



University of  
**Sheffield**

# **How Does Unpaid Caregiving Affect EQ-5D? Does The Average Treatment Effect Differ For 3L And 5L?**

Becky Pennington  
b.pennington@sheffield.ac.uk

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# Disclaimers

This work was funded through my National Institute for Health and Care Research doctoral research fellowship (NIHR300160)

This work was supervised by Mónica Hernández Alava

I am a member of the National Institute for Health and Care Excellence (NICE) Technology Appraisal Committee A

All views expressed are my own and not necessarily reflective of those of NIHR, NICE or the University of Sheffield

# Background & research questions

Unpaid carers/caregivers have worse health-related quality of life than people who do not provide care:

- SF-6D worsens by 0.045 for every additional year caring (Pennington et al 2024)
- 80 articles identified that reported spillovers for family members/caregivers (Wittenberg et al 2019)
  - EQ-5D disutility of 0.015 for adult/elderly family carers in any condition (Davidson et al 2008, n=910, Sweden)
  - EQ-5D disutility of 0.10 for mothers of children with a congenital abnormality (Poley et al 2012, n=306, Netherlands)

EQ-5D-3L and 5L UK value sets differ:

- EQ-5D-5L scores are higher and in a smaller range (Mulhern et al, 2018)

Using EQ-5D-5L instead of 3L for patients:

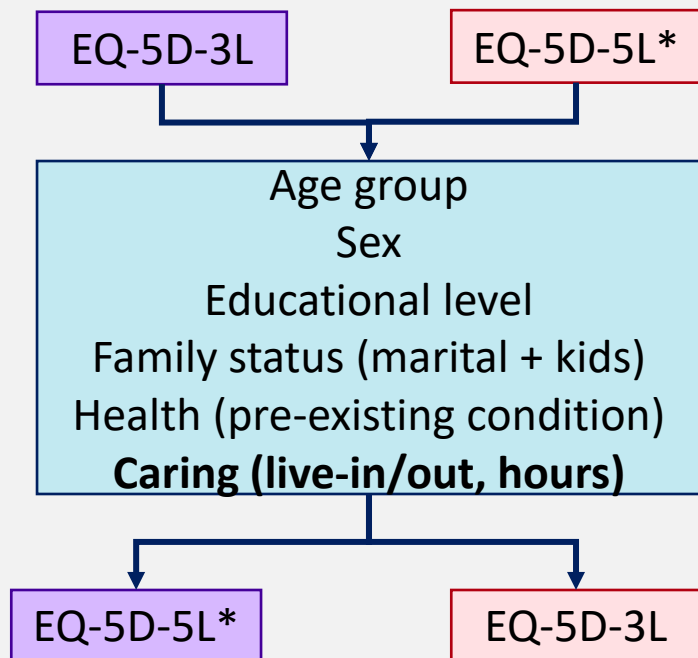
- assigns less value to improvements in quality of life
- leads to different cost-effectiveness estimates (Hernández Alava et al 2018, Pennington et al 2019)

Q1: How does unpaid caregiving affect EQ-5D in the UK?

Q2: Does the effect of caregiving differ between 3L and 5L?

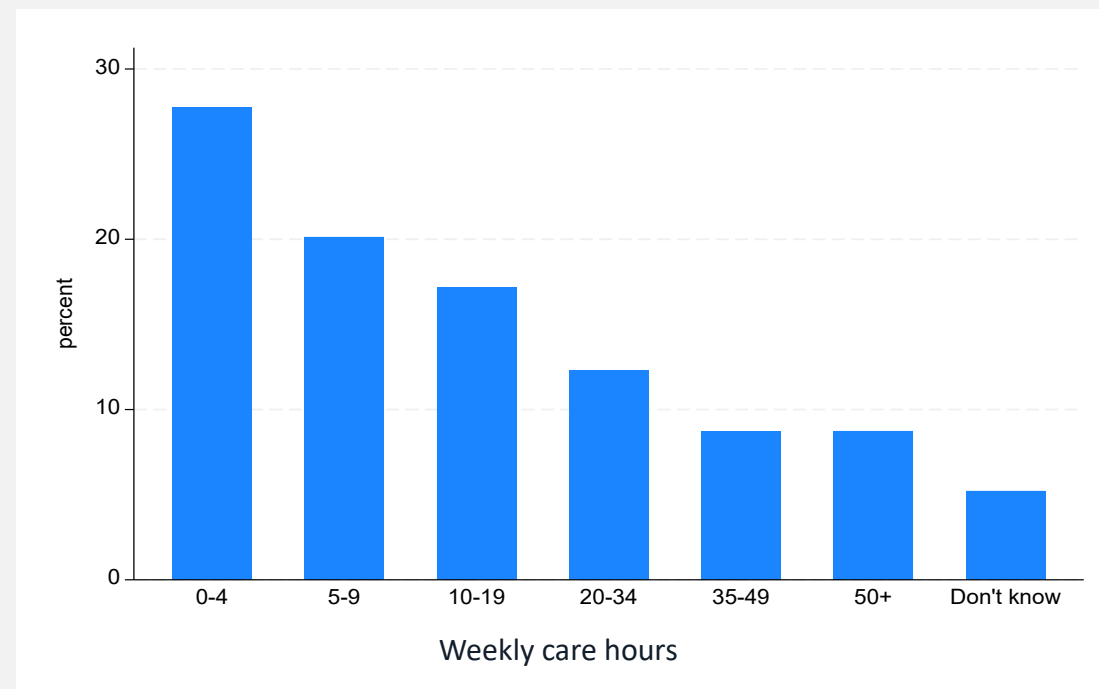
# Dataset

- Economic Evaluation Policy and Research Unit (EEPRU) dataset, April 2020, online
- Used to estimate the relationship between 3L and 5L responses (Hernandez Alava et al, 2023)
- 49,999 respondents in the UK

