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Timing, Accumulation, and the Black/White Disability Gap in Later Life: A Test of Weathering

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Research Agenda

Reconstructing Disability Trajectories

Capturing Transitions and Trajectories

Pathways Linking SES to Disability

Demography of Disability

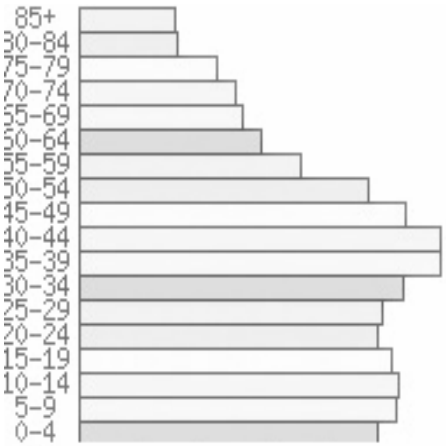
Timing, Accumulation, and the B/W Gap

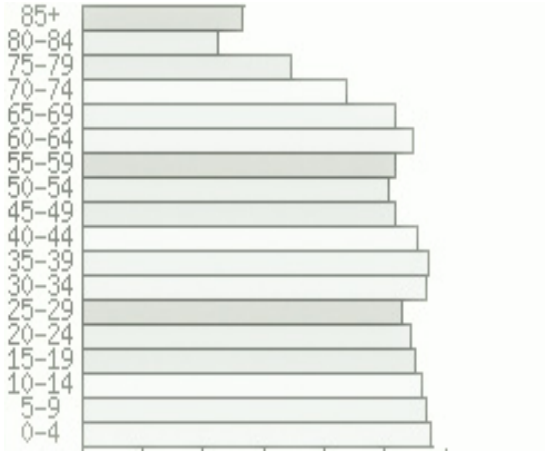
Ind. and Community Level SES on Disability

Racial Differences in Chronic Disease

Overview

- Aging, Disability, and the "Black/White Gap"
- Cumulative Disadvantage and Weathering
- Causal Mechanisms to Explain Disparity
- Empirical Test using a Novel Approach to "Growth"
- Conclusions and Implications of the Findings
- Limitations and Future Research





Introduction

- Increases in Life Expectancy and Population Aging
- Active Life Expectancy in the US
- Disability among Older Adults

Introduction

- Inequality in Increasing Health
- Disability and Cumulative Disadvantage
- Timing and Accumulation

Verbrugge and Jette (1994)

- Disability defined as "impacts that chronic and acute conditions have on the functions of specific body systems and on people's abilities to act in necessary, usual, expected, and personally desired ways in their society"
- Disability as couched in a social context
- Disability as a dynamic process

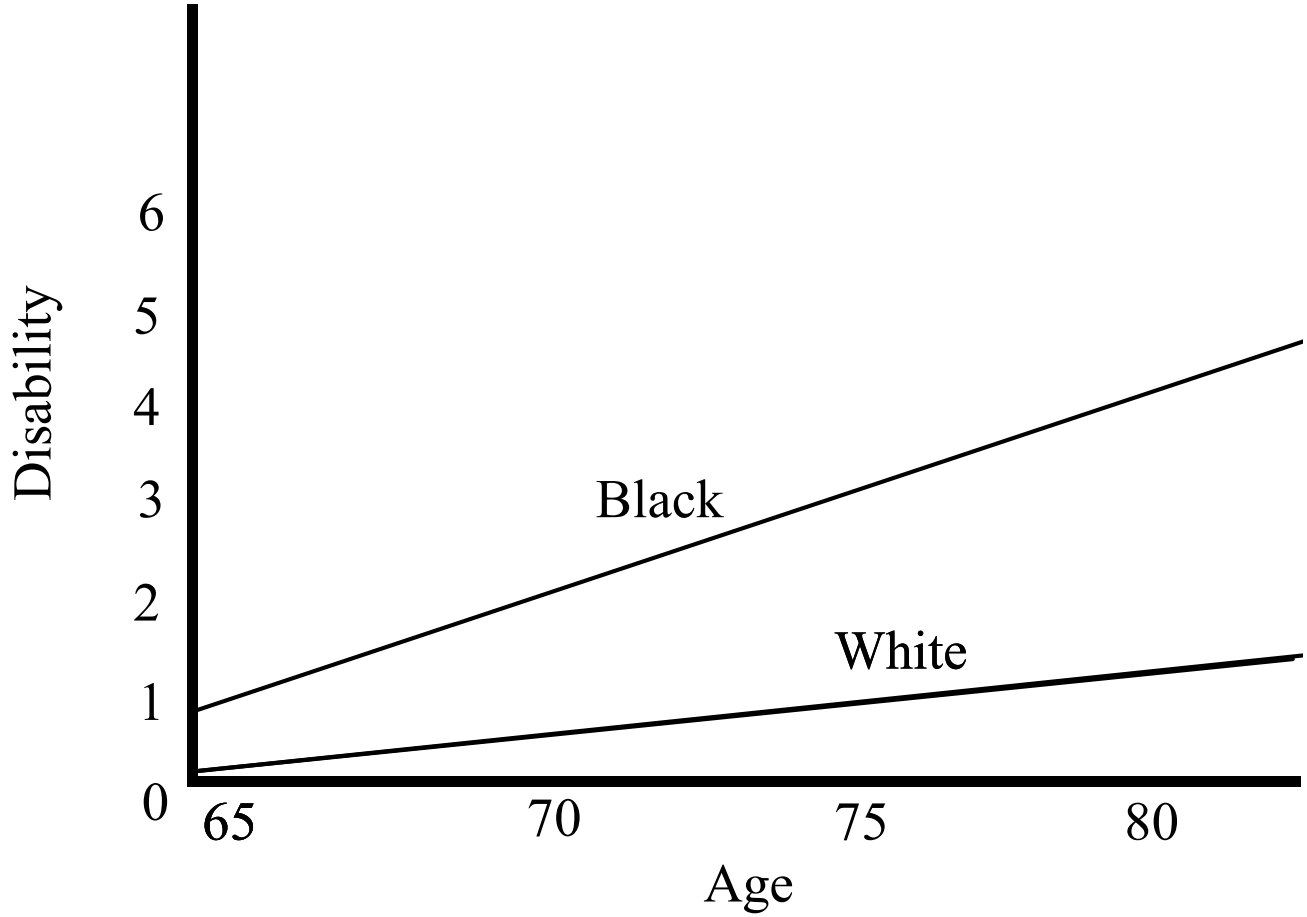
Theoretical Framework

- Cumulative Disadvantage
  - Merton (1968) and scientific careers
  - Social stratification: Education, income, mobility, etc.
- Core components of Cumulative Disadvantage theory in Life Course and Health research:
  - Trajectories of interindividual inequality
  - Increasing differentials at comparable levels of status
  - Inequality arising from “an interaction of a complex of forces” (Dannefer 2003) rather than one static position

Theoretical Framework

- Cumulative Disadvantage and Health Disparities
  - Accumulated exposure to negative events and stressors across the life course leading to inequality in health trajectories
- Evidenced by a Widening Gap in Health Across Time or Age
- Focus on Timing (Transition) *or* Trajectory in Disability Research, not both

Cumulative Disadvantage



Theoretical Framework

- Weathering Hypothesis (Geronimus 2001)
  - Unique experience of black women during reproductive years
- Also research on specific stressors and "high energy" coping strategies
  - Morbidity in middle class Blacks

(Geronimus et al. 2006; James et al. 1992)

Theoretical Framework

- Weathering posits a premature aging process for minorities (blacks)
  - Both an earlier Onset of poor health and an Acceleration of inequality (Trajectory) thereafter
  - Weathering also clearly acknowledges forces of selective mortality
- Use along side Cumulative Disadvantage
  - Some evidence for Weathering in disability (Geronimus 2001)

