Path Analysis of Education and Disease Burden in Dementia Vulnerability

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PURPOSE AND OBJECTIVES

When considering the various extrinsic variables that may affect disease vulnerability, it is valuable to study the temporal ordering of factors to identify targets for disease intervention efforts. This study sought to better understand the causal ordering of ethnicity, age, sex, education, disease burden, and dementia diagnosis. This analysis utilized data from the Aging, Demographics, and Memory Study, a sub-set of the Health and Retirement Study. The goal was to inform the development of meaningful networks of support and intervention for reduction of disease vulnerability across the lifespan.

METHODS

- Participants and/or proxies self-reported total number of chronic conditions and procedures, regarded as disease burden
- Participants assessed in four waves, not reassessed after dementia diagnosis
- Dementia diagnosis based on:
  1) Detailed in-person clinical assessments
  2) Neuropsychological test battery
  3) Physical exam
  4) Standardized neurological exam
  5) Buccal tissue testing
  6) Extensive informant reporting
- Statistical analysis *excluded*:
  1) Cognitively Impaired Not Demented (n=79)
  2) Deceased participants (n=246)
- Cross-sectional weighting utilized to adjust for sample selection, non-response adjustment, and post-stratification to U.S. population controls
- Analyses: Path modeling, logistic and linear regression analyses were conducted to produce standardized β for each dependent variable

PARTICIPANTS

Table 1. **Illustrates the means and mean percentages of the variables of interest (unweighted and weighted)**

Variable	Unweighted (n=531)	Weighted (n=1335915)
Age	82.68 ± 7.26	78.88 ± 6.07
Sex (Female %)	64.00	64.50
Ethnicity (Hispanic %)	7.50	3.40
Ethnicity (Black %)	19.20	7.30
Years of Formal Education (Education)	10.10 ± 4.40	12.00 ± 3.56
Total Number of Conditions or Procedures (Disease Burden)	6.93 ± 3.61	6.63 ± 3.39
Final Dementia Diagnosis (Demented %)	78.00	47.80

RESULTS: Path Analysis

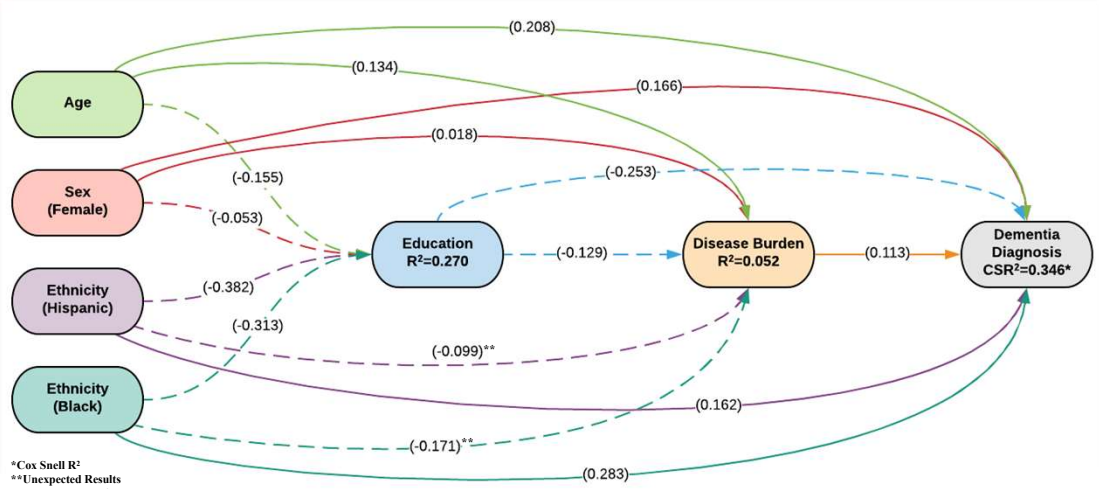

Figure 1. **Illustrates results of two linear regressions and one binary logistic regression, with education, disease burden, and dementia development as the dependent variables respectively**
Note: Male, non-Hispanic, and non-Black were used as reference categories for categorical variables.

RESULTS: Path Analysis

Table 2. Direct and Indirect Effects (β) of Variables on Dementia Diagnosis

Variable	Direct Effect*	Indirect Pathway	Indirect Effects * (Indirect Pathway β's multiplied)	Total Effect (Σβ)	Results
Age	0.208	Age, Education, Diagnosis	0.039	0.264	As age increased, risk of dementia diagnosis increased
		Age, Disease, Diagnosis	0.015		
		Age, Education, Disease, Diagnosis	0.002		
Sex (Female)	0.166	Sex, Education, Diagnosis	0.253	0.422	Being female increased risk of dementia diagnosis compared to being male
		Sex, Disease, Diagnosis	0.002		
		Sex, Education, Disease, Diagnosis	0.001		
Ethnicity (Hispanic)	0.162	Hispanic, Education, Diagnosis	0.096	0.253	Being Hispanic increased risk of dementia diagnosis compared to being non-Hispanic
		Hispanic, Disease, Diagnosis	-0.011		
		Hispanic, Education, Disease, Diagnosis	0.006		
Ethnicity (Black)	0.283	Black, Education, Diagnosis	0.079	0.348	Being Black increased risk of dementia diagnosis compared to being non-Black
		Black, Disease, Diagnosis	-0.019		
		Black, Education, Disease, Diagnosis	0.005		
Education	-0.253	Education, Disease, Diagnosis	-0.015	-0.268	As education increased, risk of dementia diagnosis decreased
Disease Burden	0.113	N/A	0.000	0.113	As disease burden increased, risk of dementia diagnosis increased

*All effects statistically significant at p<.001

DISCUSSION

Pathway of Cumulative Disadvantage:

- Older ethnic females with low education and high disease burden may be especially vulnerable to dementia diagnosis. They may suffer from lifelong cumulative disadvantage which may impact their access to education and health care. These disadvantages may also increase stress, decrease healthy lifestyle behaviors, and ultimately impact morbidity and mortality.

Unexpected Results:

- It was unanticipated that being non-white (**Figure 1) would negatively predict disease burden, despite the overall effect of ethnicity on dementia diagnosis being positive. It has been frequently documented that ethnic minorities carry a higher disease burden. However, this lower disease burden within the sample may suggest the relative health of the response sample compared to the U.S. population. It may be that these ethnic respondents were more likely to take part in the survey due to lower rates of disease compared to the general population. Alternatively, this result may point to minority groups' lower access to healthcare and disease diagnostics, and thus lower apparent burden.

FUTURE DIRECTIONS

- Conduct further SEM analyses by including other covariates and risk factors. Focus these analyses on identifying the temporal ordering of lifestyle and health behavior risk factors (i.e. smoking, drinking, physical activity), and specific diseases (i.e. diabetes and cardiovascular disease). Information on the causal ordering of these variables in relation to dementia diagnosis adds to the body of research on modifiable risk factors. This allows for the development of public health interventions and preventative treatments to alleviate the lifelong burden of disease, and potentially reduce the incidence of dementia.
- Continue to integrate ethnic- and sex-specific research into program development to better support vulnerable populations and improve the disease experience for future cohorts.

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