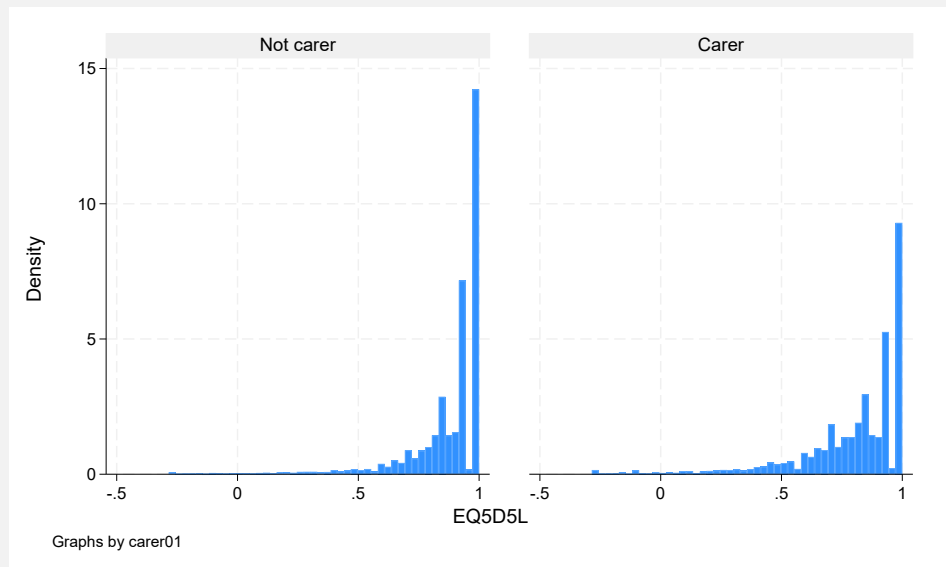
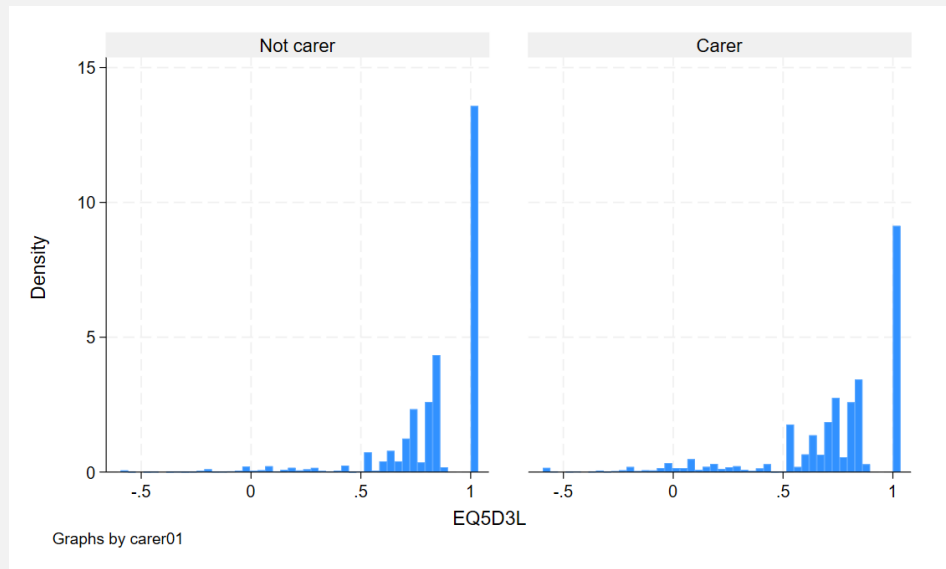


\* 5L valued using the English value set (Devlin 2018)

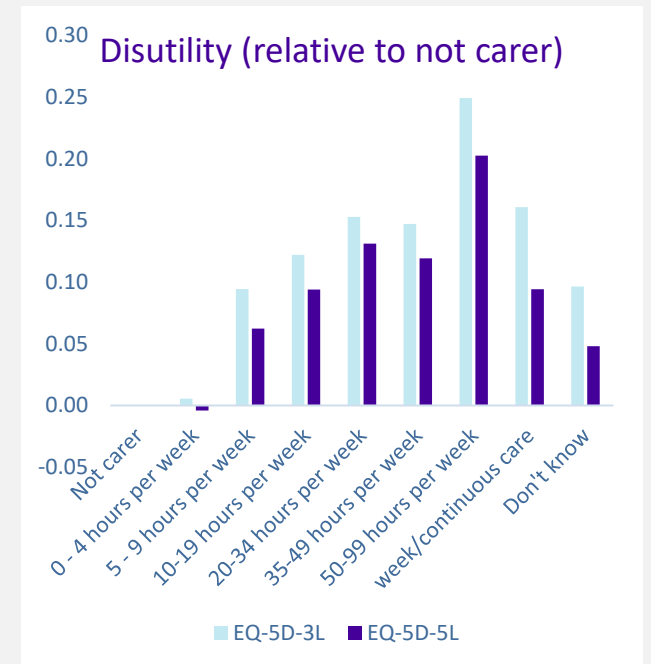
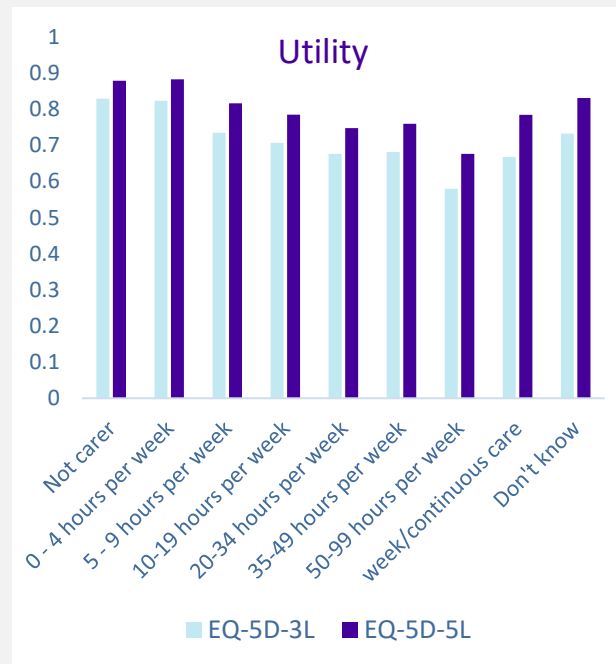
		Outside house-hold care	
		Yes	No
Inside house-hold care	Yes	3,451 7.05%	3,536 7.23%
	No	5,047 10.31%	36,901 75.41%



