

## Appendix\*

Age, Cohort, and Social Change:  
Parental and Spousal Education and White Women's Health Limitations from 1967 to 2012

### Abstract

A large body of research finds that the association between educational attainment and health is at historic highs for white women. Rapid changes in labor force participation, access to high-paying jobs, and gender attitudes have radically altered the meaning of education for women's lives and their dependence on the socioeconomic attainments of their families. Drawing on three nationally representative, longitudinal surveys conducted from 1967 to 2012, this study examines how personal, parental, and spousal attainments contribute to the widening education gap in health for successive cohorts of white women (N = 8,405). Overall, the health of women did not change substantially across cohorts, but results did uncover cohort differences among low-educated women that were linked to parental and spousal educational attainments and personal earnings. These findings confirm growing educational inequalities in health and demonstrate the importance of historical context and family attainments when examining cohort variation in the education-health relationship.

**Keywords:** health disparities; life course; aging; family; socioeconomic status

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\* Tables and figures are located at the end of the document.

## 1. Marital Status

In Table 1A, I replicate the final model in Table 3 of the manuscript using a time-invariant version of spousal education for women who were consistently married during the surveys. I then considered the same model with a time-varying version of spousal education with women in the sample who experienced a spousal loss through divorce or widowhood. Results support the same overall conclusion that parent/personal schooling is becoming more important for women's health, whereas spousal education appears to be losing relevance for more recent cohorts. However, this analysis also provided an interesting elaboration of findings. That is, the relationship between parents' education and health was only significant for women in the 1957-64 cohort who experienced divorce or widowhood.

## 2. Labor force status and health limitations

All women were asked about health problems or conditions that might affect the amount/type of work they could perform, regardless of their labor force status (see Table 2A). The wording can vary slightly across cohorts/waves, but the NLS generally collected this information by asking, "Does your health or physical condition limit the amount or kind of work you can do?" However, in some years the NLS used two questions, one about limiting kind of work and another about limiting amount. Although the NLS asked a number of other questions about limitations, e.g., does your health limit housework or other activities, that

information was not collected consistently across cohorts and survey waves (National Longitudinal Surveys 2005).

## 3. Missing Data

Tables 3A and 4A provide a more detailed look at missingness across cohorts, waves, and variables. Missingness is greatest for personal and spousal earnings. However, even high levels of missingness (up to 60 percent) do not substantially impact MI models, especially with large datasets (Kontopantelis et al. 2017). Furthermore, I replicate the analysis without respondent or spousal earnings and the results are consistent with those presented in the manuscript (see Table 5A).

## 4. Multiple Imputations

Imputing the dependent variable is problematic under certain conditions during multiple imputation (MI). A common method for handling missing data on the dependent variable within the MI framework (Rubin 1976) is von Hippel's (2007) "multiple imputation, then deletion" (MID) approach. The reasoning behind MID is that cases with missing outcome data do not contribute additional information after imputation, so retaining these cases only adds noise to the estimation process. However, several recent studies recommend that researchers use standard MI rather than MID (Kontopantelis et al. 2017; Sullivan et al. 2017). This work has found that MI and MID have negligible performance differences, and standard MI is more efficient in most settings (Kontopantelis et al. 2017). Furthermore,

auxiliary variables, i.e., variables used in the imputation model but not the analysis mode, are recommended when imputing (Young and Johnson 2015), but if these variables are associated with missingness in the outcome, MID can produce biased parameter estimates (Sullivan et al. 2015). The auxiliary variable in this study is a time-invariant measure of average rank income, which is related to both health limitations and missingness. Thus, I present results using standard MI instead of MID.

To ensure that results were generally robust to the treatment of missing cases, I compared results using MI and MID approaches (see Table 6A). I also replicated the models that were used to create Figure 3 in the manuscript. Figure 1A provides a visualization of that analysis. Figure 1A is nearly identical to Figure 3 and supports the same overall conclusions I discuss in the manuscript. One notable, but expected, difference is that the MID approach produces somewhat larger confidence intervals than the MI approach.

