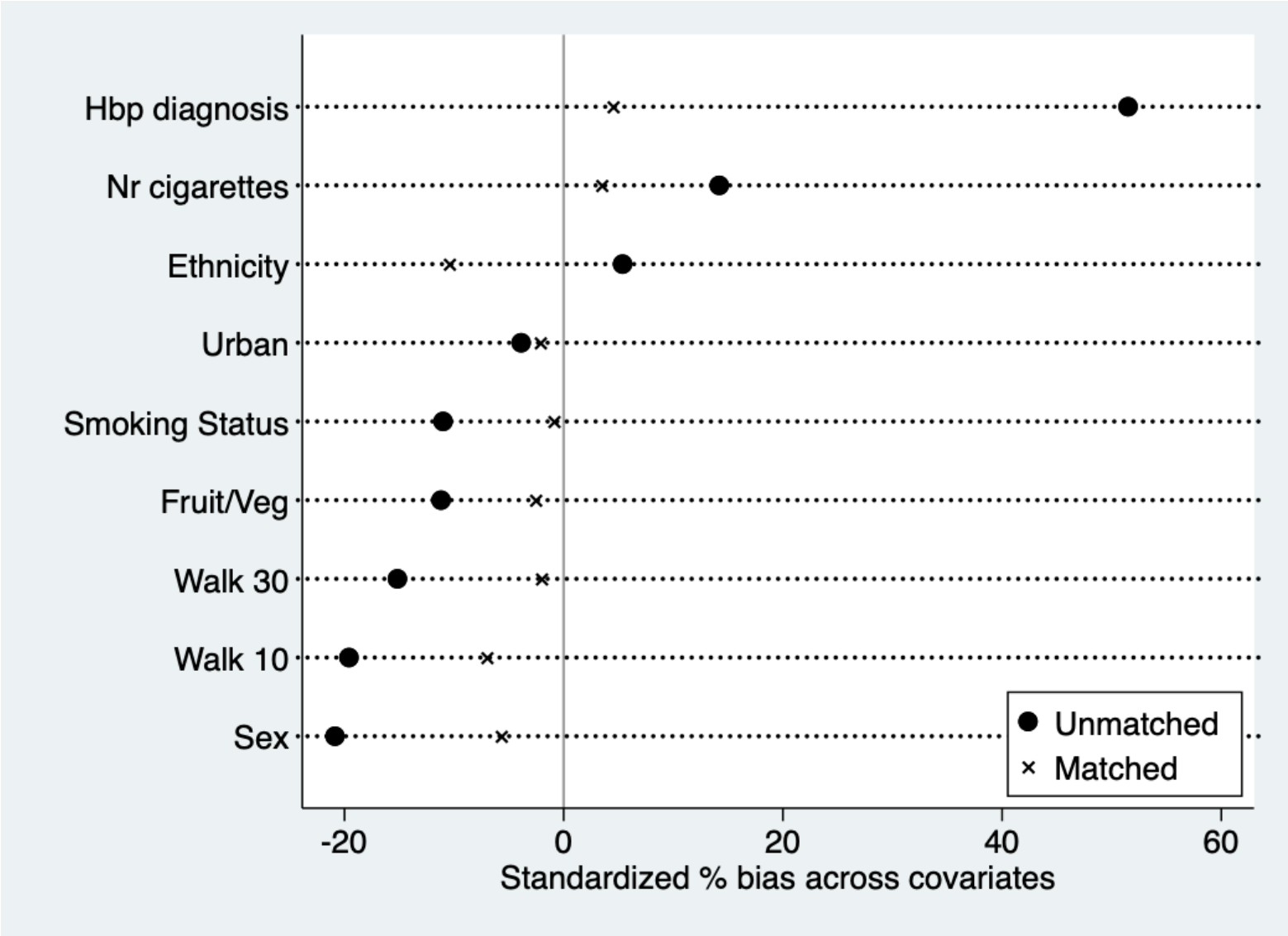
Medical: 3. Chong et al. (2017); 4. Fassier et al. (2017) Back