# Naïve comparison

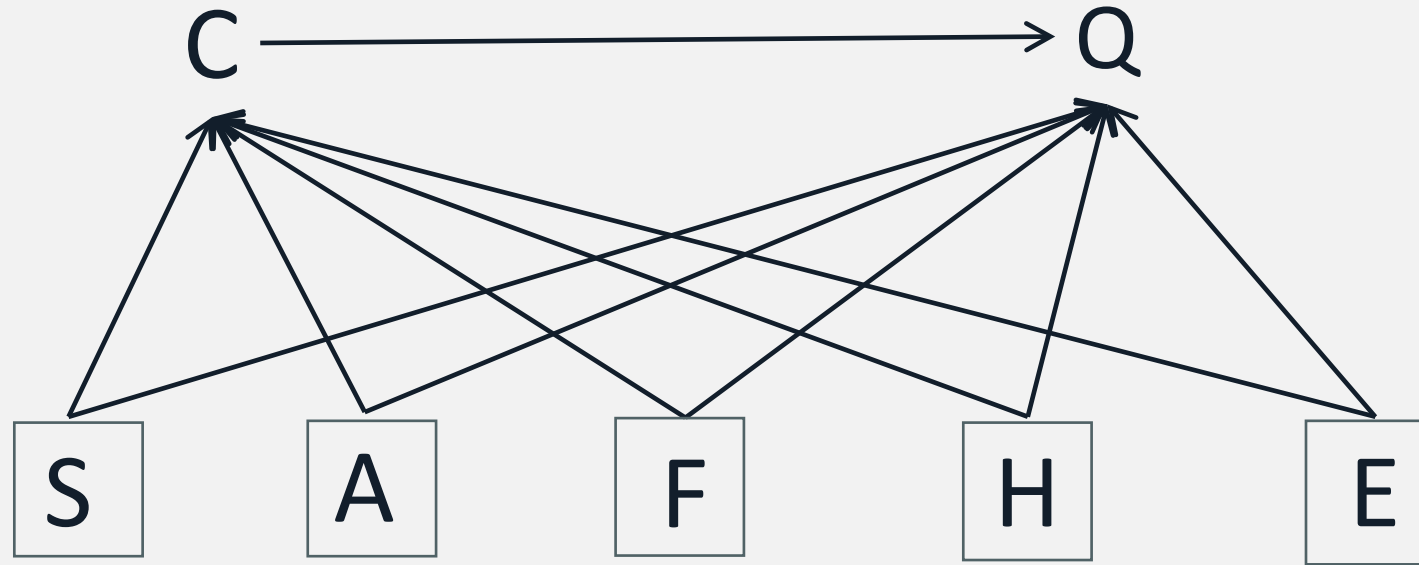


- Utilities are all higher with 5L than 3L (carers and non-carers)
- Carer disutilities are smaller with 5L than 3L
- Generally, higher volume caring hours = lower EQ-5D and higher disutility (exception 50-99 vs 100+)



- But caregiving wasn't randomised...
- How can we identify a *causal effect* of caregiving?

# Directed acyclic graph



C; Caring, Q; health-related quality of life, S: sex, A: age, F: family, H: health condition, E: education

- *Direct* path from C to Q represents a causal effect.  $C \rightarrow Q$ .
- *Backdoor path* from C to Q because S (sex) is correlated with C and sex is correlated with Q.  $C \leftarrow S \rightarrow Q$ . Sex is a confounder because it jointly determines C and Q.
- Age (A), family status (F), health condition (H), education (E) are also all confounders, so there are backdoor paths  $C \leftarrow A \rightarrow Q$ ,  $C \leftarrow F \rightarrow Q$ ,  $C \leftarrow H \rightarrow Q$ ,  $C \leftarrow E \rightarrow Q$ .
- These open backdoor paths create systematic and independent correlations between C and Q (introduce bias).
- We close the backdoor paths by *conditioning* on the confounders.

# Conditioning on confounders

## Regression

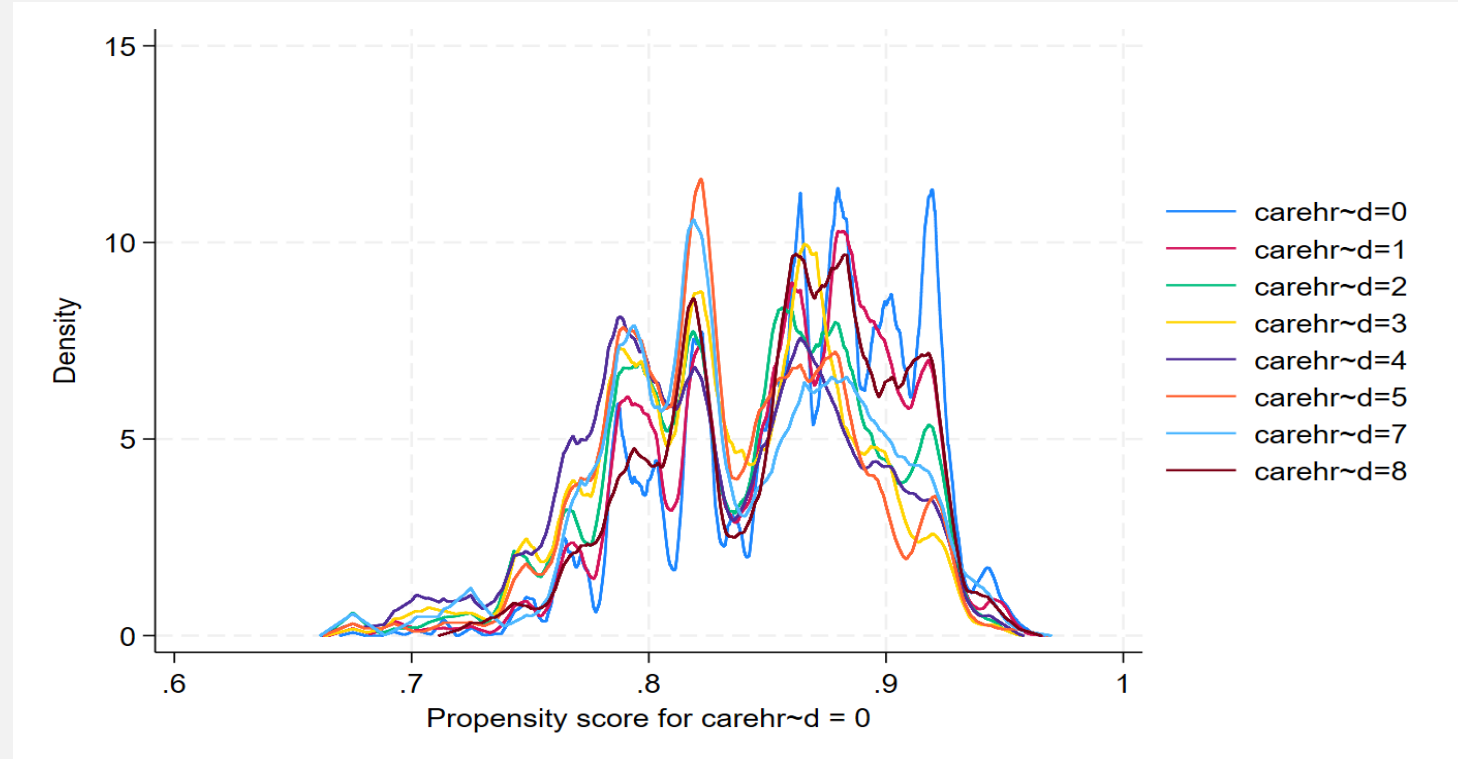
- Outcome predicted as a function of caring and confounders (“controlled for”)
- EQ-5D (3L or 5L) does not follow standard distributions
- Full health (11111) or not, modelled using probit distribution

## Inverse probability weighting (IPW)

- Multinomial logit model to predict the probability of belonging to the weekly hours of caregiving classes (as a function of the age, age squared, sex, education, family status, diagnosis of health condition)
- Each individual in the study is assigned a weight, inversely proportional to the probability of being in each class
- Weights balance the baseline distribution of covariates across groups, making them more comparable

## Checks: balance and overlap

- Collapsed 50-99 and 100+ hours of care as the confidence intervals overlapped, smallest groups
- Collapsed some confounders (education, family status) to reduce the number of strata
- Checked for balance (standardize differences close to 0, variance ratios close to 1), suggesting covariates balanced