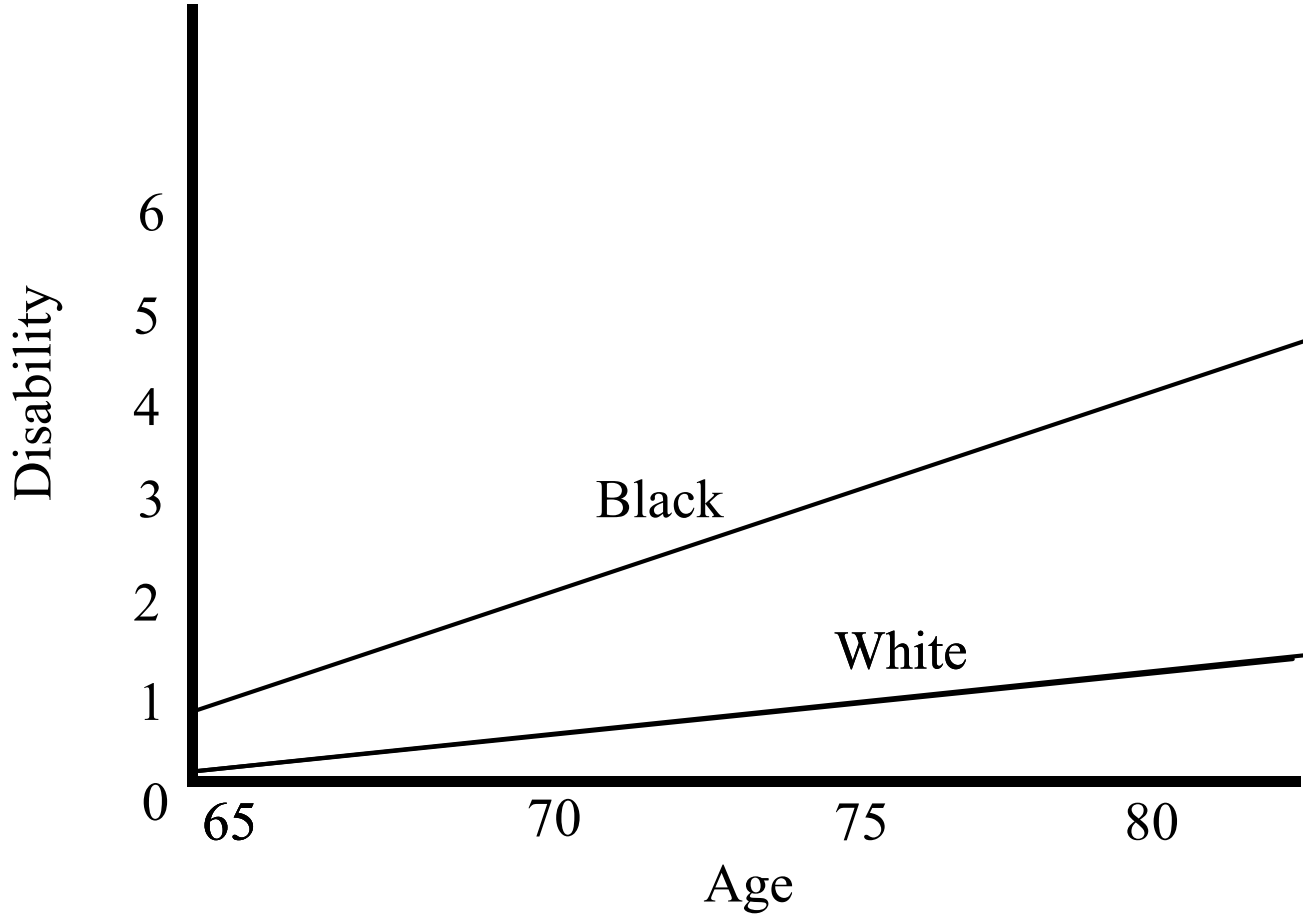
Black/White Disability Gap

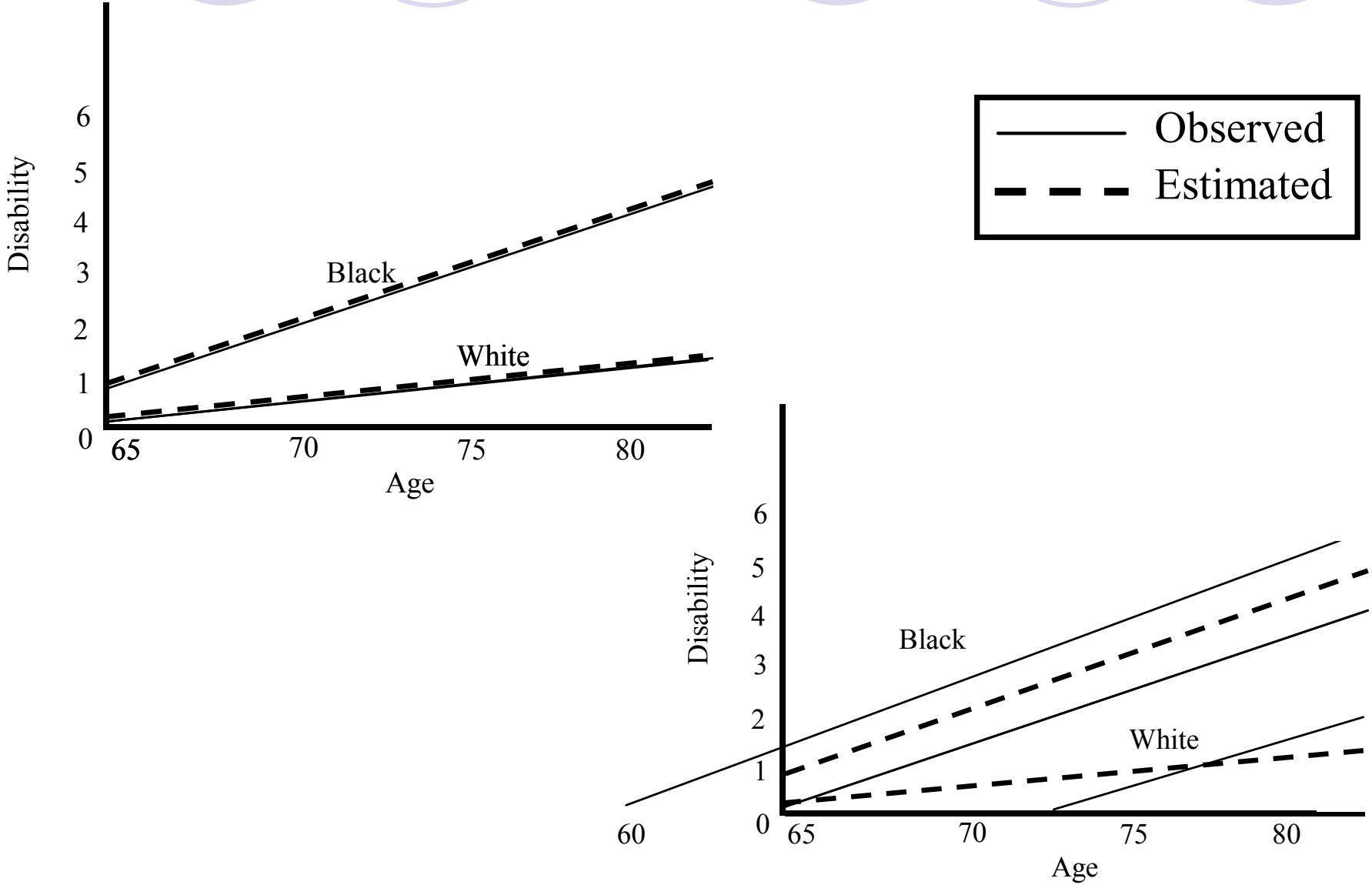
- Inequality in Disability over Time
  - Drawing back to Double Jeopardy (Dowd and Bengston 1978)
- Differentials found to be:
  - **Widening** (Clark 1997; Liao et al. 1999)
  - **Persistent** (Clark and Maddox 1992; Kelley-Moore and Ferraro 2004)
  - **Converging** (Guralnik et al. 1993; Johnson 2000)
  - **No Race Effect** (Taylor and Lynch 2004)

Inconsistent Findings

- Discrepancies in the literature are likely caused by a number of factors
  - Disability Measurement
  - SES and other Controls/Explanations
  - Selective Mortality
  - Methodological Approaches
    - (lack of focus on timing of onset)

