

# Retiring today keeps the doctor away? The causal effect of early retirement on medication use

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# Conclusion: perhaps

Table 1: Log odds ratios for the causal effect of retirement at age 60 on medication use (yes/no) at age 60-60.5

	predictor	MED all	painkillers	blood pressure	antidepressants
OLS	retired at 60	0.03	0.26**	0.14	0.16
Reduced form	1954 cohort	0.06	0.03	-0.08*	-0.02
TSLs	retired at 60	-2.12***	-0.64	2.48*	-0.01
	1954 cohort	-1.44***	-1.44***	-1.44***	-1.44***
G-estimation	retired at 60	-2.34*	-0.56	2.22**	0.54

Note: \*\*\* indicates significance at the  $\alpha = 0.001$  level, \*\* indicates significance at the  $\alpha = 0.01$  level and \* indicates significance at the  $\alpha = 0.05$  level

Painkillers: M02AA, N02A, N02B (antiinflammatory preparations, non-steroids for topical use, opioids, other analgesics and antipyretics)

Medication to reduce blood pressure: C02, C03, C07, C08, C09 (antihypertensives, diuretics, beta blocking agents, calcium channel blockers, agents acting on the renin-angiotensin system)

Antidepressants and medications for anxiety and sleep disorders: N05B N05C, N06A, N06C (anxiolytics, hypnotics and sedatives, antidepressants, psycholeptics and psychoanaleptics in combination)

(N02BE01, N02BE05, N02BA01, N02BA51, N02BB51 and 200 mg M01AE01 are not included)

## Conclusion: subgroups

Table 2: Log odds ratios for the causal effect of retirement at age 60 on medication use (yes/no) at age 60-60.5 for different subgroups

		MED			
subgroup		all	painkillers	blood pressure	antidepressants
blue-collar	TSLS	-0.22	-1.68	2.63	0.87
	G-estimation	-0.15	-1.43*	2.15	0.86
lower white-collar	TSLS	-2.86*	-0.88	0.77	0.32
	G-estimation	NA	-0.75	0.90	1.08
upper white-collar	TSLS	-5.50***	0.63	2.69	-0.73
	G-estimation	NA	0.73	1.91	-1.14
no occupation	TSLS	-0.82	-0.12	4.35	-0.60
	G-estimation	-0.89	0.24	3.83**	0.99
females	TSLS	-1.88*	-0.60	3.58**	-0.18
	G-estimation	-2.04	-0.57	3.16***	0.49
males	TSLS	-2.57*	-0.53	0.31	0.69
	G-estimation	-2.49	-0.55	0.43	0.73

Note: \*\*\* indicates significance at the  $\alpha = 0.001$  level, \*\* indicates significance at the  $\alpha = 0.01$  level and \* indicates significance at the  $\alpha = 0.05$  level

## Design

Table 3: Ages at which Early Retirement Pension (ERP) is available according to date of birth.

Date of Birth	ERP age
< 1954	60
≥ 01-January-1954	60.5
≥ 01-July-1954	61
≥ 01-January-1955	61.5
≥ 01-July-1955	62
≥ 01-January-1956	62.5
≥ 01-July-1956	63
≥ 01-January-1959	63.5
≥ 01-July-1959	64
> 1963	computed in relation to life expectancy

# Design

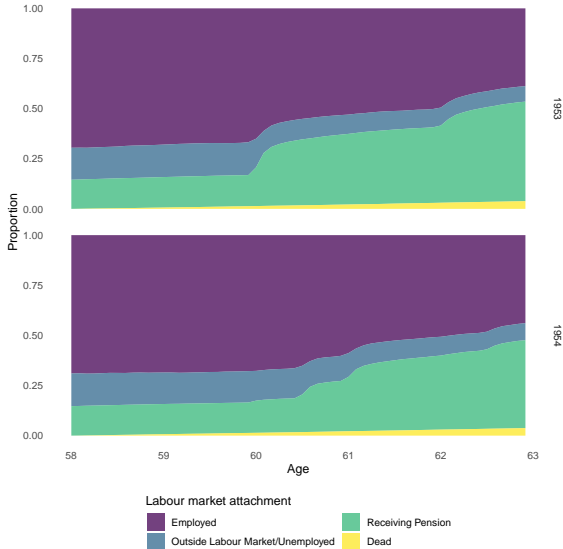


Figure 1: Attachment to the labour market over time for two cohorts.

## Design

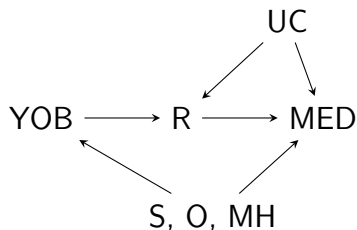


Figure 2: MED=medication use, R=retirement at age 60, YOB=year of birth(1954/1953), O=type of occupation (longest held 45-55), MH=medication history (#DDD 59.5-60), S=sex, UC=unmeasured confounders.

$$MED_i = \beta_0 + \beta_1 R_i + \beta_2 S_i + \beta_3 O_i + \beta_4 MH_i + u_i$$

$$R_i = \gamma_0 + \gamma_1 YOB_i + \gamma_2 S_i + \gamma_3 O_i + \gamma_4 MH_i + \nu_i$$

## IV DAG assumptions

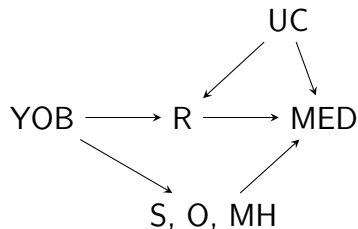


Figure 3: MED=medication use, R=retirement at age 60, YOB=year of birth(1954/1953), O=type of occupation (longest held 45-55), MH=medication history (#DDD 59.5-60), S=sex, UC=unmeasured confounders.