- Overlap plot doesn't show peaks near 0 or 1, appears similar across categories

# Results: disutility relative to not a carer

\* Not significant at 5% level

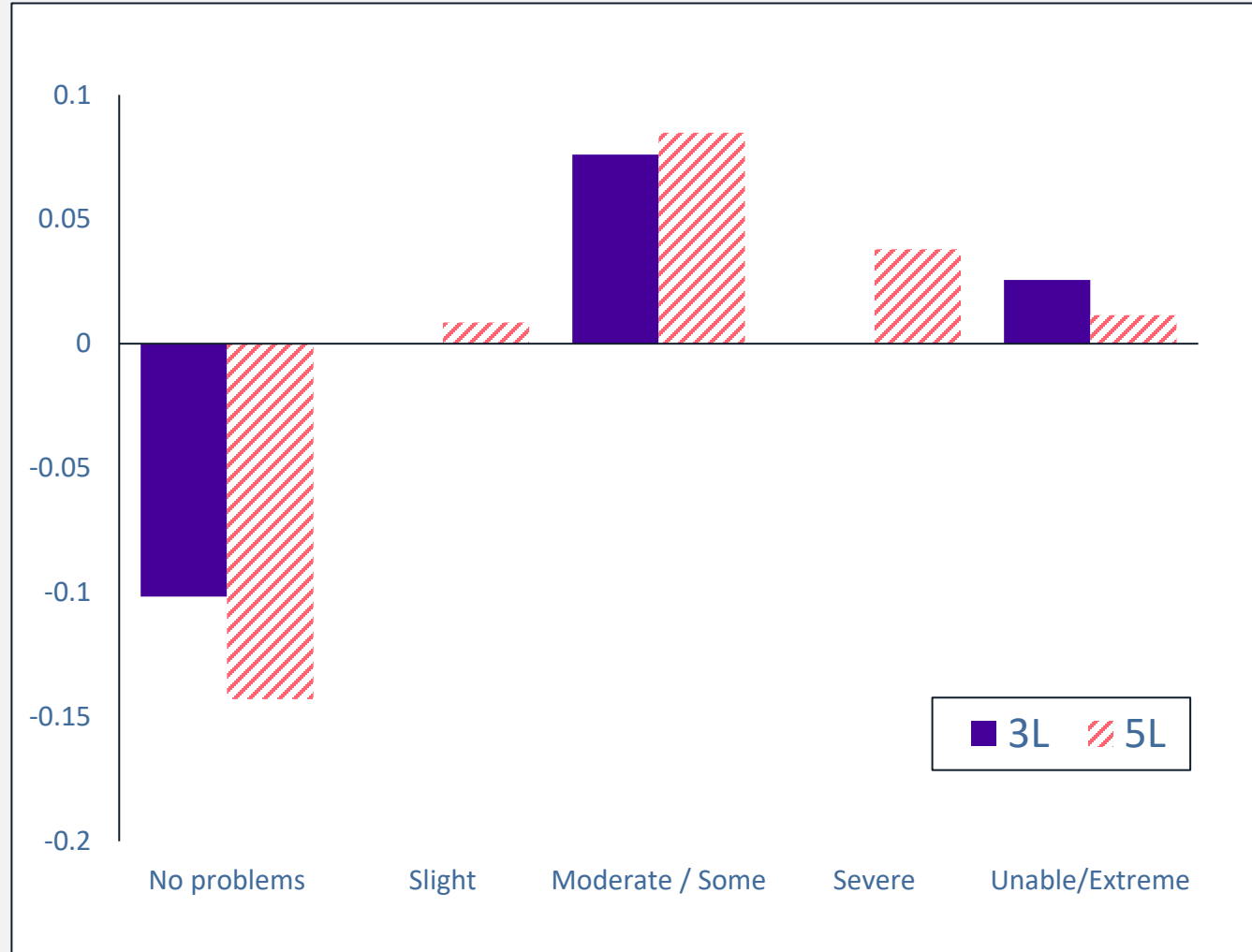
		EQ-5D-3L	EQ-5D-5L
Not carer: utility		0.826	0.877
Carer disutility			
Hours of care per week	0-4	-0.001*	0.008*
	5-9	-0.072	-0.044
	10-19	-0.097	-0.071
	20-34	-0.099	-0.082
	35-49	-0.090	-0.076
	50+	-0.157	-0.109

- Except 0-4 hours/week, carers have statistically significantly worse EQ-5D (3L and 5L) than people who are not carers
- The disutility generally increases as hours of care/week increases
- The disutilities are larger for 3L than 5L
- Why is this?

# Results: Mobility, 50+ hours care/week, marginal effects

The reduction in carers reporting “no problems” is greater for 5L than 3L.

We might expect this would increase the ATE for 5L.

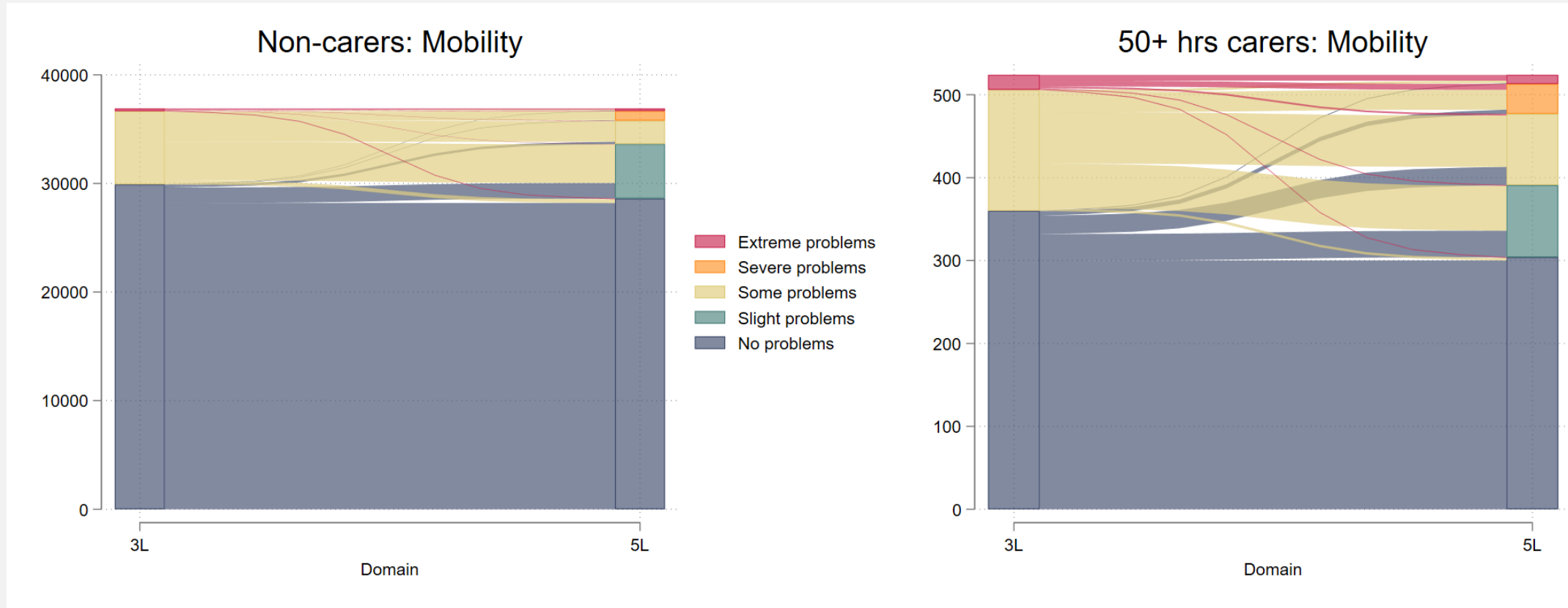


But with 5L, most of the people reporting the worst 3L level now report the second-worst level.

