Using Genetics to Estimate Intergenerational Effects of Dementia on Work, Income and Wealth

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Objectives: There is abundant evidence of a quantitatively large association between measures of economic status and health outcomes. However, dissecting how much of this association runs from health to SES has been challenging. Existing papers have used the timing of disease diagnosis in an event study framework to estimate the effect of disease onset on work, income and wealth. One limitation of such an approach is that whether and when an individual gets diagnosed is endogenous, being affected by differing levels of health care access. In this paper, we explore the use of genetics to estimate the impact of dementia on work, income, and wealth for affected individuals and their offspring.

Methods: We construct a novel data set that merges dementia diagnosis records with tax data from administrative sources, alongside intergenerational genetic and survey-based data from the Dutch Lifelines Biobank. First, we show that our constructed measure of genetic risk of Alzheimer's disease, that combines the APOE region and a polygenic index is orthogonal to socio-economic background in early and mid-life (see Figure 1). This is stark contrast with dementia diagnosis: those ever diagnosed have lower education, income and wealth starting early in life compared to those who were never diagnosed (see Figures 2 and 3). Second, our measure of genetic risk is highly predictive of dementia diagnosis, but only after age 63, when dementia prevalence begins to increase sharply (see Figure 4). These two patterns provide us with a credible strategy to estimate the economic costs of dementia onset.

Results: We find that genetics is highly predictive of dementia diagnosis from administrative health records, especially at older ages. In contrast, genetic risk for dementia is uncorrelated with education, parental background or mid-life measures of income and wealth. Results indicate that genetic risk for dementia has limited effects on the earnings, income and wealth of affected individuals (see Figure 5 and Table 1), but that it has a substantial negative effect on the wealth of offspring (see Figure 6 and Table 2). As parents age, offspring of parents in the top tercile of genetic risk (including APOE4 carriers) have average wealth 15% lower than those with parents with average genetic risk. Assuming that the effect of genetic risk on offspring wealth works exclusively through dementia diagnosis implies that parental dementia diagnosis reduces offspring wealth by 46K or 30% on average. Most of the reduction in offspring wealth comes from real estate assets (see Table 3).

Discussion: Our findings, that income and wealth of individuals exposed to Alzheimer's disease genetic risk remain unaffected later in life, indicate that late-life insurance mechanisms and institutional protections in the Netherlands are sufficient to protect against direct financial losses of individuals suffering from Alzheimer's and dementia-related diseases. By contrast, substantial negative effects on offspring's wealth suggest that the economic burden of dementia

is partially shifted to the next generation, indicating that insurance mechanisms and institutional protections do not fully protect against financial losses in the next generation.

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Figures and Tables:

Figure 1: Genetic risk of ADRD is uncorrelated with education

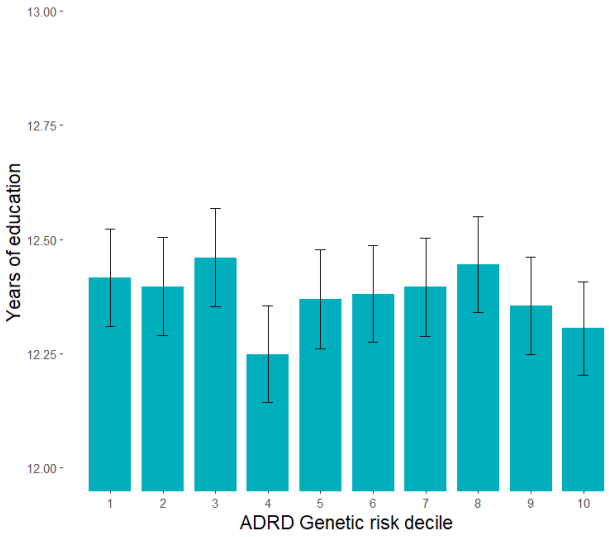


Figure 2: Those ever diagnosed with dementia have lower SES long before dementia kicks in