## IV DAG assumptions

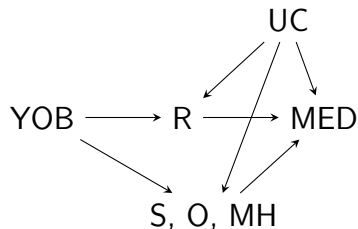
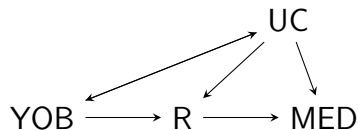


Figure 4: MED=medication use, R=retirement at age 60, YOB=year of birth(1954/1953), O=type of occupation (longest held 45-55), MH=medication history (#DDD 59.5-60), S=sex, UC=unmeasured confounders.



## IV DAG assumptions



S, O, MH

Figure 5: MED=medication use, R=retirement at age 60, YOB=year of birth(1954/1953), O=type of occupation (longest held 45-55), MH=medication history (#DDD 59.5-60), S=sex, UC=unmeasured confounders.

## Extension & Discussion

- ▶ 1950-1957 cohorts
- ▶ G-estimation for zero-inflated outcomes
- ▶ IV assumptions 2 & 3 (exclusion restriction and randomization criterion)?
- ▶ different medication types?

# Medication frequencies

Table 4: Most frequently used types of prescription medication ( $\leq 15\%$ ) in the period 2008-2017 among individuals aged 58-63 that have used prescription medication at least once.

medication type (ATC)	percentage	subtypes ( $\leq 10\%$ )
antiinfectives for systemic use (J01)	68%	penicillins
antiinflammatory and antirheumatic products (M01)	46%	ibuprofen
analgesics (N02)	45%	paracetamol, tramadol
agents acting on the renin-angiotensin system (C09)	32%	ACE inhibitors (plain), Angiotensin II receptor blockers (plain)
lipid modifying agents (C10)	30%	HMG CoA reductase inhibitors
drugs for acid related disorders (A02)	29%	proton pump inhibitors
ophthalmologicals (S01)	28%	antibiotics
corticosteroids, dermatological preparations (D07)	28%	corticosteroids, (potent, group III)
psycholeptics (N05)	21%	benzodiazepine derivatives + related drugs
antithrombotic agents (B01)	21%	platelet aggregation inhibitors
diuretics (C03)	20%	thiazides and potassium in combination
calcium channel blockers (C08)	19%	dihydropyridine derivatives
antifungals for dermatological use (D01)	17%	imidazole and triazole derivatives
beta blocking agents (C07)	17%	beta blocking agents (selective)
psychoanaleptics (N06)	17%	selective serotonin reuptake inhibitors
drugs for obstructive airway diseases (R03)	16%	selective beta-2-adrenoreceptor agonists
cough and cold preparations (R05)	16%	-
sex hormones and modulators of the genital system (G03)	15%	estradiol

# Results 1950 comparison

Table 5: Log odds ratios for the causal effect of retirement at age 60 on medication use (yes/no) at age 60-60.5

	predictor	MED	painkillers	blood pressure	antidepressants
		all			
OLS	retired at 60	0.01	0.25**	0.08	0.11
Reduced form	1954 cohort	-0.03	0.18***	-0.11**	-0.12***
TSLS	retired at 60	0.83	-4.20***	2.60**	2.81***
	1954 cohort	-1.46***	-1.48***	-1.47***	-1.47***
G-estimation	retired at 60	0.81	-2.06***	2.56***	4.86***

Note: \*\*\* indicates significance at the  $\alpha = 0.001$  level, \*\* indicates significance at the  $\alpha = 0.01$  level and \* indicates significance at the  $\alpha = 0.05$  level

# Results 1950 comparison

Table 6: Log odds ratios for the causal effect of retirement at age 60 on medication use (yes/no) at age 60-60.5 for different subgroups

		MED			
subgroup		all	painkillers	blood pressure	antidepressants
blue-collar	TSLS	1.29	-5.29***	1.08	2.84
	G-estimation	1.31	-2.37***	1.35	5.24
lower white-collar	TSLS	0.21	-5.21***	2.80	4.07**
	G-estimation	0.19	-2.39***	2.72**	NA
upper white-collar	TSLS	0.25	-2.12	4.56*	2.03
	G-estimation	-0.06	-1.59*	3.17**	2.83
no occupation	TSLS	2.20	-1.35	2.57	-1.97
	G-estimation	2.65	-0.98	2.99*	0.29
females	TSLS	0.82	-4.16***	2.47*	3.05**
	G-estimation	0.74	-2.15***	2.58***	4.69*
males	TSLS	0.78	-4.07**	2.93	2.69*
	G-estimation	1.05	-1.96***	2.67**	5.30

Note: \*\*\* indicates significance at the  $\alpha = 0.001$  level, \*\* indicates significance at the  $\alpha = 0.01$  level and \* indicates significance at the  $\alpha = 0.05$  level