Another important issue with imputing the dependent variable relates to testing the age-as-leveler hypothesis. By imputing the dependent variable, an increase in mortality will not affect estimates because these individuals are no longer missing in the outcome. Therefore, to ensure that my conclusions with respect to the cumulative disadvantage hypothesis were correct, I also examined survival rates across cohorts and whether mortality influenced results. A large majority of women survived the age ranges I examined, with only approximately 4 percent

of each cohort deceased by the final wave (MW N = 151, YW N = 71, and Y79 N = 81). Results after dropping women who died were nearly identical to analyses that included them (see Figure 2A).

## References

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Table 1A: Selected Odds Ratios by Marital History (N = 8,405; Observations = 84,050)

	MW		YW		Y79	
	Continuously Married	Divorced or Widowed	Continuously Married	Divorced or Widowed	Continuously Married	Divorced or Widowed
Schooling (ref. 16 or more)						
0 to 11 years	2.52*** (0.37)	3.07*** (0.76)	2.56*** (0.48)	3.39*** (0.59)	3.81*** (1.04)	3.84*** (0.83)
12 years	1.56** (0.21)	1.83* (0.44)	1.35* (0.19)	1.95*** (0.29)	1.59* (0.29)	2.64*** (0.52)
13 to 15 years	1.69*** (0.25)	1.51 (0.41)	1.28 (0.18)	1.51** (0.24)	1.45* (0.25)	2.47*** (0.49)
Log earnings	0.94*** (0.00)	0.91*** (0.01)	0.95*** (0.01)	0.90*** (0.01)	0.91*** (0.01)	0.88*** (0.01)
Parents' schooling (ref. 0-11)						
12 years	1.01 (0.07)	0.85 (0.08)	0.91 (0.09)	0.85 (0.09)	0.95 (0.16)	0.71** (0.08)
13 or more years	0.93 (0.09)	0.94 (0.13)	0.94 (0.12)	0.86 (0.11)	1.01 (0.20)	0.78 (0.11)
Non-nuclear family at 14/15	1.26*** (0.08)	1.21* (0.10)	1.29* (0.15)	1.15 (0.12)	1.42* (0.21)	1.50*** (0.14)
Spouse's schooling (ref. 0-11)						
12 years	0.82** (0.06)	0.78* (0.10)	0.86 (0.12)	0.83 (0.12)	0.86 (0.19)	0.89 (0.17)
13 to 15 years	0.81* (0.08)	0.75 (0.13)	0.74 (0.11)	0.74 (0.12)	1.40 (0.34)	0.85 (0.20)
16 or more years	0.69*** (0.07)	0.65* (0.13)	0.74 (0.12)	0.60** (0.11)	1.00 (0.26)	1.19 (0.25)
No spouse		1.03 (0.11)		1.18 (0.17)		0.95 (0.16)
Spouse's log earnings	1.00 (0.01)	1.00 (0.01)	1.00 (0.01)	1.02 (0.01)	0.98 (0.01)	0.99 (0.01)

Note:

- Standard errors in parentheses; \*\*  $p < 0.05$ , \*  $p < 0.01$ , \*\*\*  $p < 0.001$  (two-tailed tests)
- These analyses excluded women who never marry.
- Models also control for age, survey wave, and living in the South.

Table 2A: Proportion of Women with a Health Limitation by Wave, Cohort, and Work Status

	MW			YW			Y79		
	Blue & Pink Collar	White Collar	Not Working	Blue & Pink Collar	White Collar	Not Working	Blue & Pink Collar	White Collar	Not Working
Wave 1	0.14	0.08	0.20	0.09	0.07	0.19	0.05	0.05	0.18
Wave 2	0.11	0.07	0.19	0.10	0.07	0.15	0.06	0.06	0.20
Wave 3	0.12	0.08	0.24	0.11	0.08	0.18	0.08	0.07	0.22
Wave 4	0.12	0.07	0.25	0.14	0.12	0.22	0.08	0.06	0.29
Wave 5	0.11	0.06	0.28	0.12	0.10	0.22	0.09	0.07	0.35
Wave 6	0.13	0.08	0.33	0.15	0.12	0.33	0.09	0.06	0.37
Wave 7	0.16	0.11	0.34	0.13	0.11	0.36	0.09	0.07	0.41
Wave 8	0.23	0.14	0.38	0.17	0.11	0.37	0.10	0.07	0.42
Wave 9	0.16	0.13	0.41	0.17	0.11	0.38	0.15	0.11	0.41
Wave 10	0.24	0.17	0.43	0.14	0.09	0.37	0.21	0.10	0.49

