Gains in life expectancy associated with education

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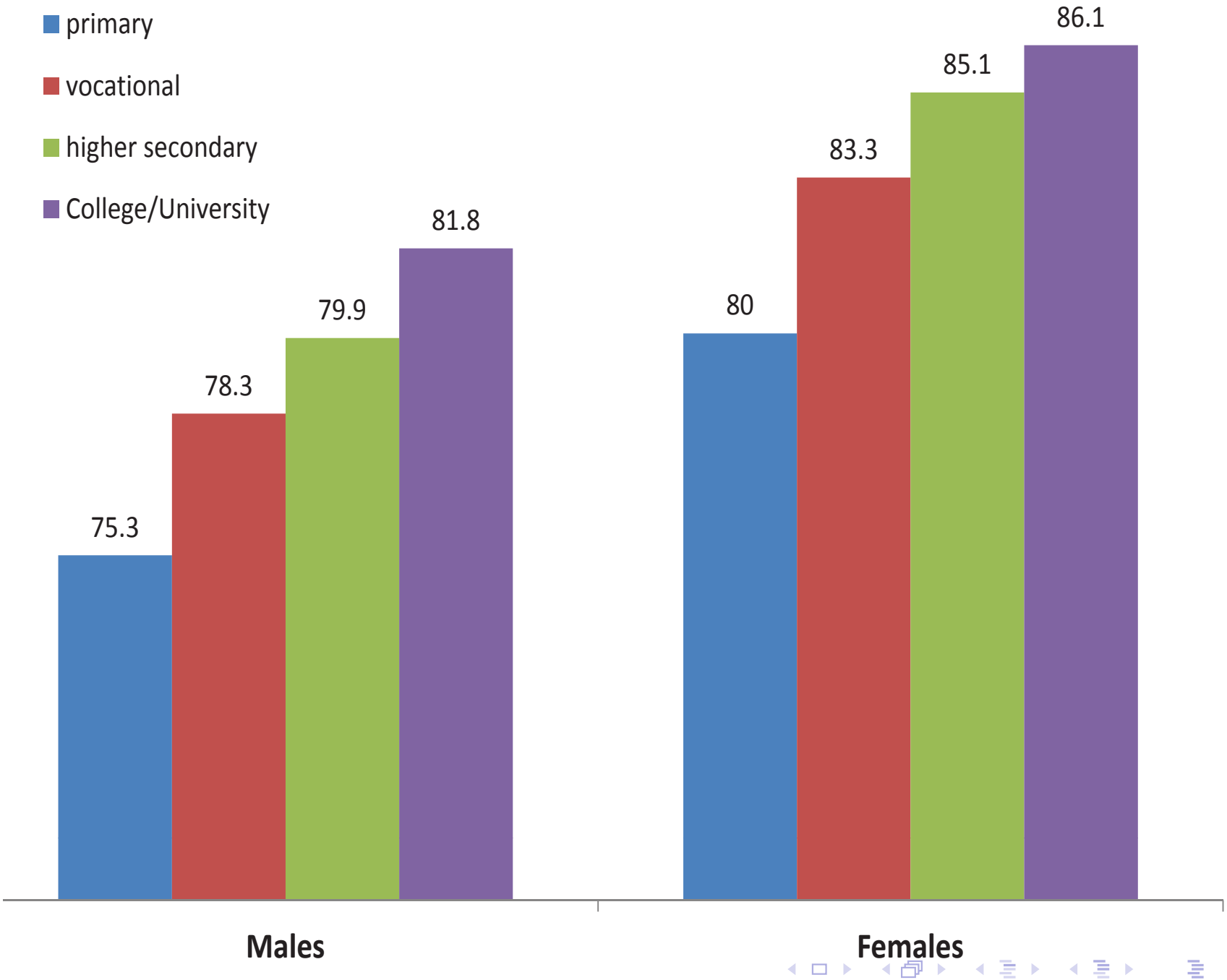
Life expectancy NL, by education level



Counterfactual education choice

When making causal inference of *education* on mortality

Fundamental problem of unobserved counterfactuals

- Want to compare individuals with different chosen education level
- Never observe individual simultaneously in all education levels
- Education choice likely to depend on (un)observed factors that also influence mortality
- Potential outcome:
  How would the mortality of an average individual change if such a person were to change education?