Matching Treated and Controls – Individual Covariates

Variable		Mean Treated	Mean Control	Standardized Difference (%)	% Reduction St. Dif.	t-test p-value
Age	U	58.63	47.89	66.7		0.000
	M	59.41	58.08	8.3	87.6	0.350
Sex - Female	U	0.49	0.59	−20.9		0.000
	M	0.46	0.49	−5.7	72.7	0.543
Ethnicity - non-white	U	0.17	0.15	5.4		0.297
	M	0.09	0.12	−10.4	−94.2	0.185
Educ. - GCSE	U	0.33	0.29	8.1		0.120
	M	0.34	0.33	0.5	93.6	0.956
Educ. - A level	U	0.15	0.18	−5.8		0.287
	M	0.15	0.16	−2.3	59.4	0.797
Educ. - Bachelor	U	0.26	0.41	−33.1		0.000
	M	0.29	0.29	0.7	98.0	0.941
Rural	U	0.22	0.24	−3.9		0.468
	M	0.24	0.25	−2.1	45.0	0.822
Employment Status - PT	U	0.10	0.17	−19.7		0.001
	M	0.11	0.11	−0.9	95.3	0.913
Employment Status - FT	U	0.22	0.41	−43.1		0.000
	M	0.23	0.24	−2.0	95.4	0.822
Fruit/Veg	U	3.14	3.31	−11.2		0.043
	M	3.20	3.24	−2.6	77.1	0.780
Walk 10	U	13.14	15.32	−19.6		0.000
	M	12.87	13.65	−7.0	64.2	0.451
Walk 30	U	7.73	9.27	−15.2		0.004
	M	7.83	8.03	−2.0	86.6	0.825
Smoking Status - no	U	0.75	0.80	−11.0		0.031
	M	0.76	0.77	−0.9	91.9	0.925
Nr Cigarettes	U	3.49	2.50	14.2		0.003
	M	3.52	3.28	3.5	75.6	0.738

Back

Percent Standardized Difference (Bias) across Propensity Score Estimation Covariates Before and After Matching