Notes

- Imputed data are excluded

Table 3A. Percent missing for all observations

	MW	YW	Y79
Health limitation	18.69	13.18	11.30
Parents' education	14.20	5.02	1.82
Personal earnings	19.62	16.12	14.47
Spouse's schooling	20.54	13.11	12.79
Spouse's earnings	20.67	17.74	15.77
Lives in the South	18.69	13.12	11.74

*Note:*

- Years of schooling, family structure in adolescence, and age contained no missing.

Table 4A: Percent Missing by Wave for Time-varying Variables

	Survey Waves									
	1	2	3	4	5	6	7	8	9	10
<i>MW survey years</i>	<i>1967</i>	<i>1971</i>	<i>1972</i>	<i>1974</i>	<i>1976</i>	<i>1977</i>	<i>1979</i>	<i>1981</i>	<i>1982</i>	<i>1984</i>
Health limitation	0.00	9.57	11.40	14.34	17.25	21.38	24.40	26.96	29.78	31.81
Earnings	0.00	9.57	11.40	14.34	17.25	23.10	26.34	29.06	31.50	33.67
Spouse's schooling	4.71	13.06	14.53	17.61	20.22	21.66	24.74	27.23	29.78	31.81
Spouse's earnings	0.00	9.57	11.40	14.34	17.25	25.32	28.51	31.31	33.47	35.55
Lives in the South	0.00	9.57	11.40	14.34	17.25	21.38	24.40	26.96	29.78	31.81
<i>YW survey years</i>	<i>1983</i>	<i>1985</i>	<i>1987</i>	<i>1988</i>	<i>1991</i>	<i>1993</i>	<i>1995</i>	<i>1997</i>	<i>1999</i>	<i>2001</i>
Health limitation	0.00	5.10	5.81	8.20	10.12	14.63	19.97	19.42	23.07	25.50
Earnings	1.33	6.55	7.61	9.85	12.20	17.61	23.89	23.70	27.93	30.52
Spouse's schooling	0.00	5.10	5.81	8.20	10.16	14.63	19.77	19.30	22.83	25.30
Spouse's earnings	2.47	7.96	8.63	10.44	13.77	19.81	26.09	26.44	29.38	32.37
Lives in the South	0.00	5.10	5.81	8.20	10.16	14.67	19.81	19.38	22.79	25.30
<i>Y79 survey years</i>	<i>1994</i>	<i>1996</i>	<i>1998</i>	<i>2000</i>	<i>2002</i>	<i>2004</i>	<i>2006</i>	<i>2008</i>	<i>2010</i>	<i>2012</i>
Health limitation	0.04	4.58	5.82	9.73	12.49	13.69	15.02	14.89	16.76	20.00
Earnings	3.60	7.64	9.16	13.91	15.91	17.02	18.31	17.69	19.33	22.09
Spouse's schooling	1.02	6.00	7.78	11.69	14.22	14.93	16.62	16.04	18.04	21.51
Spouse's earnings	5.69	9.96	10.22	15.91	17.60	17.42	18.71	18.67	20.49	23.02
Lives in the South	0.67	5.29	6.84	10.09	12.84	13.82	15.47	15.33	16.93	20.09

*Note:*

- Years of schooling, family structure in adolescence, and age contained no missing.

Table 5A: Exponentiated Coefficients from Population-averaged Logistic Regression Models Predicting Health Limitations without Personal and Spousal Earnings (N = 8,405; Observations = 84,050)

	MW	YW	Y79
Schooling (ref. 16 or more)			
0 to 11 years	3.43*** (0.39)	3.88*** (0.43)	5.25*** (0.73)
12 years	1.90*** (0.20)	1.74*** (0.16)	2.41*** (0.28)
13 to 15 years	1.91*** (0.23)	1.39*** (0.13)	1.94*** (0.22)
Parents' schooling (ref. 0-11)			
12 years	0.94 (0.05)	0.90 (0.06)	0.73*** (0.06)
13 or more years	0.97 (0.07)	0.93 (0.08)	0.85 (0.09)
Non-nuclear family at 14/15	1.28*** (0.06)	1.16* (0.08)	1.48*** (0.11)
Spouse schooling (ref. 0-11)			
12 years	0.80*** (0.04)	0.91 (0.09)	0.86 (0.11)
13 to 15 years	0.83* (0.06)	0.83 (0.09)	0.97 (0.14)
16 or more years	0.70*** (0.06)	0.80 (0.09)	1.11 (0.14)
No spouse	1.14* (0.06)	1.27** (0.11)	1.24* (0.13)