Cumulative Disadvantage

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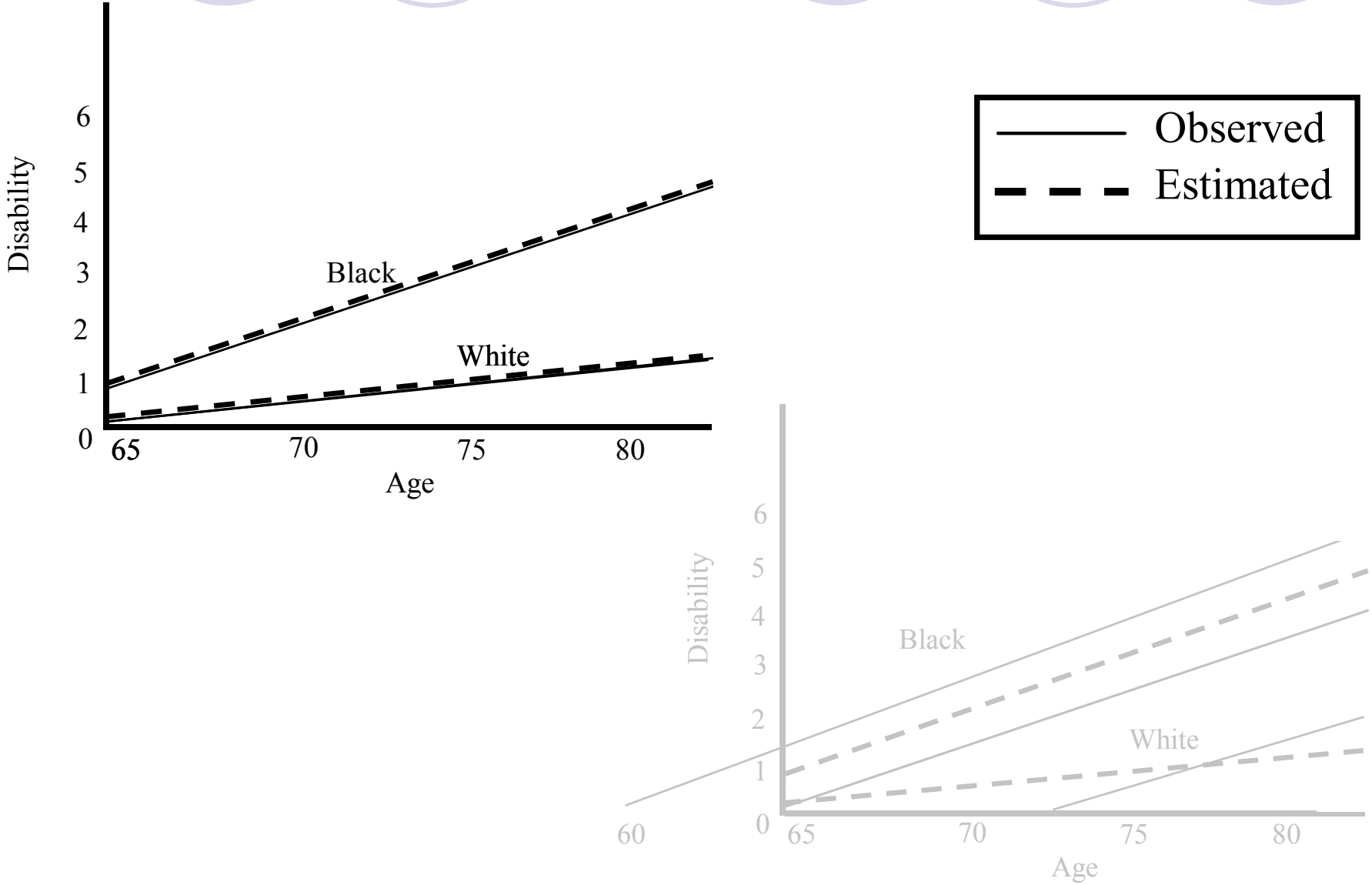
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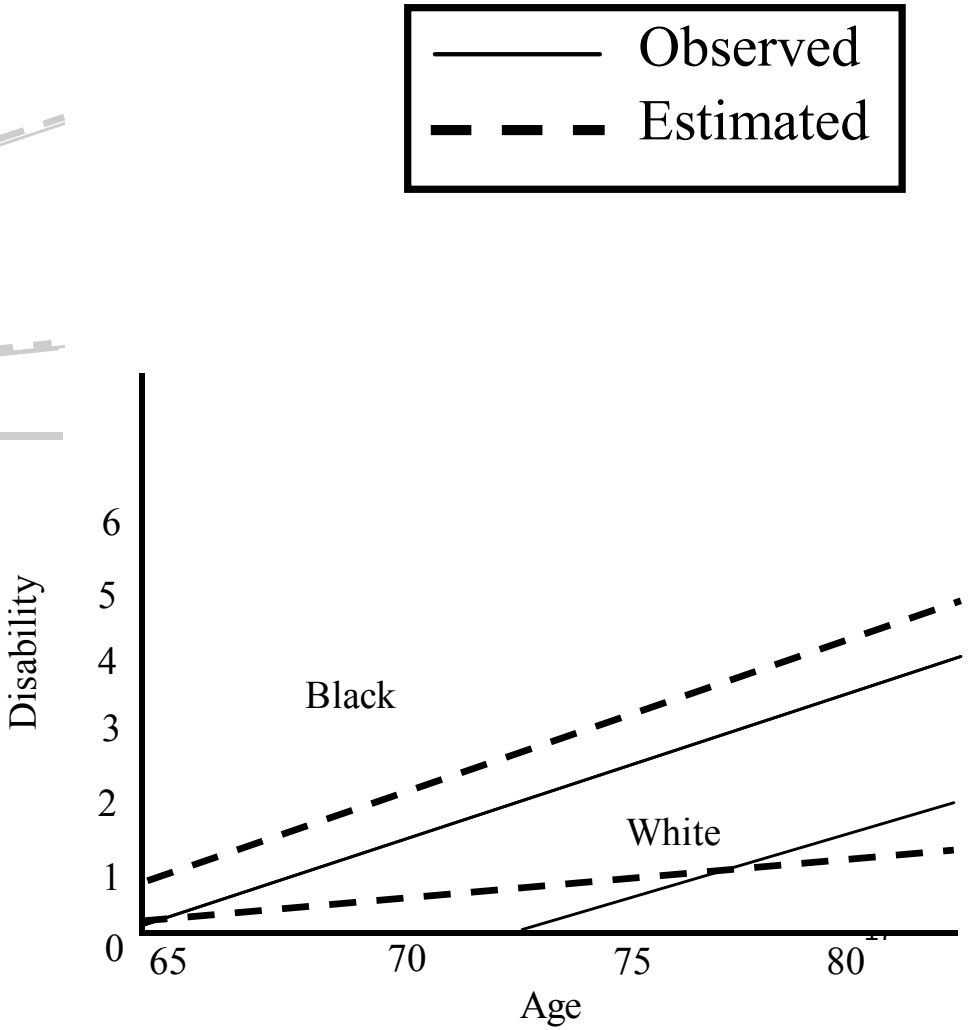
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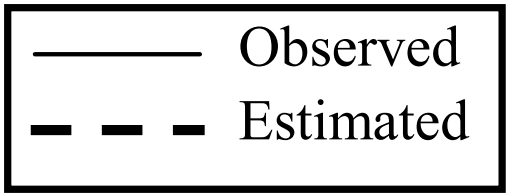
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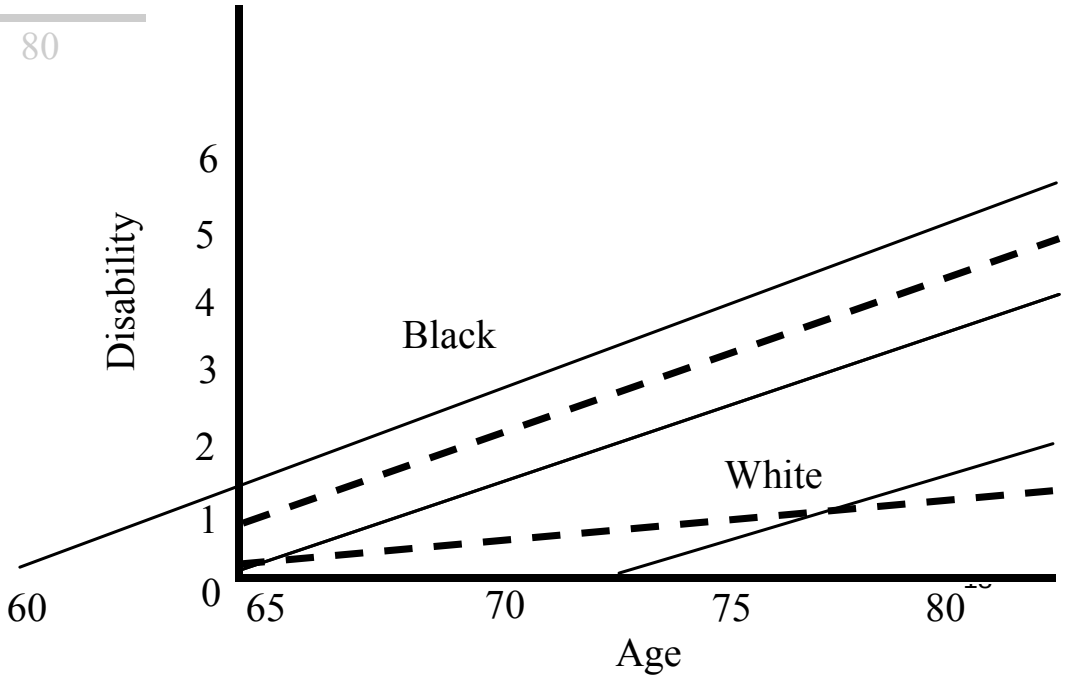
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Causal Mechanisms

- Four primary Causal Mechanisms in Health Disparities Research
  - Socioeconomic Status
  - Differential Health Behaviors
  - Differential Exposure to Stressors/ Resources
  - Biological or Genetic Disadvantage

Research Questions

- Reexamination of the Black/White Disability Gap in 2 components:
  - Timing of Onset and Trajectory of Severity or Level
- Test of the Mediating Roles of:
  - Socioeconomic Status
  - Chronic Conditions
  - Health Behaviors
  - Access to Care

Data

- Duke Established Populations for Epidemiologic Studies of the Elderly **(EPESE)**
- In-person: 1986/87, 1989, 1992, 1996
- Blacks Oversampled (54%)
- 26 individuals other than Black or White Dropped
- Original N=4,162, Analytic sample=3,941
- Missingness on Dependent Variable: FIML
- Missingness on Ind. Variables (10%): Imputed with dichotomous missing variables to account for bias

Measures

- Disability: *Activities of Daily Living (ADL's) and Instrumental Activities of Daily Living (IADL's)* (Katz et al. 1963; Lawton and Brody 1969)
  - Summed index (Spector and Fleishman, 1998; Taylor and Lynch 2004)
- Disability index split into 2 components:
- Dichotomous indicator of disability onset at each wave
- Continuous measure of disability level given onset (0=missing)