Back

Summary Stats: Comparing Matched Treated and Controls

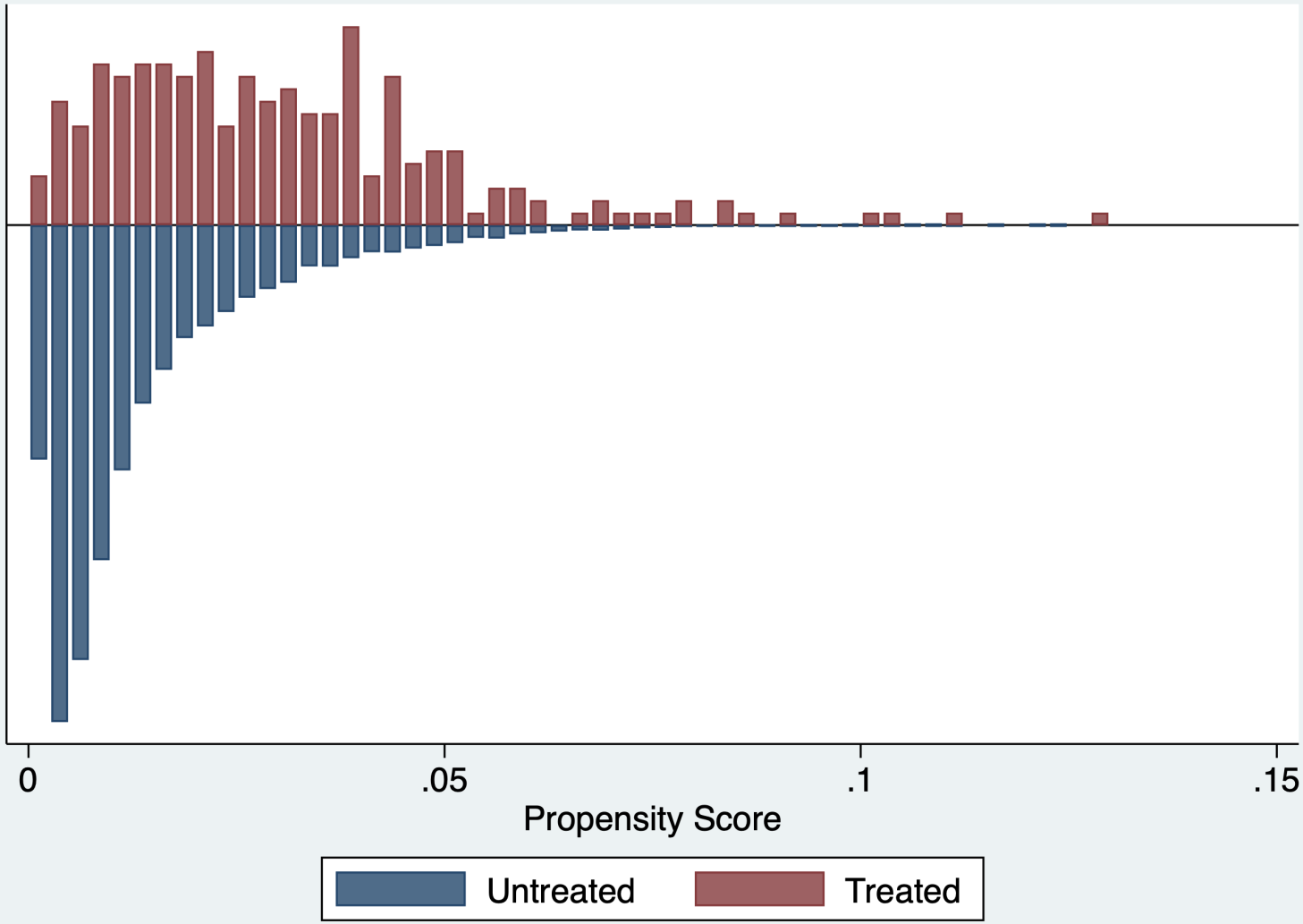
Variable	Mean Treated	Mean Control
Demographics		
Age	59.41	58.08
Female	0.46	0.49
Non-white	0.09	0.12
Education: No qualification	0.22	0.22
Education: GCSE or other school qualification	0.34	0.33
Education: A-level etc	0.15	0.16
Education: Bachelor's degree or above	0.29	0.29
Urban	0.24	0.25
Employment status: Inactive	0.66	0.65
Employment status: PT Employed	0.11	0.11
Employment status: FT Employed	0.23	0.24
Health Behaviours (pre-treatment)		
Number of servings of fruit/veg consumed per day	3.20	3.24
Number of days walked at least 10 minutes, past 4 weeks	12.87	13.65
Number of days walked at least 30 minutes, past 4 weeks	7.83	8.03
Does not smoke	0.76	0.76
Number of cigarettes smoked per day	3.52	3.28
Does not drink (at least in past 12 months)	0.13	0.14
Total drinks on heaviest drinking day, past 7 days	2.39	2.58
Number days did not drink, past 7 days	5.25	4.93
Pre-treatment Healthy Lifestyle Behaviours Index Score		
Healthy Behaviour Index	−0.45	−0.41

Note: None of the differences between treated and control are statistically significantly different from one another at the 5% level (or even at the 10% level). For the smoking and alcohol variables the full sample is used, regardless of whether individuals smoke or drink.