Motivation

- Differences in health and life expectancy across educational groups are striking and pervasive.
- Recent results deriving from natural experiments in education suggest that causal effect of education on health is small or even absent
- Suggest an important role for confounding factors, such as discount rates, cognitive and non-cognitive skills

Motivation (2)

- Established that cognitive ability are associated with health outcomes at ages 30-40
- Nonetheless, hardly anything is known about how much of the association between education and health is explained by these cognitive abilities.

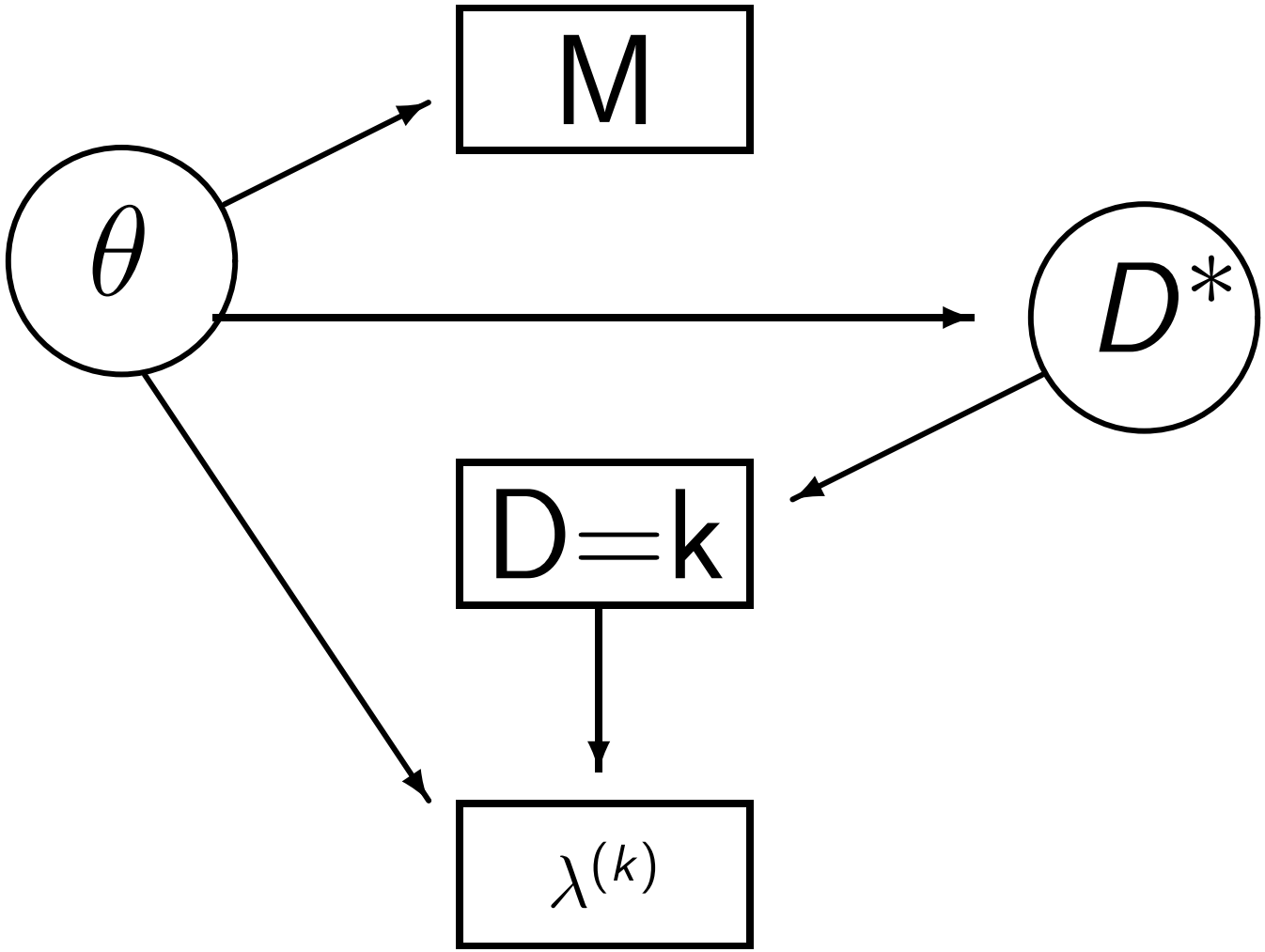
Our contribution

Disentangle the effects of education and cognitive ability on mortality

Contribution is twofold:

1. Causal effect of education on mortality between ages 18 and 67 and implied life-expectancy
2. Decompose the observed mortality/life-expectancy difference by education level
   in treatment effect, educational gain,
   and selection effect both on observed and unobserved (cognitive ability) characteristics

Graphical representation of the model



Basic model: educational choice

Assume an ordered probit model for D, educational choice: Underlying utility, D^* depends on observed characteristics and latent cognitive ability θ.

For each individual four potential mortality rates $\lambda_i^{(0)}, \ldots, \lambda_i^{(3)}$ with only one observed mortality depending on educational choice, D_i Gompertz mortality rate, exponential increasing in age; depending on exogenous characteristics and on θ

Measurement, M for the ability (e.g. IQ-test), standard linear regression including latent θ

Gains from increasing school level

Use estimated model to derive treatment effects of increasing education:

Calculate counterfactual mortality of an average individual in particular education group if (s)he had had 2 additional years of education.

Average over the distribution of included factors

- Difference in survival
- Difference in implied life-expectancy

We calculate the *treatment effect on the untreated, ATEU*: use observed distribution of factors of lower education group.

Decomposition of educational gain

For the observed ages (18-67) and the life-expectancy 18–67:

Decompose the educational gain:

$$G_{\text{observed}} = G_{\text{TE}} + G_{\text{SEobserved}} + G_{\text{SEcognitiveability}}$$

Observed (raw) educational gain, G_{observed}: difference in Kaplan-Meier estimates (or implied life-expectancy)

Treatment effect, G_{TE}: difference implied by structural model

Selection on observed characteristics, $G_{\text{SEobserved}}$: difference Kaplan-Meier and simple model

Selection on cognitive ability, $G_{\text{SEcognitiveability}}$: difference simple and structural model

Military recruits Data for Netherlands

Examinations for military service 1961-1965, using 39,804 men born 1944-1947 (removed those with special education).

- Detailed info on individual demographic and socioeconomic characteristics, including father's occupation, religion and, birth order
- Battery of intelligence tests: Raven progressive matrix
- Education classified in 4 levels: primary school, lower vocational (+ 2 yr), lower secondary (+ 4yr) and, general secondary and higher education (+ 6yr)
- Linkage to administrative records (Stat NL) cause of death register