The decrements for the two worst 5L levels are smaller than decrement for the worst 3L level.

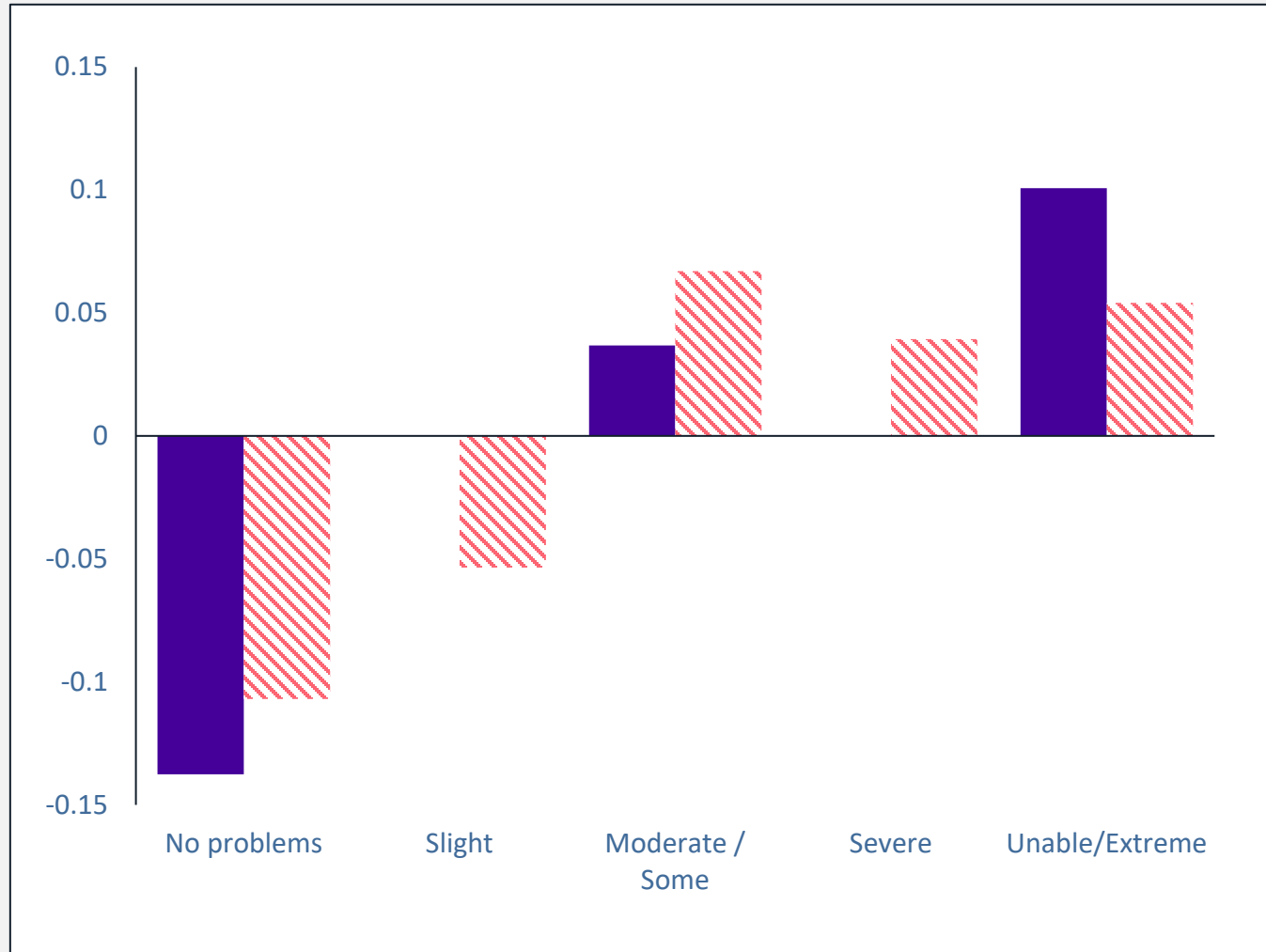
Self-care domain is similar

# Results: Mobility, raw data, non-carers and 50+ hours



# Results: Anxiety/depression, 50+ hours care/week, marginal effects

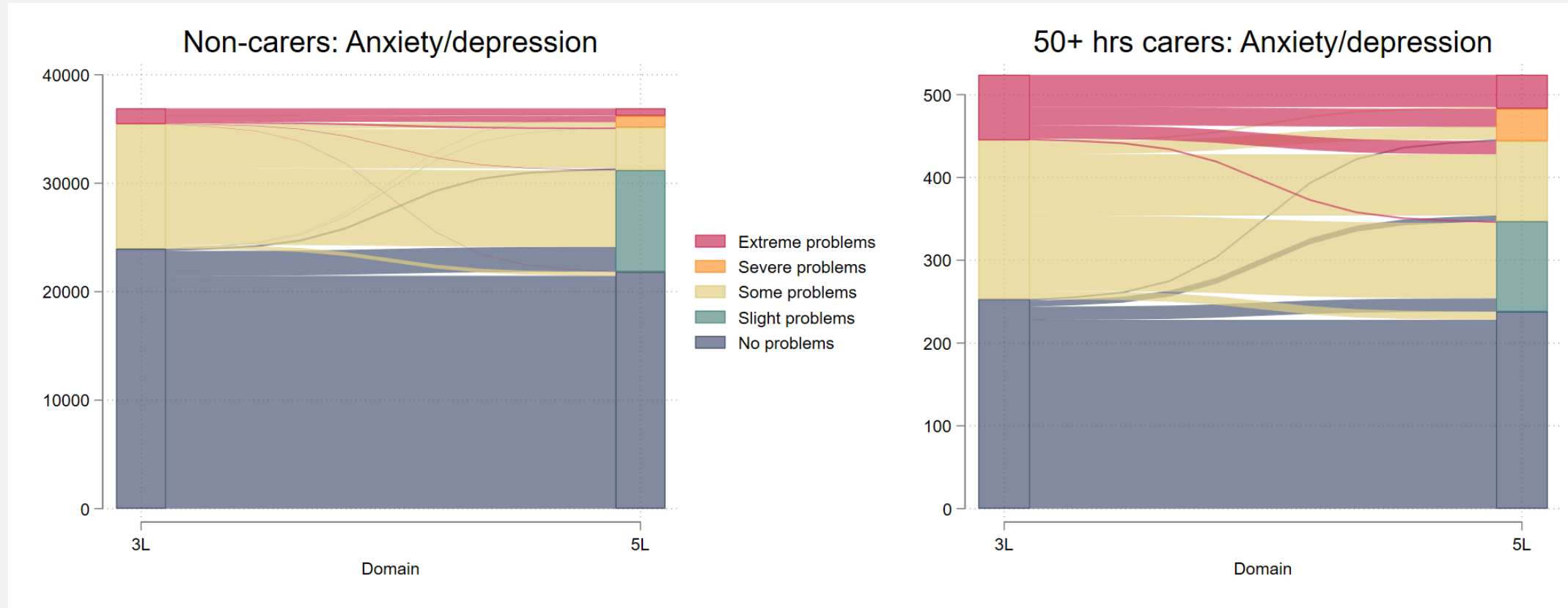
The reduction in carers reporting “no problems” is smaller for 5L than 3L (because more non-carers report the second-best level with 5L and the best level with 3L).