Measures

- Demographic Controls: *Age*, *Gender*, *Marital Status*
- Socioeconomic Status: *Education*, *Employment*, *Income*, *Assets*
- Chronic Conditions: *Heart Attack*, *Stroke*, *Hypertension*, *Cancer*, *Diabetes*, *Hip Fracture*
- Health Behaviors: *Obesity*, *Smoking*
- Access to Health Care: *Urban*, *Limited Access to Physician*, *Insurance*

Descriptive Statistics

	Total (N=3941)	Blacks (N=2145)	Whites (N=1796)
Disability 1986	1.11 (2.31)	1.26 (2.38)	.94 (2.20)
Disability 1989	1.64 (3.00)	1.79 (3.03)	1.47 (2.94)
Disability 1992	2.17 (3.49)	2.49 (3.61)	1.78 (3.31)
Disability 1996	2.95 (4.06)	3.32 (4.19)	2.51 (3.86)
Onset 1986	33.5%	38.2%	27.9%
Onset 1989	25.4%	27.0%	23.6%
Onset 1992	26.6%	32.7%	20.3%
Onset 1996	31.1%	34.2%	28.4%
Dis. level 1986 (0=mis)	3.35 (2.92)	3.31 (2.86)	3.40 (3.03)
Dis. level 1989 (0=mis)	4.08 (3.51)	4.02 (3.41)	4.17 (3.66)
Dis. level 1992 (0=mis)	4.65 (3.83)	4.67 (3.78)	4.62 (3.92)
Dis. level 1996 (0=mis)	5.59 (4.87)	5.67 (4.09)	5.46 (4.04)

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Onset and Growth

- Transition and Growth as Separate Processes
- Transition: $P(u_{ij}=1)=\frac{1}{1+e^{-(\mathbf{logit}_{ij})'}}$
- where: $\text{logit}_{ij} = \beta_j + \lambda'_{uj}\,\eta_{ui}$,

$$\eta_{ui} = \alpha_u + \gamma'_u\, x_i$$

Masyn, K. E. 2004. "Discrete-Time Survival Analysis using Latent Variables." Available at: http://www.ats.ucla.edu/stat/mplus/seminars/DiscreteTimeSurvival/default.htm

Onset and Growth

- Transition and Growth as Separate Processes

- Growth: $\alpha_{yi} = \mu_{ay} + \gamma_{\alpha_y} x_i + \zeta_{\alpha_{yi}}$

$$\beta_{yi} = \mu_{\beta y} + \gamma_{\beta_y} x_i + \zeta_{\beta_{yi}}$$

Bollen, K. A. and P. J. Curran. 2005. *Latent Trajectory (Curve) Models: A Structural Equation Perspective*. New York: John Wiley.

Albert, P. S. and J. H. Shih. 2003. "Modeling Tumor Growth with Random Onset". *Biometrics*, 59: 897-906.

Bivariate Models

N=3,941	(A) Growth Curve		(B) Growth Curve with Random Onset		
	Intercept	Slope	Hazard OR	Intercept	Slope
Black	**0.28*** **	**0.13*** **	**1.54*** **	**0.07**	**-0.02**
Age	**0.10*** **	**0.10*** **	**1.11*** **	**0.07*** **	**0.06*** **
Intercept	-6.34***	-6.06***	---	-2.93***	-3.38***
Var.	3.84***	1.28***	---	6.89***	1.30***
Cov. (α, β)	0.47***	---	---	0.88***	---
R^2	0.10	0.24	---	0.04	0.11
λ's	1,1,1,1	0,1,2,3	1,1,1,1	1,1,1,1	0,1,2,3
LL (npar)	-40673.84 (13)		-15970.76 (19)		
BIC	81414.00		32038.46		

*p<.05, **p<.01, ***p<.001.