Empirical Approach | Descriptive Statistics

Propensity Score Histogram

- Common support for all treated units



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Hochberg Correction

a.k.a. Benjamin-Hochberg (B-H) multiple hypothesis testing correction

- Sort p-values from smallest to largest
- Calculate B-H critical value for each p-value using $\frac{i}{m}Q$
  - Where i is p-value rank ($i = 1$ is the smallest), m is total number of tests, Q is false discovery rate (FDR).
- Check which p-values significant under B-H correction using FDR 0.1.

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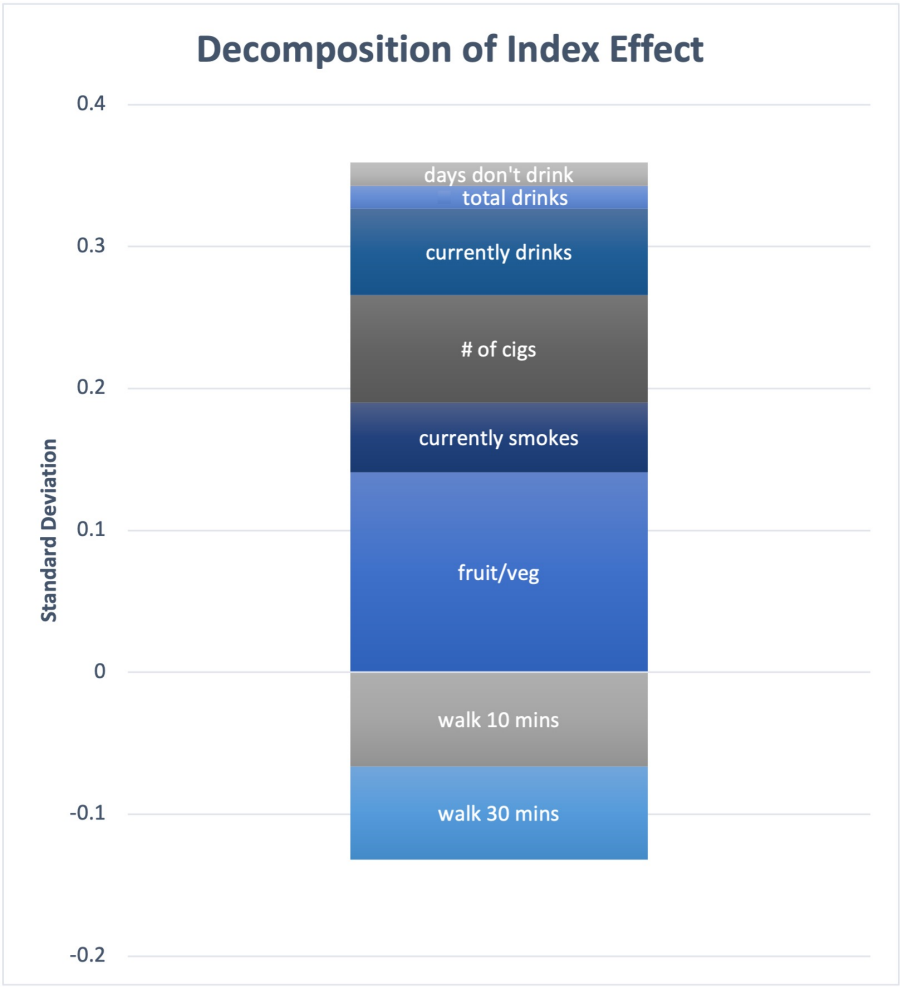
Overview of Index Decomposition Findings - Main Analysis



- Stat. significant responses:
  - 1.6 p.p. increase in probability to not drink
  - 20% reduction in number of cigarettes smoked
- Weakly stat. sig. responses:
  - 5-7% *decrease* in days walking
  - 7% increase in fruit/veg consumption
  - 1.9 p.p. increase in probability to not smoke