The decrements for the two worst 5L levels are *bigger* than the worst 3L level (even though the increase in the worst level is higher with 3L than 5L).

This would increase the ATE...but N3 term included in 3L.

# Results: Anxiety/depression, raw data, non-carers and 50+ hours



# Implications

- Using 5L instead of 3L will show smaller impacts to carers' HRQoL
- Interventions for carers will be less cost-effective using 5L than 3L
- Impact on interventions for patients with spillovers on carers will vary:
  - Reduction in carer burden will be smaller, so interventions that reduce carer burden by improving patient's health status will be less cost-effective
  - The effect on interventions which extend patient's lives is more complicated, as the decrease in carer QALYs from increasing the duration of their HRQoL impact will be less, so the effect of the "carer QALY trap" will be smaller

We will update (and publish) this work once the revised UK 5L value set is available

# References

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# Questions

**[b.pennington@sheffield.ac.uk](mailto:b.pennington@sheffield.ac.uk)**

# Results: reduction in proportion reporting full health 11111

		EQ-5D-3L	EQ-5D-5L
Not carer: proportion in full health		0.464	0.392
Carer reduction in proportion in full health			
Hours of care per week	0-4	-0.040*	-0.012
	5-9	-0.115	-0.091
	10-19	-0.137	-0.098
	20-34	-0.165	-0.133
	35-49	-0.104	-0.082
	50+	-0.125	-0.071

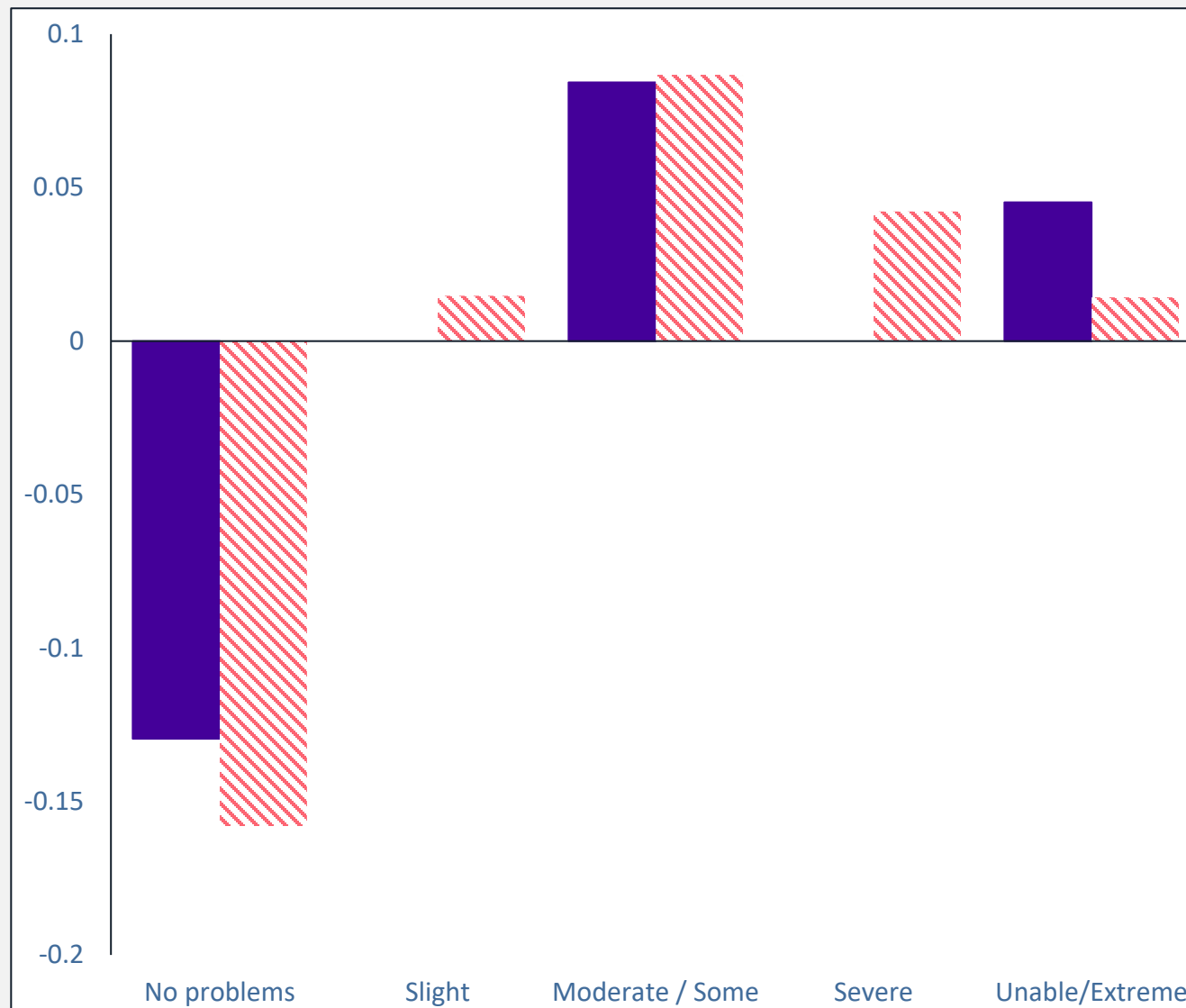
\* Not significant at 5% level

- Fewer people report full health with EQ-5D-5L than 3L
  - 39% 5L versus 46% 3L
- The *reduction* in the proportion of carers reporting full health is smaller with EQ-5D-5L than 3L

# Results: Domains – Usual activities, 50+ hours care/week

The reduction in carers reporting “no problems” is greater for 5L than 3L (for most domains and most care hours).

We might this would increase the ATE for 5L.