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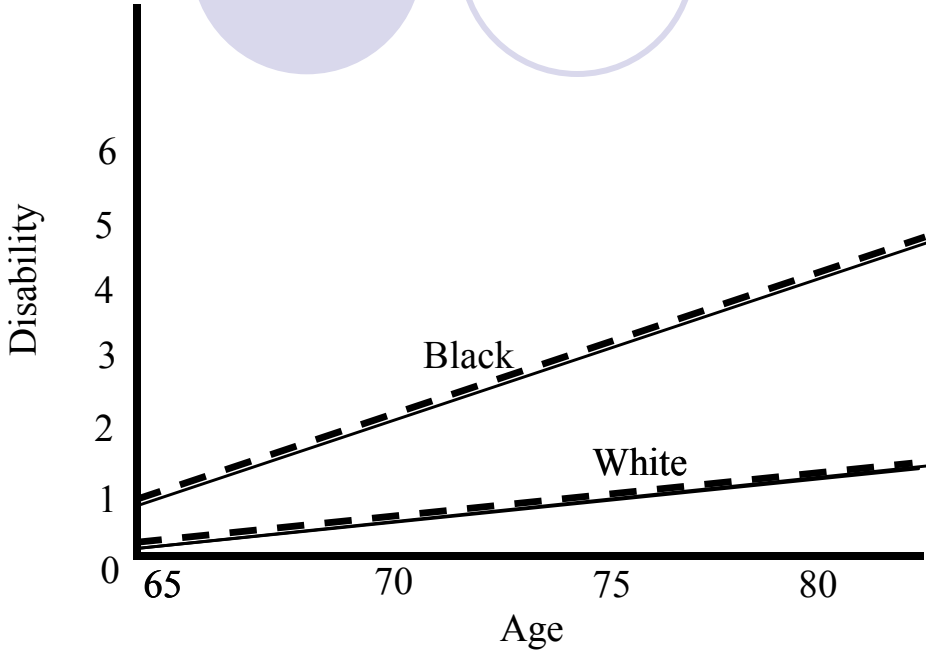
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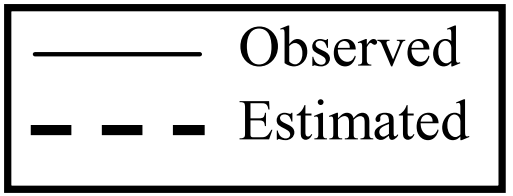
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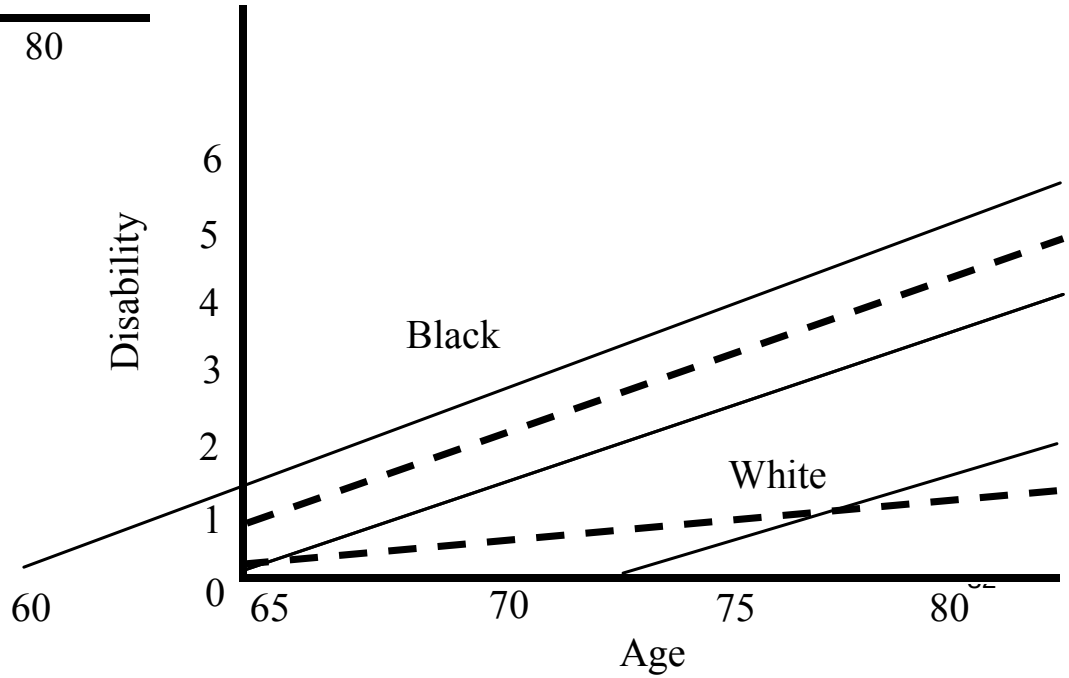
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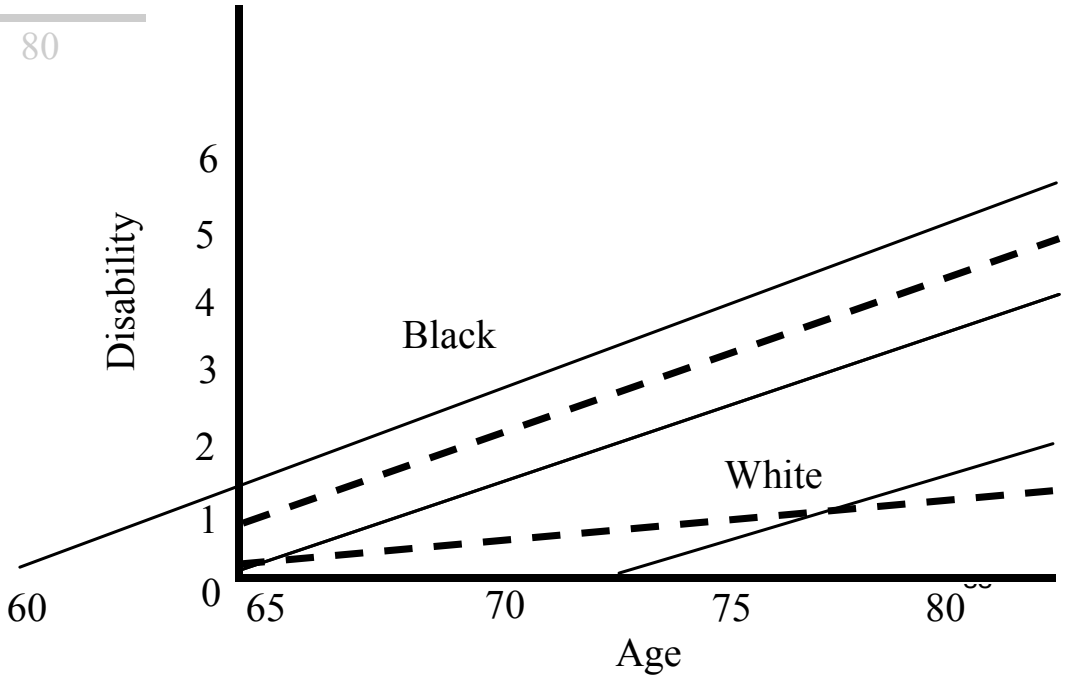
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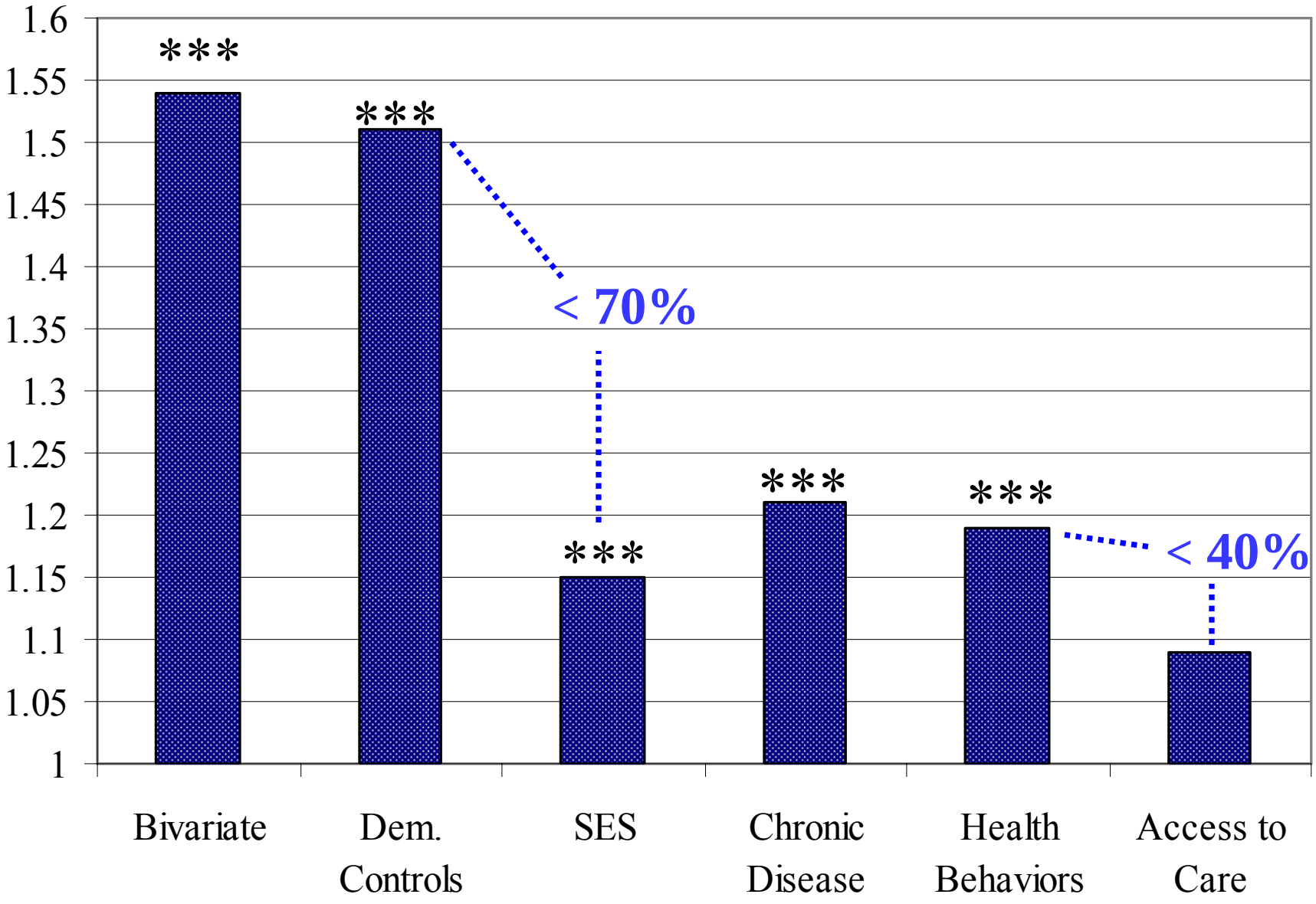
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< 70%
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Bivariate
Dem. Controls
SES
Chronic Disease
Health Behaviors
Access to Care

Nested Models

- **Model 1** (Demographic Controls):
  - Age and Marital Status
- **Model 2** (SES):
  - Education, Homemaker, Employment, Income, and Assets
  - Race Differential in onset reduced by 70%
- **Model 3** (Chronic Conditions):
  - Heart attack, Stroke, Hypertension, Diabetes, and Hip Fracture
- **Model 4** (Health Behaviors):
  - Obesity
- **Model 5** (Access to Care):
  - Limited access to Physician and Insurance
  - Access to care Mediated many of the SES effects
  - Differential in onset reduced by 40% and became nonsignificant

Conclusions

- Black/White Disability Gap fueled solely by differences in onset
  - Black individuals live more years with disability but do not have higher levels or faster accumulation compared to White individuals
- Does not necessarily refute Cumulative Disadvantage, but calls into question the way we test it
- Clear but limited support for Weathering
- Importance of Weathering or "Cascading" Disadvantage (Ferraro et al. 2006) in theory of Health Disparities

Conclusions

- Expected Results for SES
  - Mediated largest portion of disparity
  - Support for Cumulative Disadvantage
- Chronic Conditions and Health Behaviors had little effects on disparities
  - Contradictory to recent findings
- Other than SES, Access to Care had the largest mediating effects
  - Theoretical and Substantive Implications

Limitations

- Truest test of Cumulative Disadvantage was not possible here given the methods
- Time-invariant covariates (except chronic conditions)
- Selective Mortality during and prior to observation

Future Research

- Structural characteristics as Part of Cum. Dis. argument (only Urban used here)
  - Neighborhood poverty level, access to care, segregation
- Gender, Family, and Social Support
- Trends in Inequality over Time and Cohort
- Quality of Care / Discrimination w/in System