Note:

- Standard errors in parentheses; \*\*  $p < 0.05$ , \*  $p < 0.01$ , \*\*\*  $p < 0.001$  (two-tailed tests)
- Models also control for age, survey wave, and living in the South.

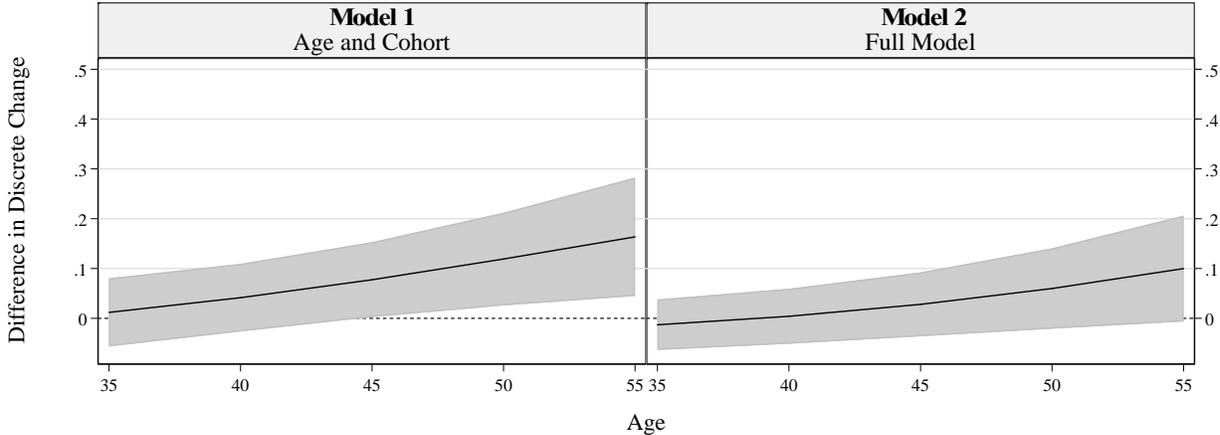
Table 6A: Comparing Results from Multiple Imputation (MI) and MI-then-delete (MID) Approaches

	MW		YW		Y79	
	MI	MID	MI	MID	MI	MID
Schooling (ref. 16 or more)						
0 to 11 years	2.97*** (0.33)	3.12*** (0.39)	3.33*** (0.37)	3.44*** (0.48)	3.91*** (0.54)	4.19*** (0.68)
12 years	1.76*** (0.18)	1.77*** (0.21)	1.66*** (0.15)	1.61*** (0.17)	2.10*** (0.24)	1.98*** (0.26)
13 to 15 years	1.82*** (0.21)	1.89*** (0.25)	1.36*** (0.13)	1.42** (0.16)	1.80*** (0.20)	1.59*** (0.21)
Log earnings	0.93*** (0.00)	0.94*** (0.00)	0.93*** (0.00)	0.94*** (0.01)	0.89*** (0.00)	0.91*** (0.01)
Parents' schooling (ref. 0-11)						
12 years	0.94 (0.05)	0.96 (0.06)	0.91 (0.06)	0.94 (0.08)	0.75*** (0.06)	0.73** (0.07)
13 or more years	0.98 (0.07)	0.99 (0.08)	0.94 (0.08)	0.96 (0.10)	0.87 (0.09)	0.89 (0.11)
Non-nuclear family at 14/15	1.29*** (0.06)	1.27*** (0.07)	1.17* (0.08)	1.20* (0.11)	1.47*** (0.10)	1.44*** (0.13)
Spouse schooling (ref. 0-11)						
12 years	0.77*** (0.04)	0.79*** (0.05)	0.87 (0.08)	0.83 (0.09)	0.85 (0.11)	0.79 (0.11)
13 to 15 years	0.80** (0.06)	0.81* (0.07)	0.80* (0.08)	0.81 (0.10)	0.96 (0.14)	0.92 (0.15)
16 or more years	0.63*** (0.05)	0.68*** (0.06)	0.72** (0.08)	0.73* (0.09)	1.00 (0.14)	0.90 (0.14)
No spouse	1.13 (0.07)	1.12 (0.07)	1.38** (0.14)	1.26* (0.14)	1.13 (0.13)	1.02 (0.14)
Spouse log earnings	0.99 (0.00)	0.99 (0.00)	1.01 (0.01)	1.00 (0.01)	0.98* (0.01)	0.98* (0.01)
Observations	36,060	27,679	25,490	17,825	22,500	17,216