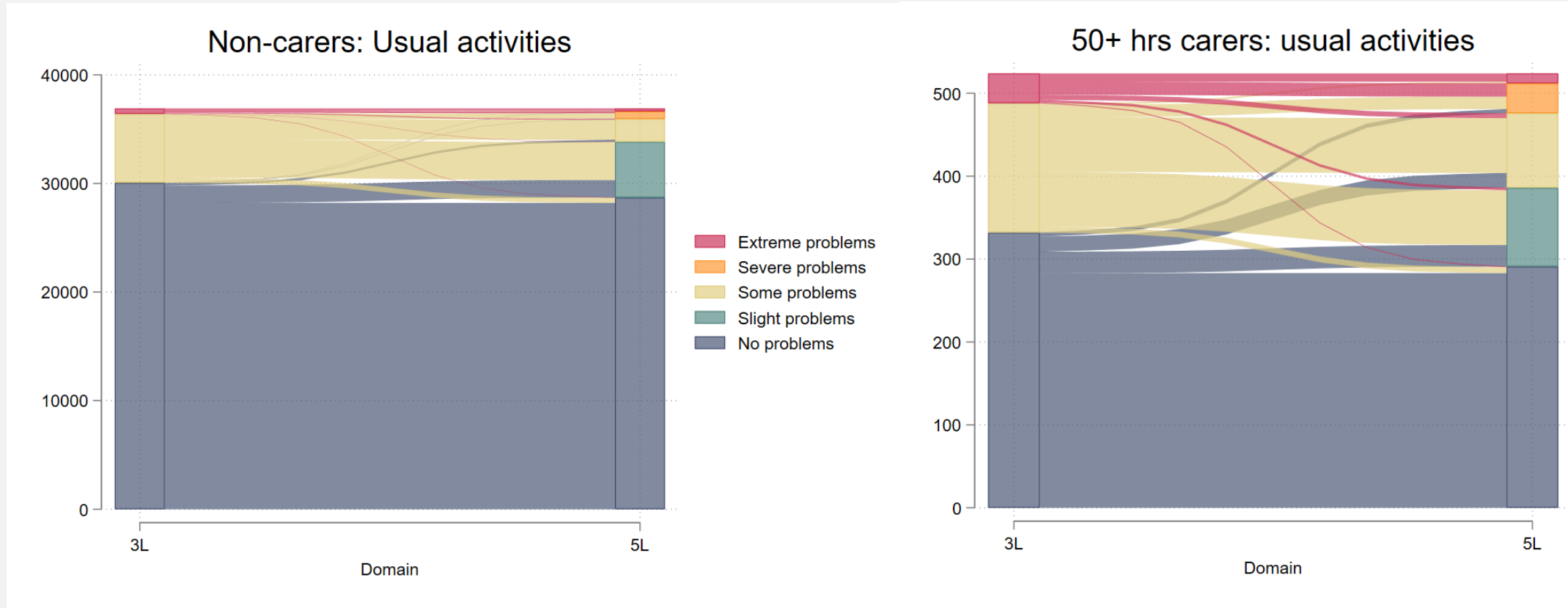


But with 5L, most of the people reporting the worst 3L level now report the second-worst level.

The decrements for the two worst 5L levels are *bigger* than decrement for the worst 3L level.

But 3L has an “N3” term with an additional decrement for anyone reporting the worst level of any domain.

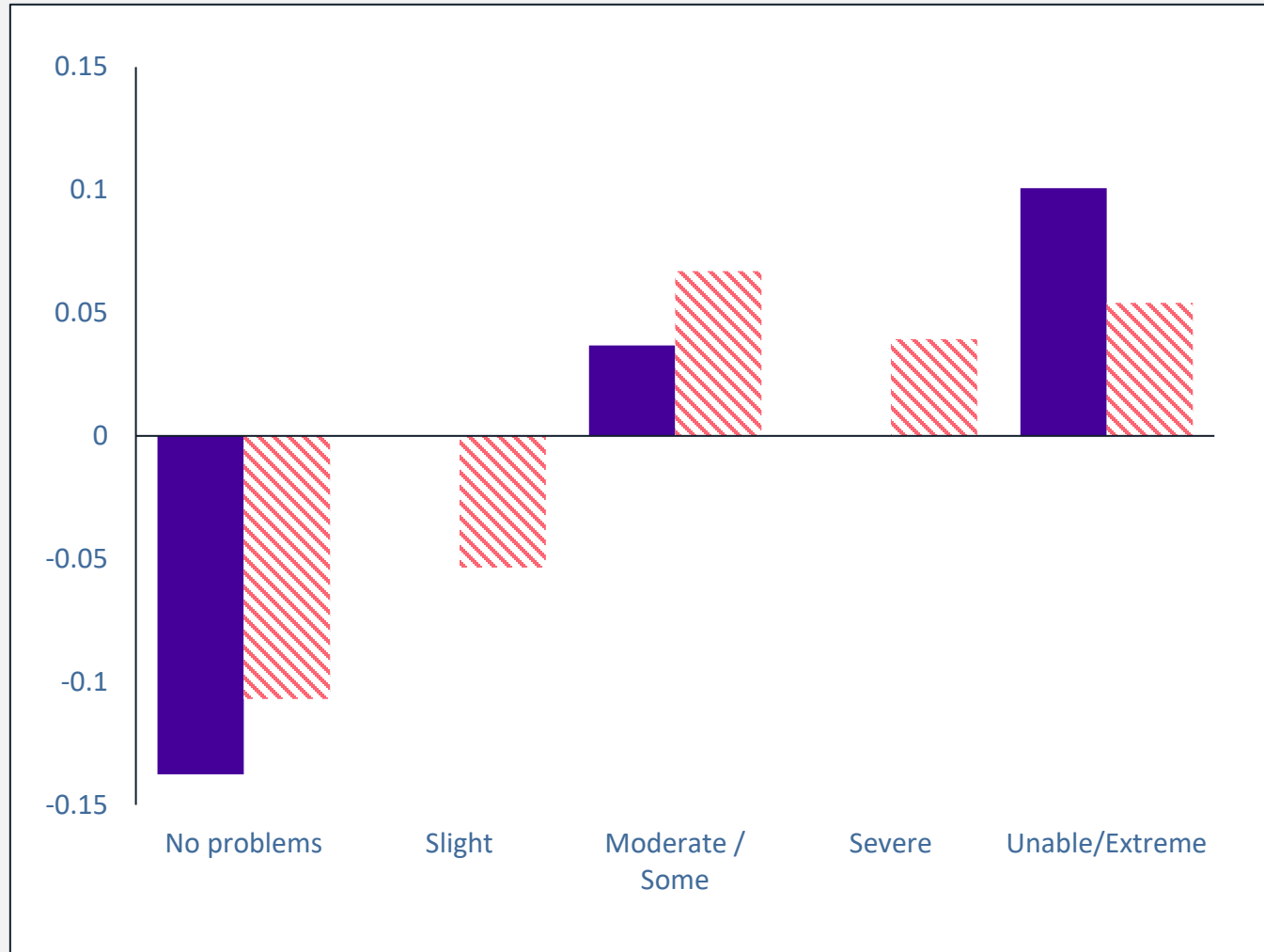
# Results: Usual activities, raw data, non-carers and 50+ hours