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Acknowledgements

- National Institute on Aging NRSA Institutional Training Award (T32AG00139), 2001-2005
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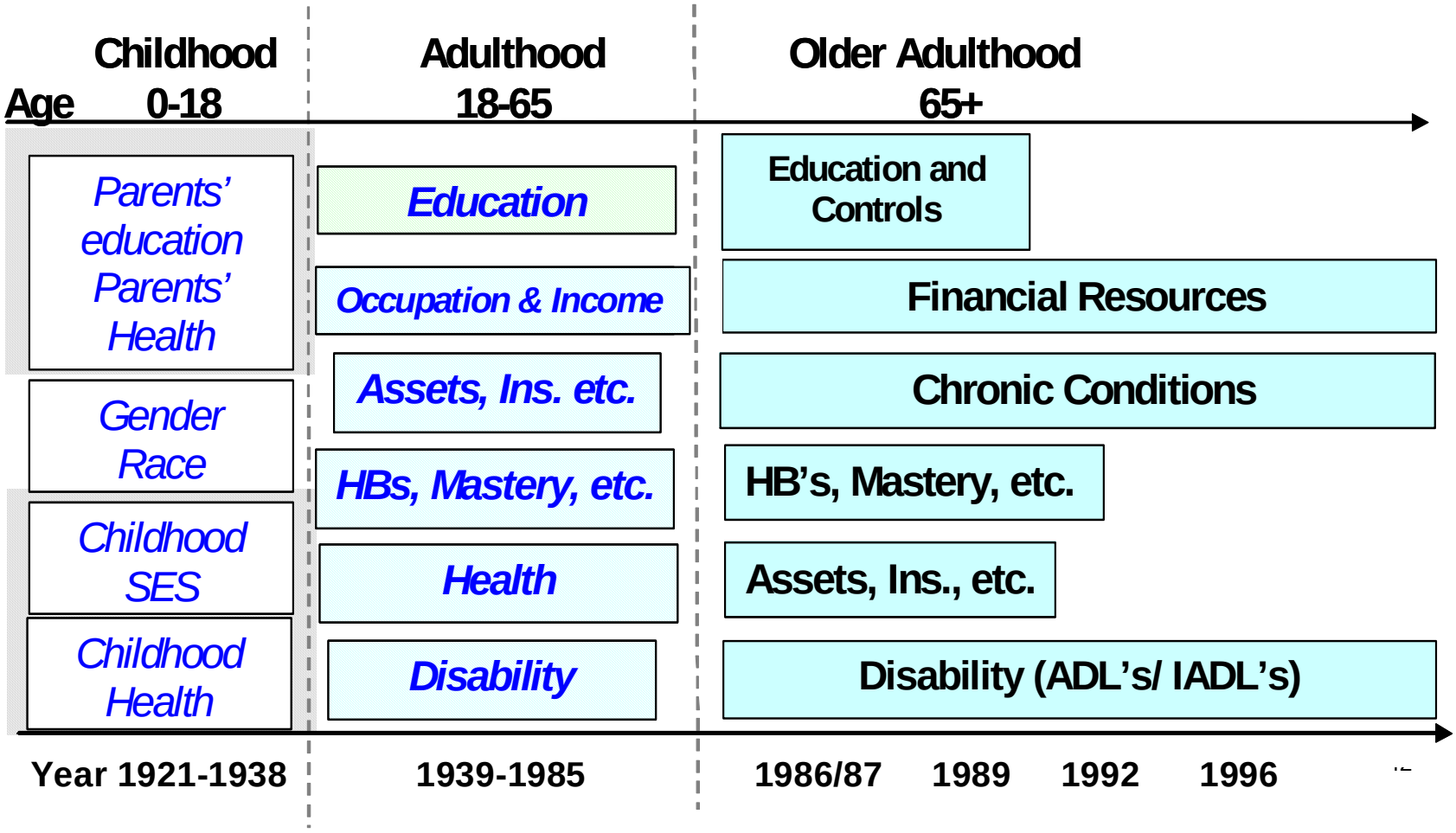
- Demography of Economics and Aging Research (DEAR), UNC-Chapel Hill Pilot Project Award, 2006
- National Institute on Aging Pathways to Independence Award (K99AG030471), 2007-2011

"Time is the one immaterial object which we cannot influence-neither speed up nor slow down, add to nor diminish."

~ Maya Angelou

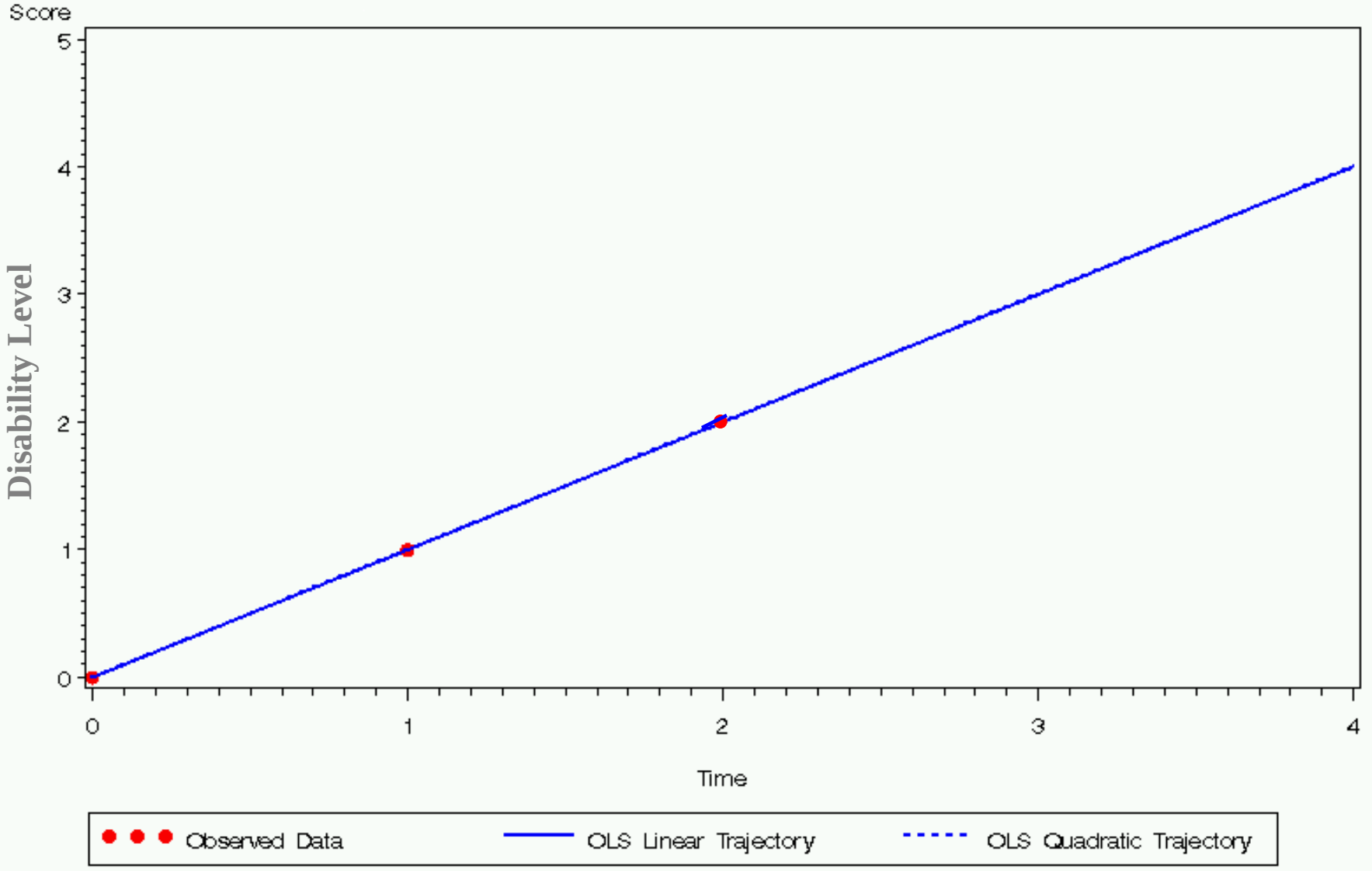
Race, SES & Health Across the Life Course