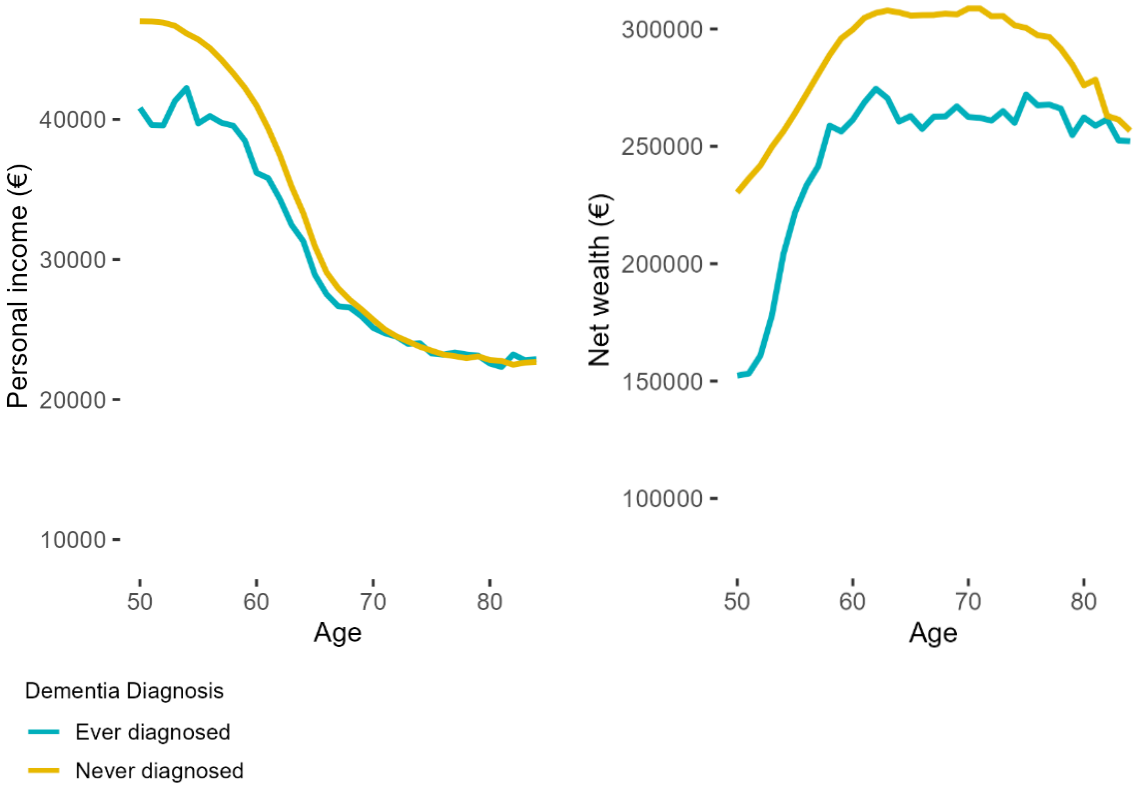


Figure 3: Different than diagnosis, genetic risk does not predict midlife SES

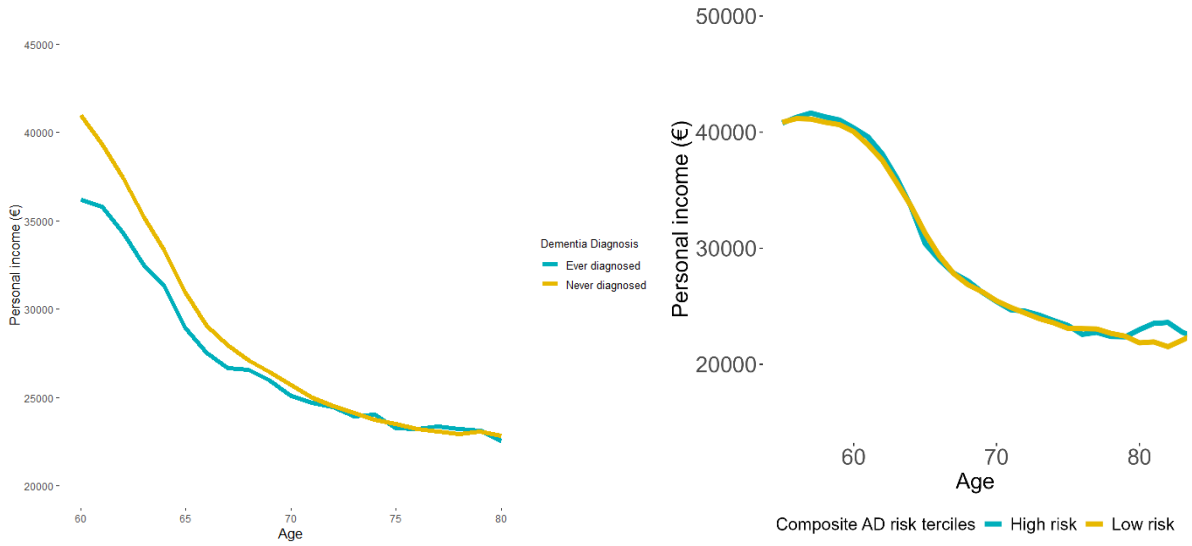


Figure 4: Genetics Predics Dementia Diagnosis

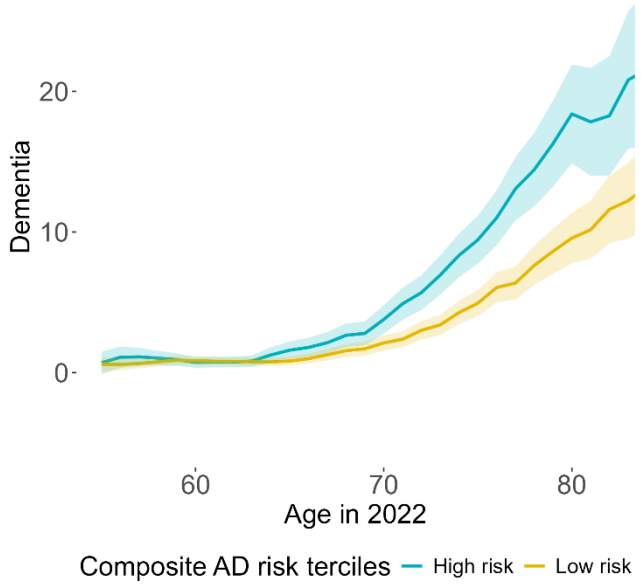


Figure 5: Income and Wealth Trajectories by Terciles ADRD Risk: Parent Sample

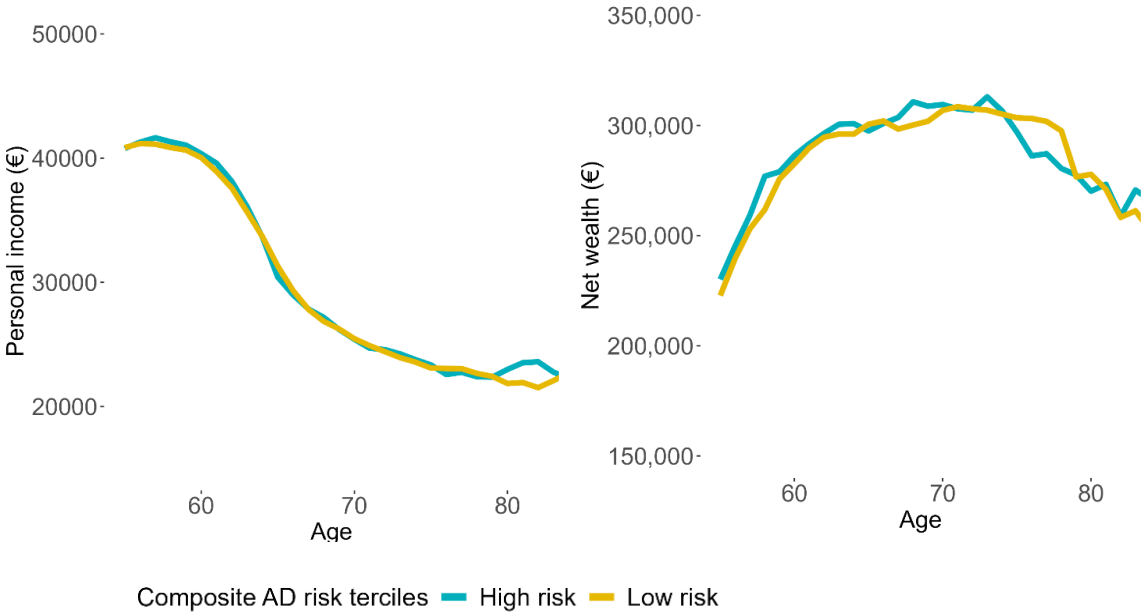


Table 1: Effect of High Genetic Risk on Dementia, Wealth and Income by Age

	Individuals aged 55-75				Individuals at least age 75			
	Dementia	*Net Wealth*	*Personal Income*	*Hhld. Income*	*Dementia*	*Net Wealth*	*Personal Income*	*Hhld. Income*
Panel A: outcomes in levels								
Top Tercile Risk	0.267***	5,477	294.8		1.98***	-8,359	-1,116	
	(0.0898)	(5,482)	(342.4)		(0.507)	(12,715)	(747.5)	
Panel B: outcomes in percentiles								
Top Tercile Risk		0.455	0.279	-0.339		-0.887	0.492	0.309
		(0.392)	(0.380)	(0.381)		(1.012)	(1.123)	(1.066)
Observations	17,162	113,644	113,644	113,680	3,621	13,489	13,489	13,552

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

The tables show the effect of highest tercile of genetic ADRD risk

Robust standard errors in brackets, clustered on parent ID. P-values in square brackets

All specifications additionally control for parent's sex, child's sex, first 10 PCs of the genetic data, year of measurement fixed effect, and age (linearly)