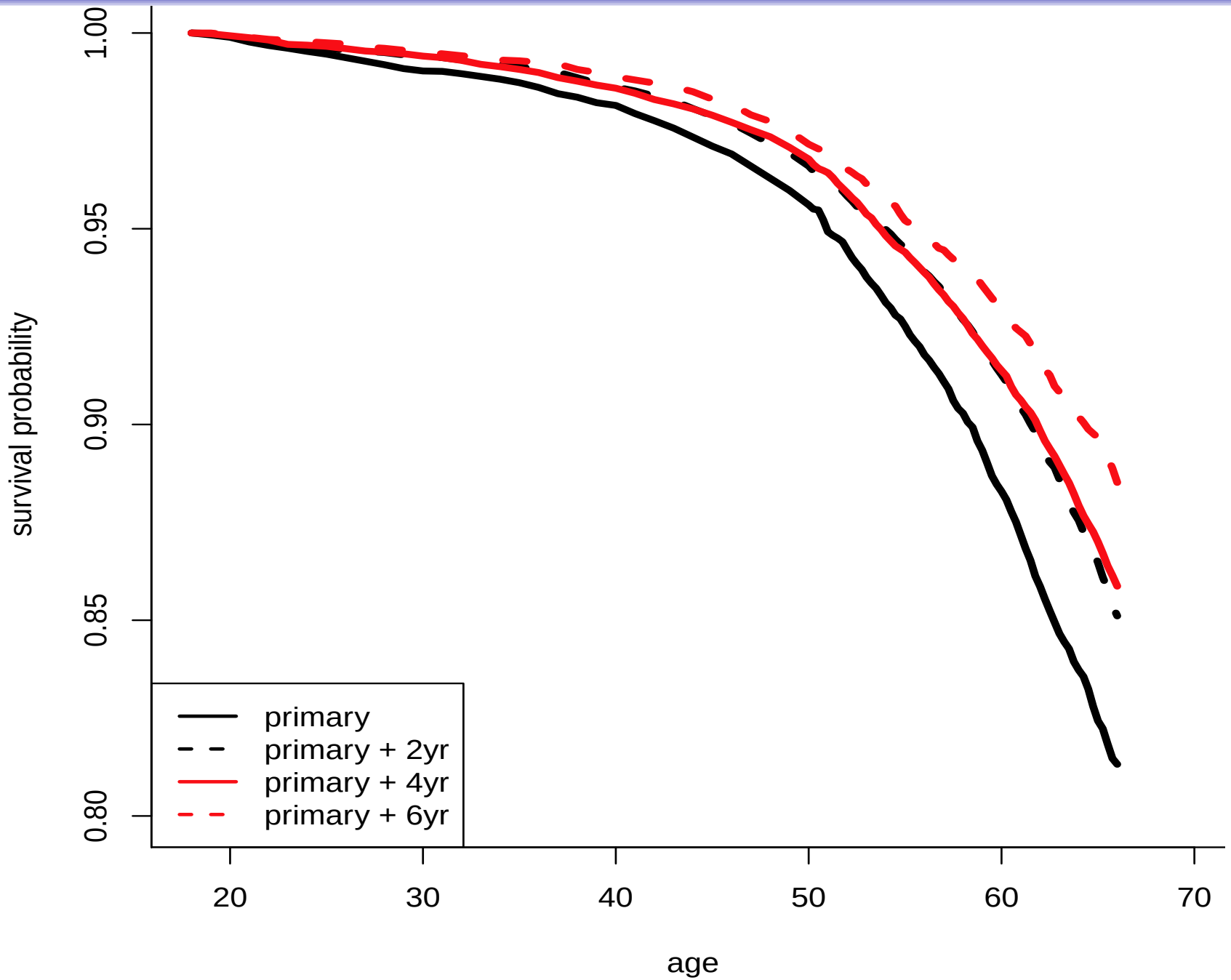
Descriptive statistics

	primary	+ 2yr	+ 4yr	+ 6yr
	14%	36%	33%	16%
High to low		*Intelligence*		
IQ (Raven) 1	4%	16%	29%	50%
IQ (Raven) 2	18%	35%	40%	37%
IQ (Raven) 3	24%	26%	19%	9%
IQ (Raven) 4	23%	14%	8%	3%
IQ (Raven) 5	23%	7%	3%	0.5%
IQ (Raven) 6	9%	2%	1%	0.2%

Background information

	primary	+ 2yr	+ 4yr	+ 6yr
		Religion		
Catholic	40%	32%	31%	32%
Reformed	26%	31%	31%	30%
Other	4%	8%	9%	10%
Without	30%	28%	29%	28%
		Birth order		
First	28%	32%	39%	42%
Second	27%	30%	31%	30%
5+	15%	10%	7%	5%
		Father's occupation		
Professional	1%	2%	1%	11%
Manager	8%	8%	12%	19%
Cleric	13%	24%	35%	38%
Self-employed	6%	6%	8%	5%
Shop assistant	38%	33%	23%	9%
Laborer	14%	8%	5%	2%