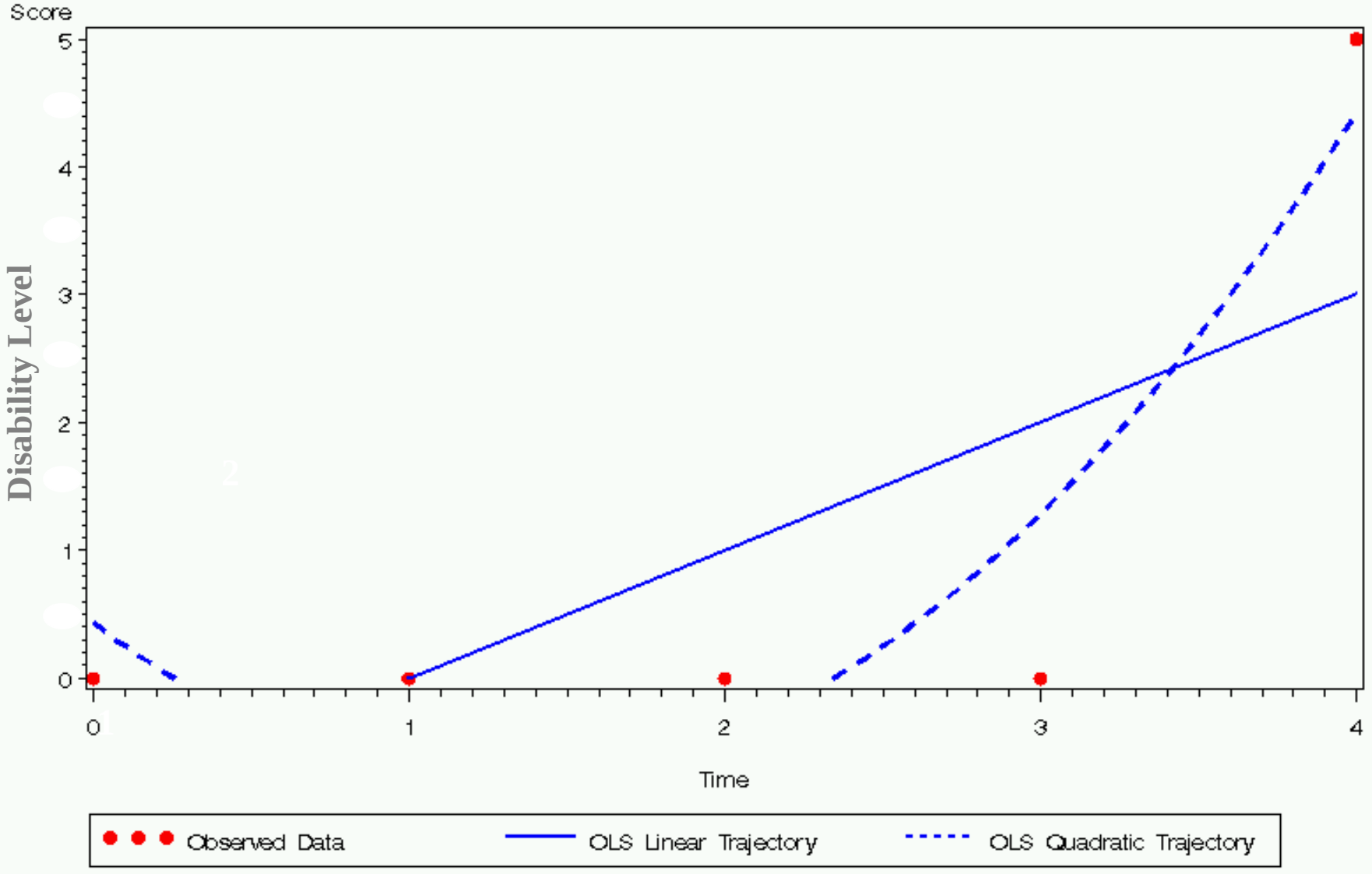
Sensitivity Analyses

- Selective Mortality
  - Both a mortality and attrition indicator and split analyses
- Alternate Disability Measurement Specifications
  - ADL's, IADL's alone
- Other Covariates:
  - Widowed, Depressive Symptoms, Social Support, Religious Attendance
  - Alternate Specifications of Education, Income, and Occ. Prestige
  - Chronic Condition Incidence
  - Overweight, Current Vs. Past Smoker
- Cohort Variations

Linear Experience of Disability Over Time



Delayed Experience of Disability Over Time



N=3941	Model 1			Model 2			Model 3			Model 4			Model 5		
	Haz. OR	Int.	Slope	Haz. OR	Int.	Slope	Haz. OR	Int.	Slope	Haz. OR	Int.	Slope	Haz. OR	Int.	Slope
Black	1.51***	0.07	-0.03	1.15***	0.20	-0.15	1.21***	0.26	-0.07	1.19***	0.23	-0.08	1.09	0.10	-0.09
Female	1.10	-0.30	-0.02	1.06	-0.38***	-0.01	1.05	-0.32	-0.02	1.08	-0.50	-0.21	1.08	-0.07	-0.19
Age	1.10***	0.08***	0.06***	1.09***	0.08***	0.05***	1.09***	0.08***	0.05***	1.09***	0.07***	0.05***	1.09***	0.07***	0.05***
Married	0.77***	0.19	-0.27***	0.94	0.18	-0.20	0.94	0.23	-0.20	0.94	0.19	-0.19	0.92	0.24	-0.21
Education	---	---	---	0.91***	0.01	-0.03*	0.92***	0.00	-0.03	0.92***	0.01	-0.03	0.93***	0.01	-0.02
Occ. Prestige	---	---	---	1.00	0.01	-0.00	1.004	0.01	-0.00	1.004	0.01	-0.00	1.00	0.01	-0.00
Homemaker	---	---	---	1.37***	0.19	0.09	1.38***	0.20	0.12	1.37***	0.18	0.11	1.32***	0.17	0.01
Employed	---	---	---	0.57***	-1.07***	0.09	0.59***	-0.93***	0.09	0.60***	-0.63***	-0.02	0.61***	-0.57***	-0.03
Income	---	---	---	0.99***	0.02	-0.00	0.99***	0.02	-0.01	0.99***	0.01	0.00	0.99	0.01	0.00
Own Home	---	---	---	0.71***	-0.30***	-0.07	0.73***	-0.28	-0.07	0.74***	-0.13	0.10	0.79***	0.03	-0.12
Heart Attack	---	---	---	---	---	---	1.33***	-0.06	0.02	1.34***	-0.02	0.03	1.30***	-0.04	0.05
Stroke	---	---	---	---	---	---	2.06***	1.34***	0.41***	2.03***	1.05***	0.49***	2.03***	1.05***	0.48***
Hypertension	---	---	---	---	---	---	1.13***	-0.25	-0.05	1.13***	-0.06	-0.10	1.14***	-0.07	-0.08
Cancer	---	---	---	---	---	---	1.04	-0.02	0.04	1.04	0.07	0.03	1.03	0.04	0.03
Diabetes	---	---	---	---	---	---	1.27***	0.44***	0.09	1.26***	0.47***	0.08	1.23***	0.45***	0.09
Hip Fracture	---	---	---	---	---	---	2.11***	0.66***	0.61***	2.14***	0.64***	0.64***	2.16***	0.62***	0.64***
Obese	---	---	---	---	---	---	---	---	---	1.21***	-0.21	0.09	1.21***	-0.20	0.09
Pack Years	---	---	---	---	---	---	---	---	---	1.00	0.00	-0.01***	1.00	0.00	-0.01***
Urban	---	---	---	---	---	---	---	---	---	---	---	---	0.91	0.06	-0.05
Limited Access	---	---	---	---	---	---	---	---	---	---	---	---	1.42***	-0.29***	0.06
Medicaid	---	---	---	---	---	---	---	---	---	---	---	---	1.30***	0.63***	-0.27
Supp. Insurance	---	---	---	---	---	---	---	---	---	---	---	---	0.72***	-0.15	-0.18
Intercept	---	-3.24***	-2.89***	---	-3.25***	-2.31***		-3.93***	-2.41***		-3.32***	2.33***		-3.17***	-2.28***
Var.	---	6.82***	-3.32***	---	6.76***	1.25***	---	6.36***	1.20***	---	-0.44	-2.71***	---	5.37***	1.25***
Cov. (α, β)	---	1.25***		---	-0.85***	1.07***	---	-0.99***		---	-0.88***		---	-0.92***	
R^2	---	0.04	0.12	---	0.06	0.14	---	0.12	0.19	---	0.21	0.21	---	0.22	0.21
λ's	1,1,1,1	1,1,1,1	0,1,2,3	1,1,1,1	1,1,1,1	0,1,2,3	1,1,1,1	1,1,1,1	0,1,2,3	1,1,1,1	1,1,1,1	0,1,2,3	1,1,1,1	1,1,1,1	0,1,2,3
LL (npar)	-15948.11 (25)			-15744.77 (43)			-15517.8((67)			-15367.38 (76)			-15320.8 (88)		
BIC	32023.76			31708.91			31377.41			31122.48			31090.62		

*p<.05, **p<.01, ***p<.001.

Model fit

Growth Portion Alone

χ^2 (df)	84.79 (9)
CFI	0.93
IFI	0.93
RMSEA	0.046

Access to Care

- More than 886,000 deaths could have been prevented from 1991 to 2000 if African Americans had received the same care as whites (Woolf et al. 2004)
- Twice as many African Americans age 0-64 have no coverage compared to Whites (UCLA/Kaiser 2000)