Figure 6: Child Income and Wealth Trajectories by Parental Terciles ADRD risk

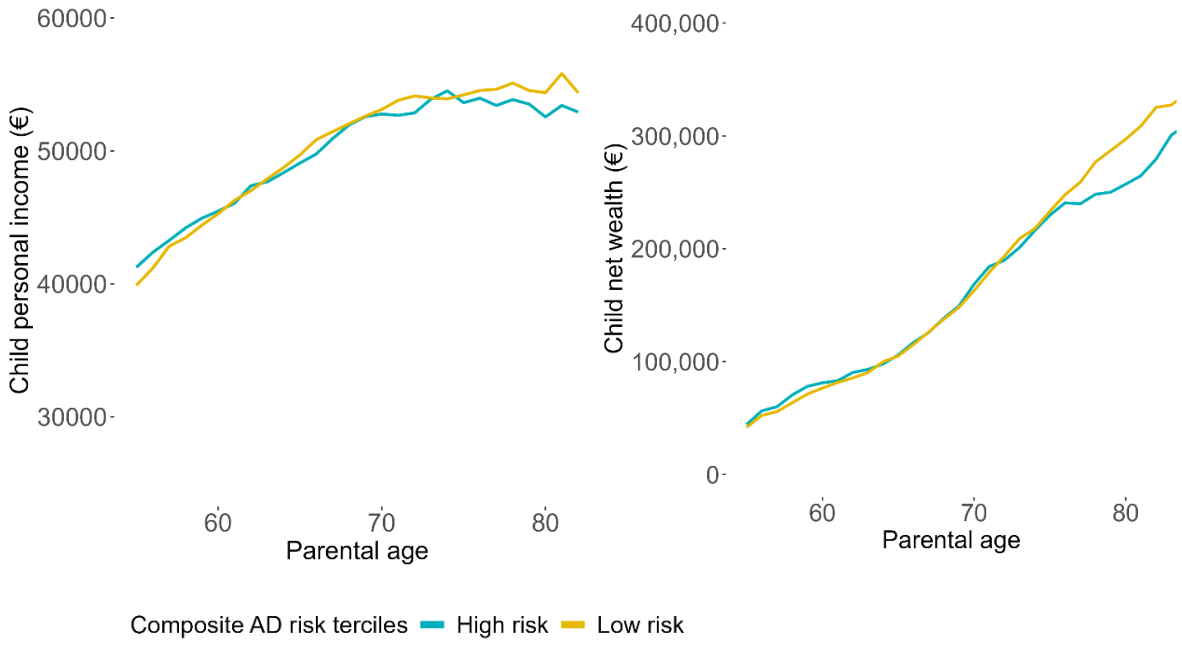


Table 2: Effect of High Parental Genetic Risk on Offspring Wealth and Income by Age

	Parent aged 55-75			Parent at least age 75		
	child's outcome			child's outcome		
	Net Wealth	*Personal Income*	*Hhld. Income*	*Net Wealth*	*Personal Income*	*Hhld. Income*
Panel A: outcomes in levels						
Top Tercile Risk	1,802	-149.5		-23,615***	-1,116	
	(2,547)	(294.8)		(8,716)	(747.5)	
Panel B: outcomes in percentiles						
Top Tercile Risk	0.302	-0.088	-0.339	-1.494**	-0.607	-1.474**
	(0.288)	(0.274)	(0.381)	(0.644)	(0.621)	(0.644)
Observations	208,187	208,187	208,423	37,736	37,736	37,783

*** p<0.01, ** p<0.05, * p<0.1
The tables show the effect of highest tercile of genetic ADRD risk
Robust standard errors in brackets, clustered on parent ID. P-values in square brackets
All specifications additionally control for parent's sex, child's sex, first 10 PCs of the genetic data, year of measurement fixed effect, and age (linearly)

Table 3: Effect of High Parental Genetic Risk on Offspring Wealth Components

	Parent aged 55-75				Parent at least age 75			
	child's outcome				child's outcome			
	Net Wealth	*Financial Assets*	*Real Estate*	*Total Assets*	*Net Wealth*	*Financial Assets*	*Real Estate*	*Total Assets*
Top Tercile Risk	0.302	0.348	0.222	0.276	-1.494**	-0.833	-1.770***	-1.515**
	(0.287)	(0.278)	(0.310)	(0.297)	(0.644)	(0.632)	(0.687)	(0.702)
Observations	208,187	208,187	208,187	208,178	37,736	37,736	37,736	37,736

*** p<0.01, ** p<0.05, * p<0.1
The tables show the effect of highest tercile of genetic ADRD risk
Robust standard errors in brackets, clustered on parent ID. P-values in square brackets
All specifications additionally control for parent's sex, child's sex, first 10 PCs of the genetic data, year of measurement fixed effect, and age (linearly)