# Results: Domains – Pain/Discomfort, 50+ hours care/week

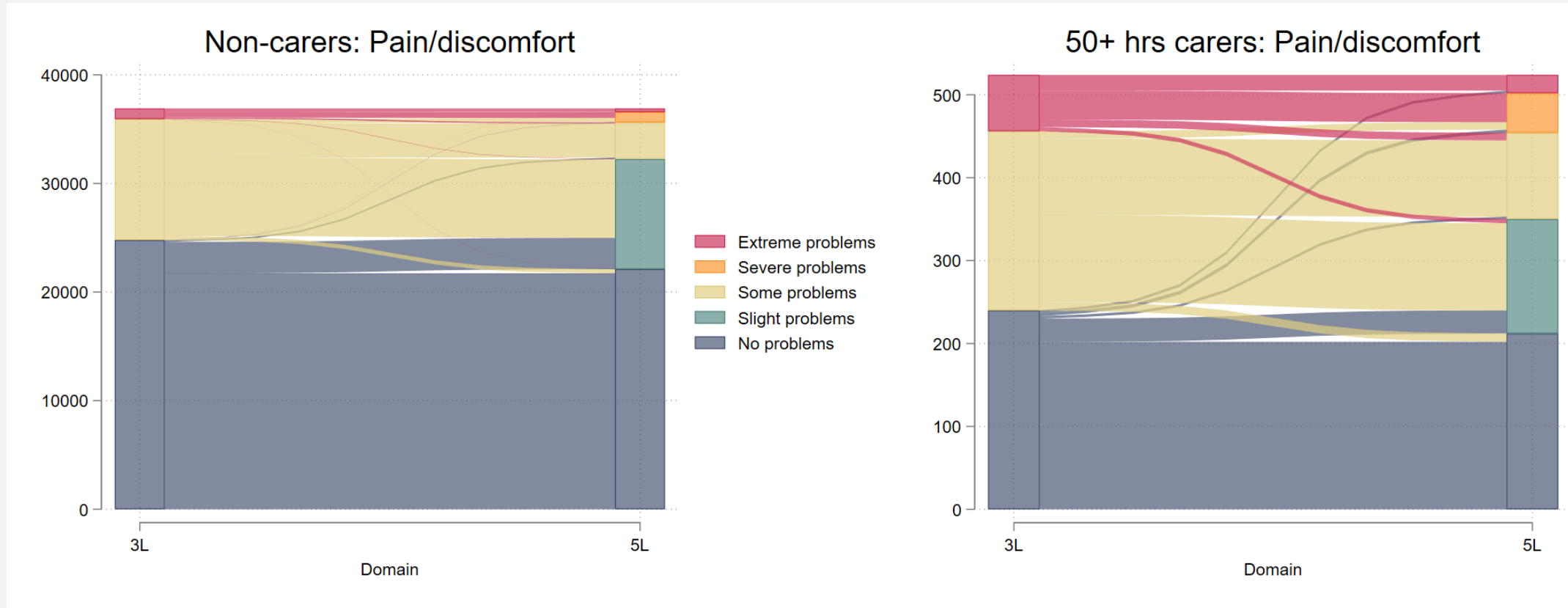
The reduction in carers reporting “no problems” is smaller for 5L than 3L (for most domains and most care hours).

This decreases the ATE.



The decrements for the two worst 5L levels are smaller than the worst 3L level.

# Results: Pain/discomfort, raw data, non-carers and 50+ hours



## Scenario: excluding outside-household only carers

		EQ-5D-3L	EQ-5D-5L
Not carer: utility		0.829	0.879
Carer disutility			
Hours of care per week	0-4	-0.084	-0.051
	5-9	-0.130	-0.095
	10-19	-0.152	-0.117
	20-34	-0.138	-0.087
	35-49	-0.130	-0.103
	50+	-0.192	-0.134

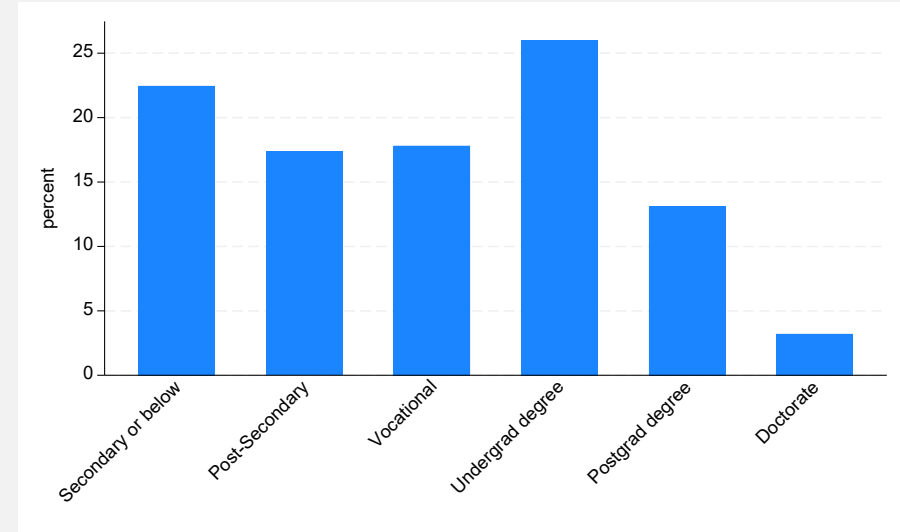
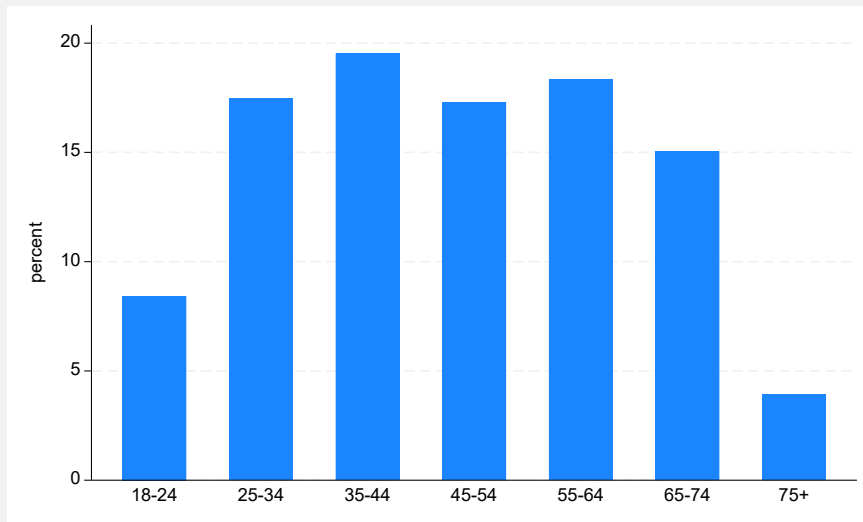
- Carers have statistically significantly worse EQ-5D (3L and 5L) than people who are not carers
- The disutility generally increases as hours of care/week increases
- The disutilities are larger for 3L than 5L
- The disutilities are higher than for the combined group of within-, outside- and within & outside household

# Dataset (continued)



51.38% female

35.38% no diagnosed health conditions



		Children	
		Yes	No
Lives with partner	Yes	20,921 41.84%	7,324 14.65%
	No	7,673 15.35%	14,081 28.16%