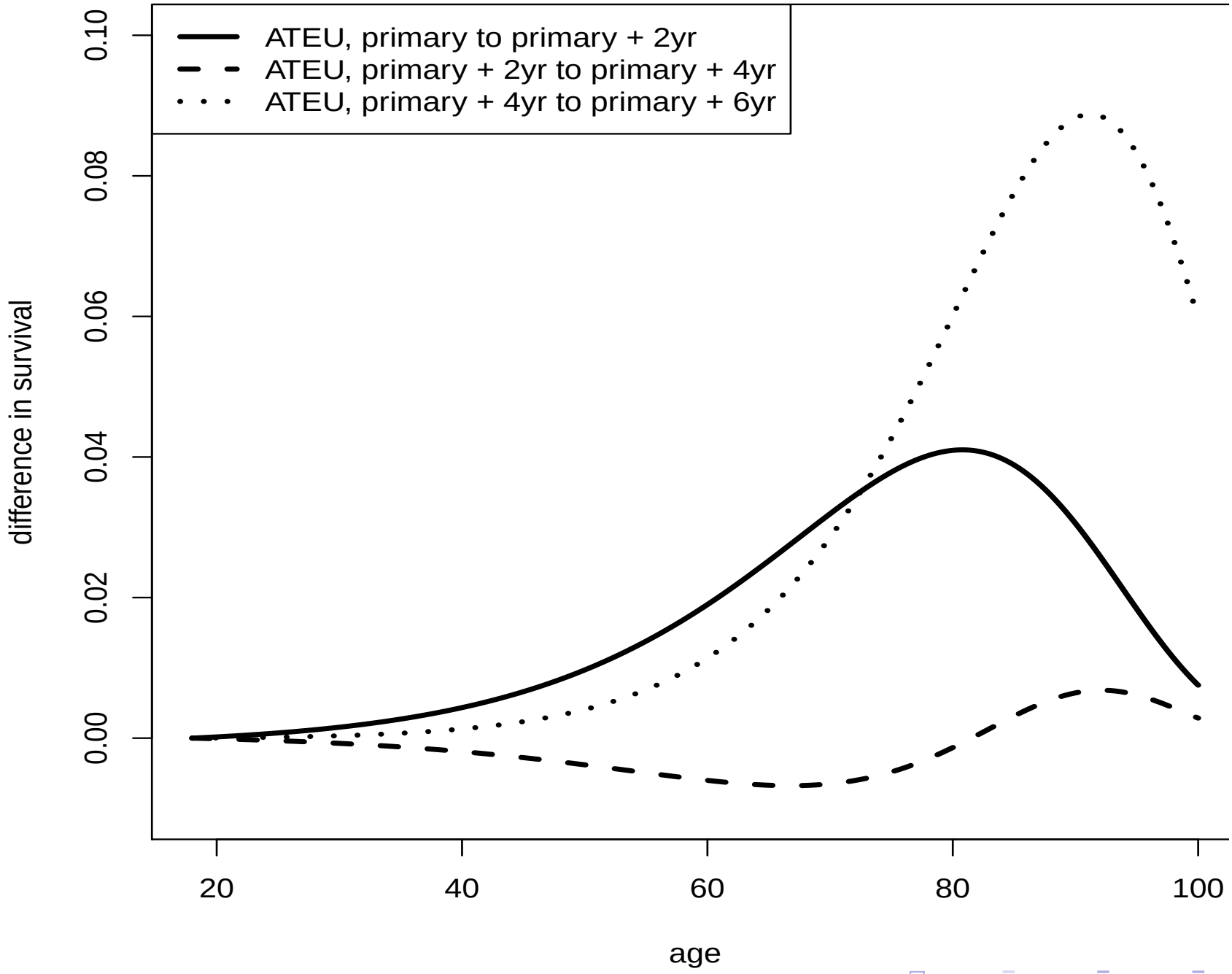
Kaplan-Meier survival, by education level