Back

Main Analysis Effect, by Sex

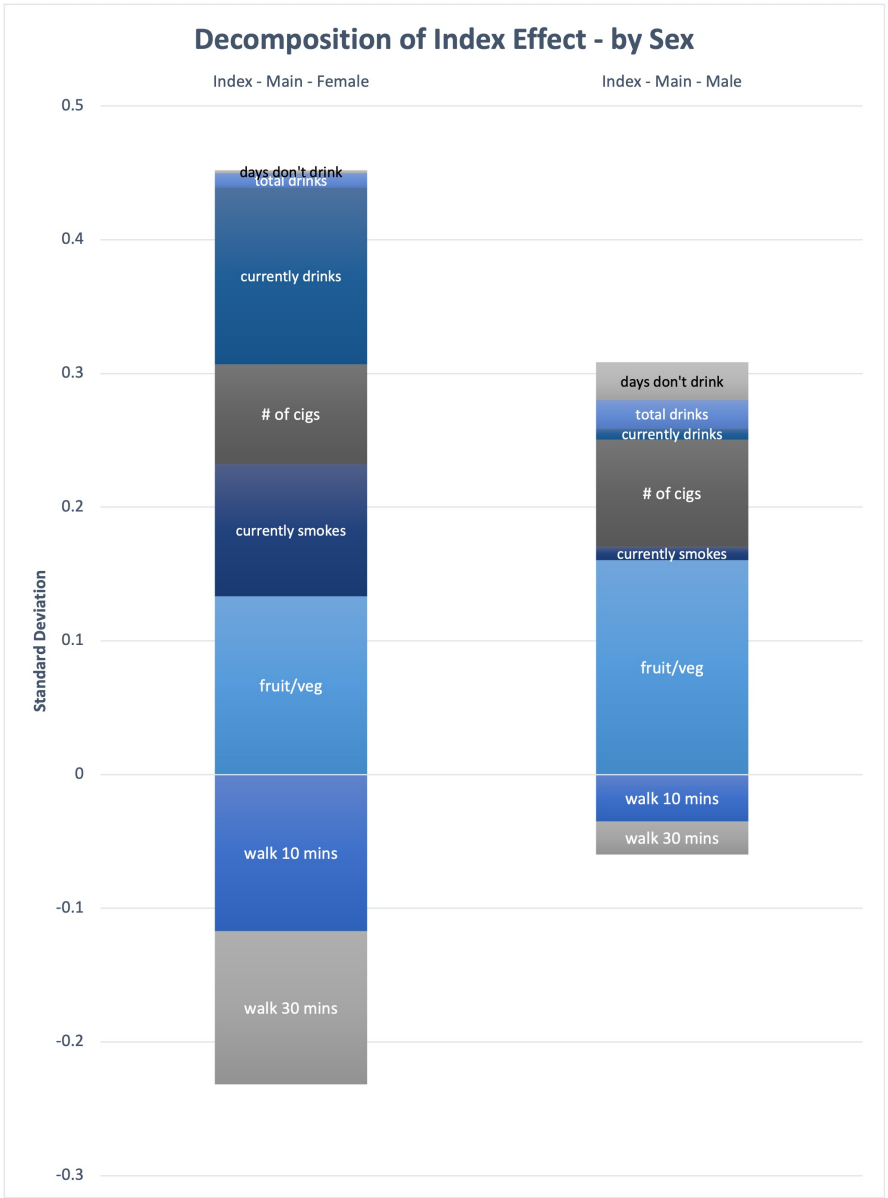
ATT of Negative Health Event on Change in Lifestyle Index, By Sex

	Lifestyle Index Female	Lifestyle Index Male
Negative Health Event	0.220	0.248*
	(0.180)	(0.138)
Observations	9,311	6,542

- Difference not statistically significant
- Heterogeneous effects among individual index components