Note:

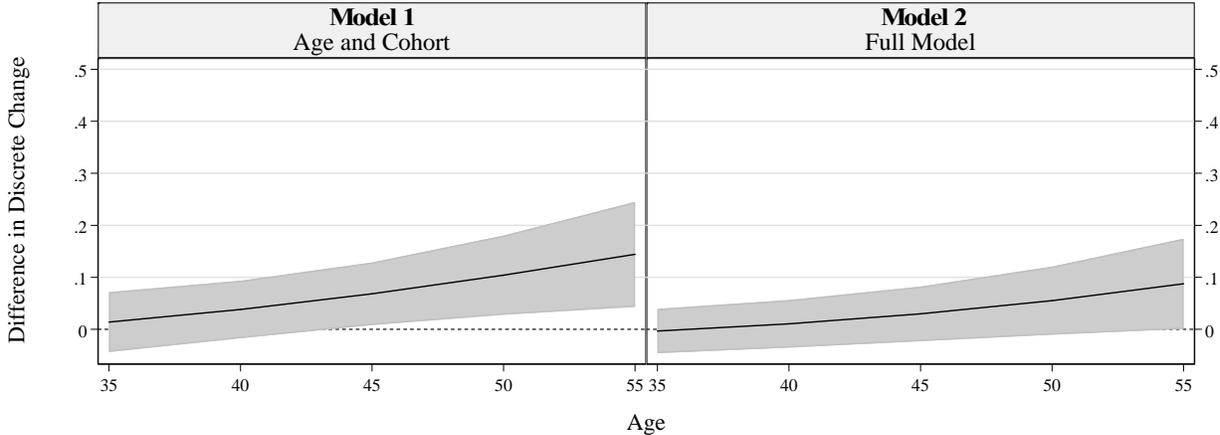
- Standard errors in parentheses; \*\*  $p < 0.05$ , \*  $p < 0.01$ , \*\*\*  $p < 0.001$  (two-tailed tests)
- Models also control for age, survey wave, and living in the South.

Figure 1A: Differences between the 1957-64 and the 1922-37 Cohorts in the Discrete Change in the Probability of a Health Limitation Using the MI-then-delete Approach



- Note:*
- A positive value means that the increase in the probability of a limitation for a change from 16 or more years of schooling to less than 12 years of schooling is larger for women in the 1957-64 cohort compared to the 1922-37 cohort.
  - Highlighted areas represent 95 percent confidence intervals. When confidence intervals do not overlap 0, the difference in discrete change is significant at the .05 level or lower.
  - During postestimation for the full model in the second panel, schooling was held at 12 years for parents and 16 or more years for spouses, and respondent and spousal earnings were held at the median values of highly educated women.

Figure 2A: Differences between the 1957-64 and the 1922-37 Cohorts in the Discrete Change in the Probability of a Health Limitation After Dropping Deceased Respondents



- Note:*
- A positive value means that the increase in the probability of a limitation for a change from 16 or more years of schooling to less than 12 years of schooling is larger for women in the 1957-64 cohort compared to the 1922-37 cohort.
  - Highlighted areas represent 95 percent confidence intervals. When confidence intervals do not overlap 0, the difference in discrete change is significant at the .05 level or lower.
  - During postestimation for the full model in the second panel, schooling was held at 12 years for parents and 16 or more years for spouses, and respondent and spousal earnings were held at the median values of highly educated women.