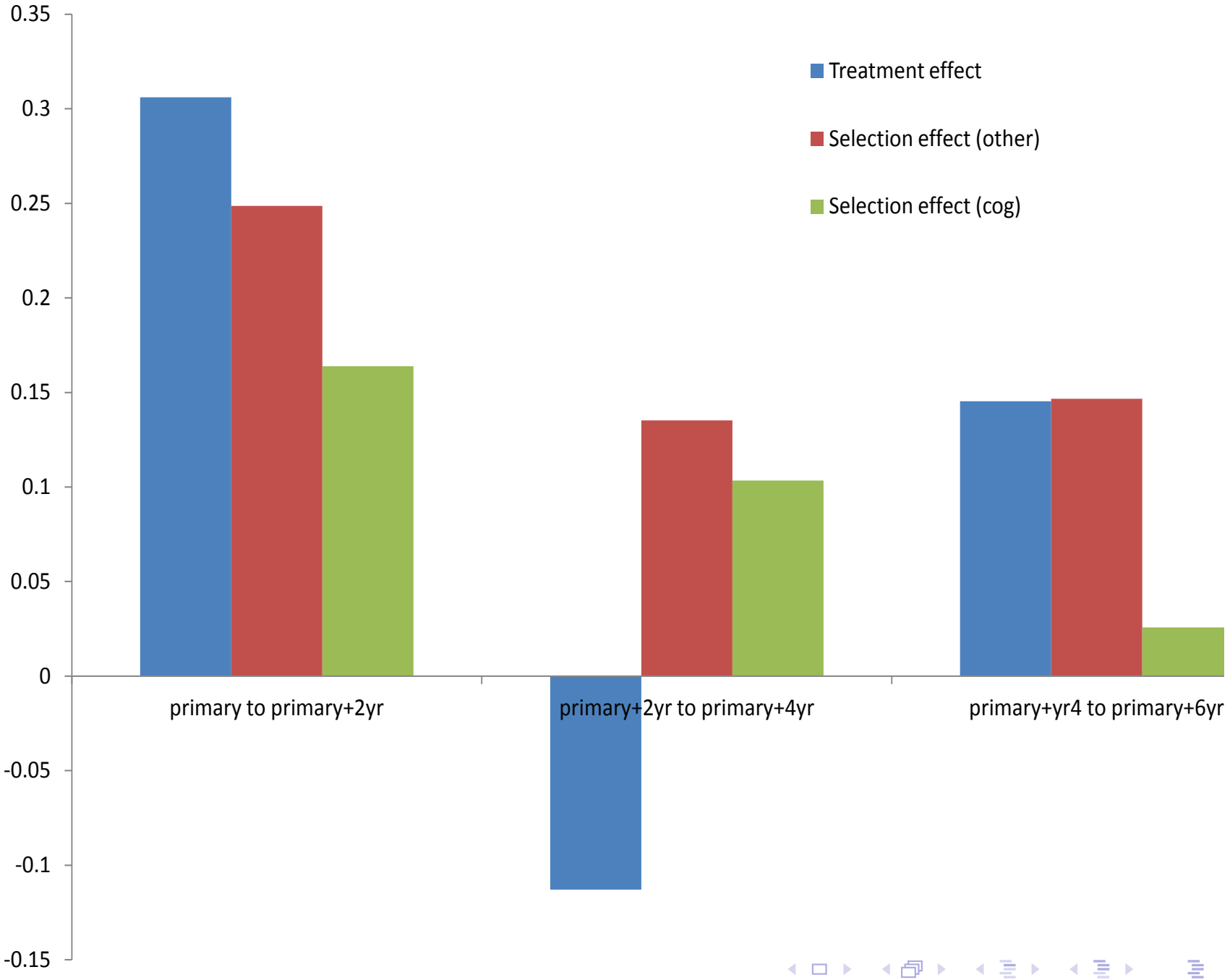
Estimated Odd's rates (selection)

	Edu	M	Mortality rates $\lambda^{(0)}$	$\lambda^{(1)}$	$\lambda^{(2)}$	$\lambda^{(3)}$
Cognitive Ability						
α	2.98*	3.79*	0.81	0.72*	0.92	0.94
Control variables						
birth rank 2	0.84*	0.99	0.99	0.94	0.91	1.01
birth rank 4	0.68*	0.82*	0.95	0.92	1.07	1.02
religion, ref none						
Reformed	1.07*	1.00*	0.95	0.97	0.96	1.00
Other	1.32*	1.14*	0.72*	0.94	0.82*	0.79
father's occupation, ref cleric						
Professional	3.86*	1.69*	0.44*	0.69	1.02	1.12
Manager	1.05*	0.91*	0.83	1.04	0.97	1.19
Self employed	0.66*	0.74*	1.30*	1.10	1.07	1.24
Shop assistant	0.42*	0.61*	1.11	1.02	1.13*	1.25
Laborer	0.31*	0.49*	1.33*	1.08	1.25*	1.76*

Survival gain



Decomposition Life-expectancy (18-67)



Conclusion

- Structural model for educational choice and mortality
  1. Interdependence between cognitive ability and education and their joint influence on mortality
  2. Both intelligence and education in mortality
  3. large data (40,000 military recruits)

- Gains of education
  - High educated live longer
  - Raw difference overestimates gain
  - Positive selection important in explaining educational gain