Back

Overview of Index Decomposition Findings - by Sex



- Stat. significant responses:
  - Female: 4.2 p.p. increase in probability to not drink
  - Female: 3.9 p.p. increase in probability to not smoke
  - Female: 8-12% *decrease* in days walking
- Weakly stat. sig. responses:
  - Concern insufficient power
  - Male: 21% decrease in daily number of cigarettes
  - Male: 8% increase in fruit and veg consumption

Back

Heterogeneous Effect by Median Age

	Younger (< 62 years)	Older (≥ 62 years)
Negative Health Event	0.452***	0.0391
	(0.170)	(0.145)
Observations	12,231	3,622

Bootstrap standard errors in parentheses, 1000 reps

Kernel matching (0.0075 bandwidth). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Only younger individuals respond to negative health event

	Younger (≤ 58 years)	Older (> 58 years)
Realized Health Risk	0.540**	0.551*
	(0.255)	(0.313)
Observations	9,820	2,519

Kernel matching (0.00375 bandwidth)

- *Both* younger and older individuals respond equally to realized risk

	Younger (≤ 55 years)	Older (> 55 years)
Risk Factor Diagnosis	0.173	0.0186
	(0.131)	(0.108)
Observations	9,392	3,309

Kernel matching (0.0075 bandwidth)

- No heterogeneous effect by age for risk factor diagnosis

Back to main heterogeneity End

Heterogeneous Effect by (no) Higher Education

	No Higher Education	Some Higher Education
Negative Health Event	0.294**	0.0603
	(0.139)	(0.177)
Observations	8,904	6,949

Bootstrap standard errors in parentheses, 1000 reps

Kernel matching (0.0075 bandwidth). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Only lower educated individuals (less than bachelor) respond

	No Higher Education	Some Higher Education
Realized Health Risk	0.717***	0.114
	(0.262)	(0.254)
Observations	6,540	5,799

Kernel matching (0.0375 bandwidth).

- Still only lower educated respond to realized risk (dif. from age)

	No Higher Education	Some Higher Education
Risk Factor Diagnosis	0.103	0.0530
	(0.109)	(0.150)
Observations	6,767	5,934

Kernel matching (0.0075 bandwidth)

- No heterogeneous effect by education with risk factor diagnosis only

Back to main heterogeneity

Heterogeneous Effect by Wave of Diagnosis

Negative Health Event on Index — Split by Timing of Diagnosis

	Wave 3	Wave 4
Negative Health Event	0.309*	0.187
	(0.187)	(0.155)
Total Observations	15,713	15,738
Treated Observations	92	117

Omitted if diagnosis in both waves, $< 10\%$ of sample

Bootstrap standard errors in parentheses, 1000 reps

Kernel matching (0.0075 bandwidth)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Difference not statistically significant
- Suggests if anything that people need time to adjust their behaviour

Back to main

Heterogeneous Effect by Diagnosis: Heart Attack vs Diabetes

Negative Health Event on Index — Split by Realized Health Risk

	Heart Attack	Diabetes
Negative Health Event	0.270	0.180
	(0.193)	(0.136)
Total Observations	15,695	15,776
Treated Observations	74	155

Omitted if both diagnoses received, 1% of sample

Bootstrap standard errors in parentheses, 1000 reps

Kernel matching (0.0075 bandwidth)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

- Difference not statistically significant

Back to main End

Healthy Lifestyle Behaviour Index

- Outcome: Individual-level healthy lifestyle behaviour index: $Index_i$
- The four lifestyle behaviours (B_k) combined equally into an index:

$$Index_i = \sum_{k=1}^{4} B_{ik}$$

- Each behaviour consists of the average one or more variables (j):

$$B_{i1} = z_{i1}, B_2 = \frac{z_{i2_a} + z_{i2_b}}{2}, B_3 = \frac{z_{i3_a} + z_{i3_b}}{2}, \text{and } B_4 = \frac{z_{i4_a} + z_{i4_b} + z_{i4_c}}{3}$$

- Where each variable is standardized, mean zero and variance one: $z_{ij} = \frac{x_{ij} - \mu_j}{\sigma_j}$

back

Attrition

- My analysis only includes individuals who have all necessary data. In particular, they must have data on the diagnoses experienced in waves 3 and 4; and have lifestyle behaviours in waves 2 and 5.
- There could be concern that I lose individuals who would have been in my sample had they not died (of particular concern those who die due to poor health). These are individuals who have no diagnosis in wave 2 and then die some time thereafter.
  - For those who do experience a diagnosis in wave 3 or 4 and then die before wave 5 this is not much of a concern, there are very few such individuals. Only six individuals experienced a diagnosis and then died before the wave 5 data collection; one of whom already misses a variable that results in omission from the analysis.
  - Regarding individuals who would have been in my sample in wave 2 and then die before the collection of data in wave 3. These are both the would-be-treated and would-be-controls. Though these people are perhaps the least healthy individuals of the entire population of my data, so possible more likely would-be-controls...

References I

Bhalotra, S., Delavande, A., Fisher, P., & James, J. (2020). The impact of a personalised blood pressure warning on health outcomes and behaviours. *Institute of Social and Economic Research (ISER) Working Paper Series; No. 2020-2*. Retrieved from https://www.iser.essex.ac.uk/research/publications/working-papers/iser/2020-02.pdf

Brownell, K. D., & Cohen, L. R. (1995). Adherence to dietary regimens 1: An overview of research. *Behavioral Medicine*, *20*(4), 149–154.

Chong, S., Ding, D., Byun, R., Comino, E., Bauman, A., & Jalaludin, B. (2017). Lifestyle changes after a diagnosis of type 2 diabetes. *Diabetes Spectrum*, *30*(1), 43–50.

Condon, C., & McCarthy, G. (2006). Lifestyle changes following acute myocardial infarction: Patients perspectives. *European Journal of Cardiovascular Nursing*, *5*(1), 37–44.

Esselstyn, C. B., Jr., Ellis, S. G., Medendorp, S. V., & Crowe, T. D. (1995). A strategy to arrest and reverse coronary artery disease: a 5-year longitudinal study of a single physician's practice. *Journal of Family Practice*, *41*(6), 560–568.

References II

Fassier, P., Zelek, L., Lécuyer, L., Bachmann, P., Touillaud, M., Druesne-Pecollo, N., ... others (2017). Modifications in dietary and alcohol intakes between before and after cancer diagnosis: Results from the prospective population-based nutrinet-santé cohort. *International Journal of Cancer*, *141*(3), 457–470.

Hut, S., & Oster, E. (2022). Changes in household diet: Determinants and predictability. *Journal of Public Economics*, *208*.

Lanza, E., Schatzkin, A., Daston, C., Corle, D., Freedman, L., Ballard-Barbash, R., ... the PPT Study Group (2001). Implementation of a 4-y, high-fiber, high-fruit-and-vegetable, low-fat dietary intervention: results of dietary changes in the polyp prevention trial. *American Journal of Clinical Nutrition*, *74*(3), 387–401.

Lunn, T. E., Nowson, C. A., Worsley, A., & Torres, S. J. (2014). Does personality affect dietary intake? *Nutrition*, *30*(4), 403–409.

ONS. (2019). *Avoidable mortality in the UK: 2017.* Office for National Statistics. Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/bulletins/avoidablemortalityinenglandandwales/2017

Ornish, D., Scherwitz, L. W., Billings, J. H., Gould, K. L., Merritt, T. A., Sparler, S., ... Brand, R. J. (1998). Intensive lifestyle changes for reversal of coronary heart disease. *Journal of the American Medical Association*, *280*(23), 2001–2007.

References III

UK Department of Health. (2014). *Living well for longer: National support for local action to reduce premature avoidable mortality.* UK Government. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/307703/LW4L.pdf

WHO. (2020, December 09). *The top 10 causes of death.* Retrieved from https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death