UNC
CAROLINA
POPULATION
CENTER

AGE-ADJUSTED RATES FOR 10 LEADING CAUSES OF DEATH BY ETHNIC GROUP PER 100,000 MALES

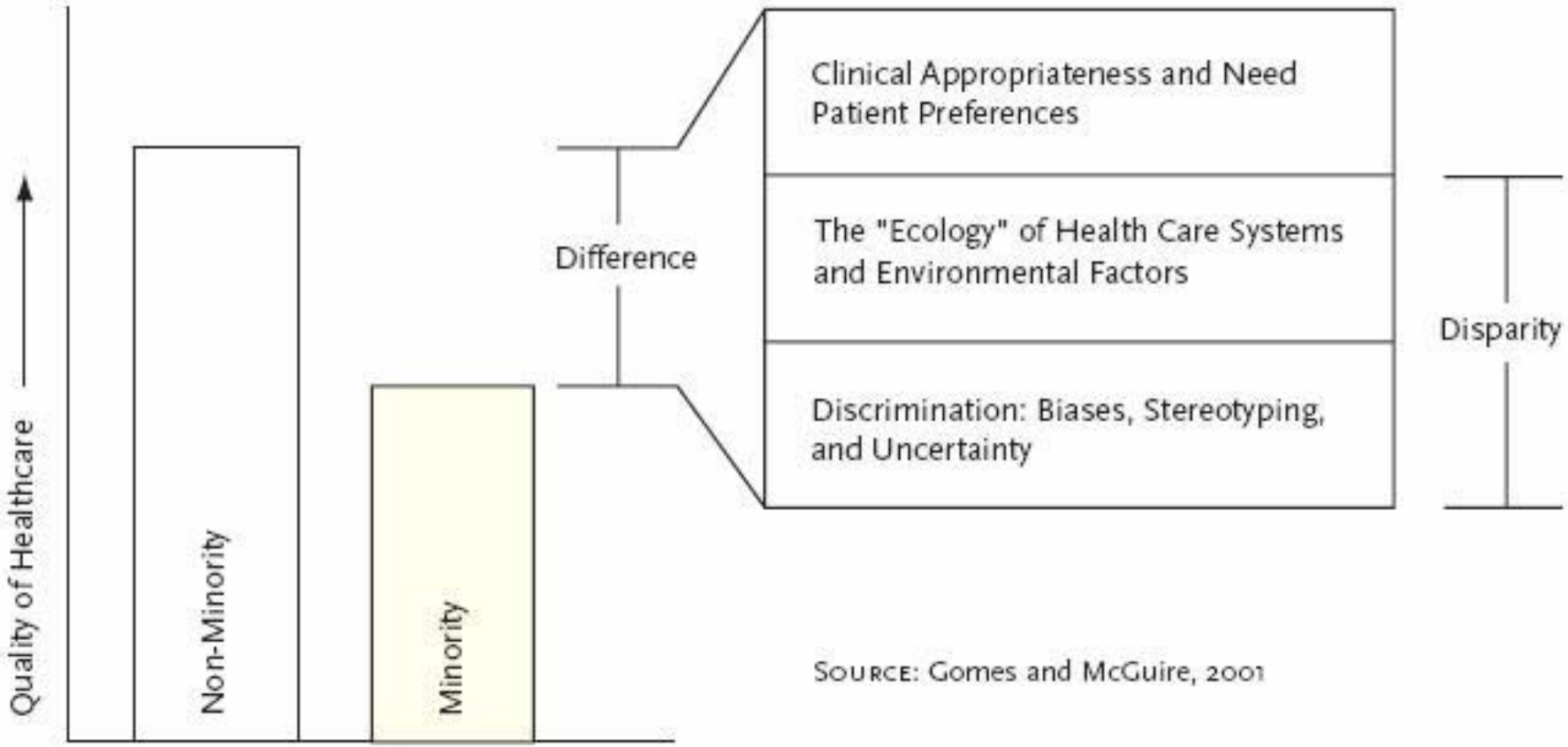
Disease	All	Non-Hispanic White	Non-Hispanic Blacks	Hispanic
Heart	328.1	329.5	344.3	212.7
All cancer	251.6	251.4	350.1	151.4
Cerebrovascular diseases	62.4	60.5	89.7	44.6
Chronic obstructive pulmonary disease	58.1	61.3	51.4	27.3
Unintentional accidents	50.6	49.1	64.2	47.2
Pneumonia and influenza	28.0	28.0	33.0	18.6
Diabetes mellitus	27.7	25.0	50.1	34.5
Suicide	18.2	20.3	10.8	10.7
Kidney infections	16.2	14.8	33.8	12.9
Chronic liver disease and cirrhosis	13.7	12.7	15.6	23.0

AGE-ADJUSTED RATES FOR 10 LEADING CAUSES OF DEATH BY ETHNIC GROUP PER 100,000 FEMALES

Disease	All	Non-Hispanic White	Non-Hispanic Blacks	Hispanic
Heart	220.9	218.1	297.0	146.5
All cancer	169.9	172.1	205.6	101.4
Cerebrovascular diseases	60.5	59.6	80.0	36.6
Chronic obstructive pulmonary disease	38.2	41.5	24.5	15.3
Diabetes mellitus	23.3	19.5	51.7	32.6
Unintentional accidents	22.7	23.1	24.4	15.5
Pneumonia and influenza	20.8	21.1	21.7	13.5
Alzheimer's disease	17.6	18.8	12.4	8.4
Kidney infections	11.2	9.7	26.6	8.8
Septicemia	10.5	9.5	23.0	6.8

SOURCE: Centers for Disease Control and Prevention (2001).

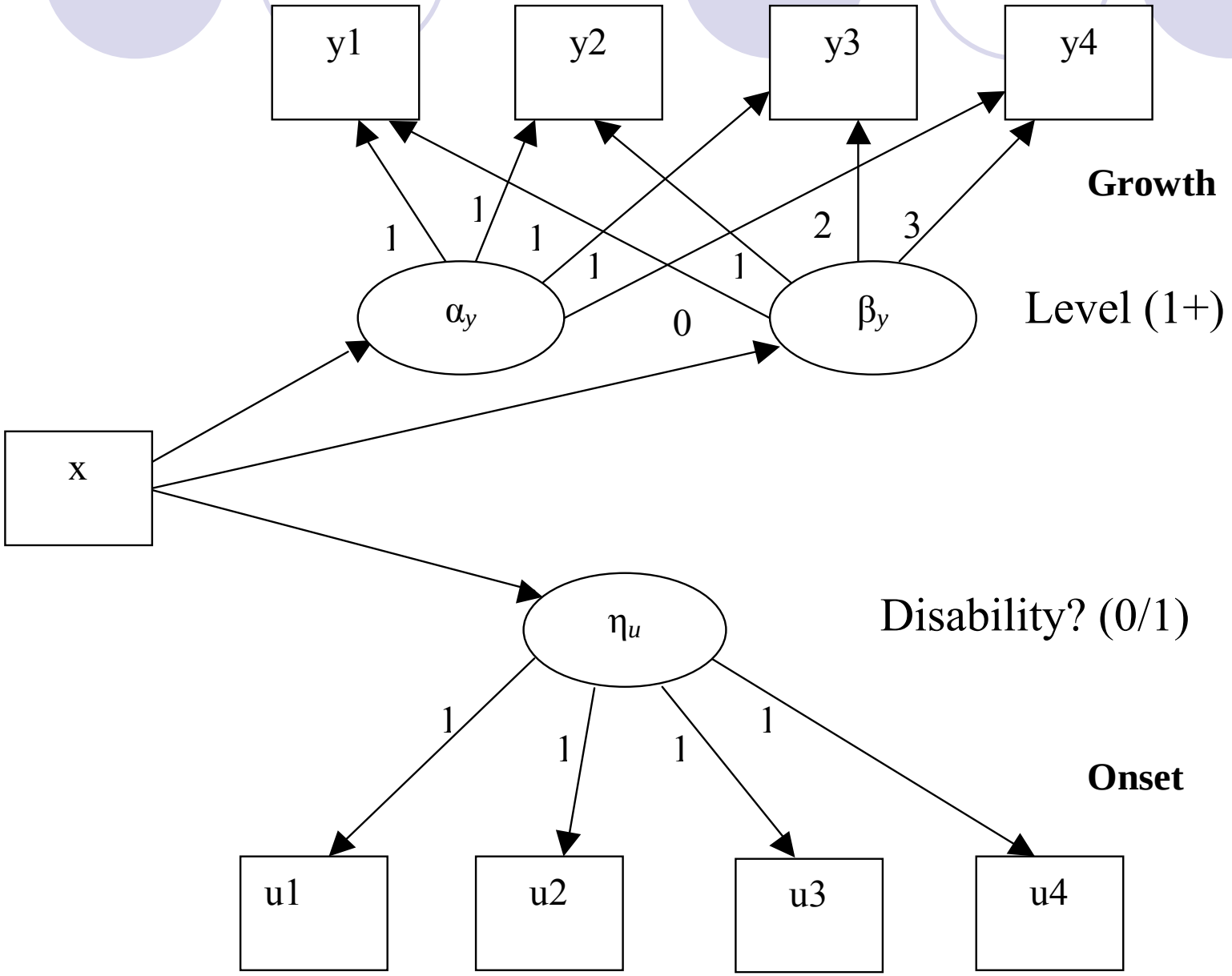
DIFFERENCES, DISPARITIES, AND DISCRIMINATION: POPULATIONS WITH EQUAL ACCESS TO HEALTHCARE



SOURCE: Gomes and McGuire, 2001

So What?

- Theoretical/Methods
  - Cum. Dis. theory
  - Health "Trajectories"
  - Studies of *Aging*
  - Selective Mortality and Left Censoring
- Application/Policy
  - Interventions
  - Access and Quality of Care
  - Structural Components of Disadvantage


y1
y2
y3
y4
Growth
1
1
1
1
1
2
3
α_y
β_y
0
Level (1+)
x
η_u
Disability? (0/1)
1
1
1
1
Onset
u1
u2
u3
u4

1912-1921 Cohort	Age 65-74	N=2,458
Covariates	Value	df
Male	9.270*	3
White	4.663	3
Age	3.289	3
Education 9 to 12	6.850	3
Education 13 to 17	6.198	3
Income 10 to 20,000	1.648	3
Income 20,000+	5.280	3

1902-1911 Cohort	Age 75-84	N=1,230
Covariates	Value	df
Male	0.221	3
White	0.852	3
Age	3.042	3
Education 9 to 12	3.021	3
Education 13 to 17	0.341	3
Income 10 to 20,000	0.697	3
Income 20,000+	1.844	3

1881-1901 Cohort	Age 85-105	N=279
Covariates	Value	df
Male	0.978	3
White	2.045	3
Age	0.436	3
Education 9 to 12	1.846	3
Education 13 to 17	3.101	3
Income 10 to 20,000	0.231	3
Income 20,000+	3.832	3

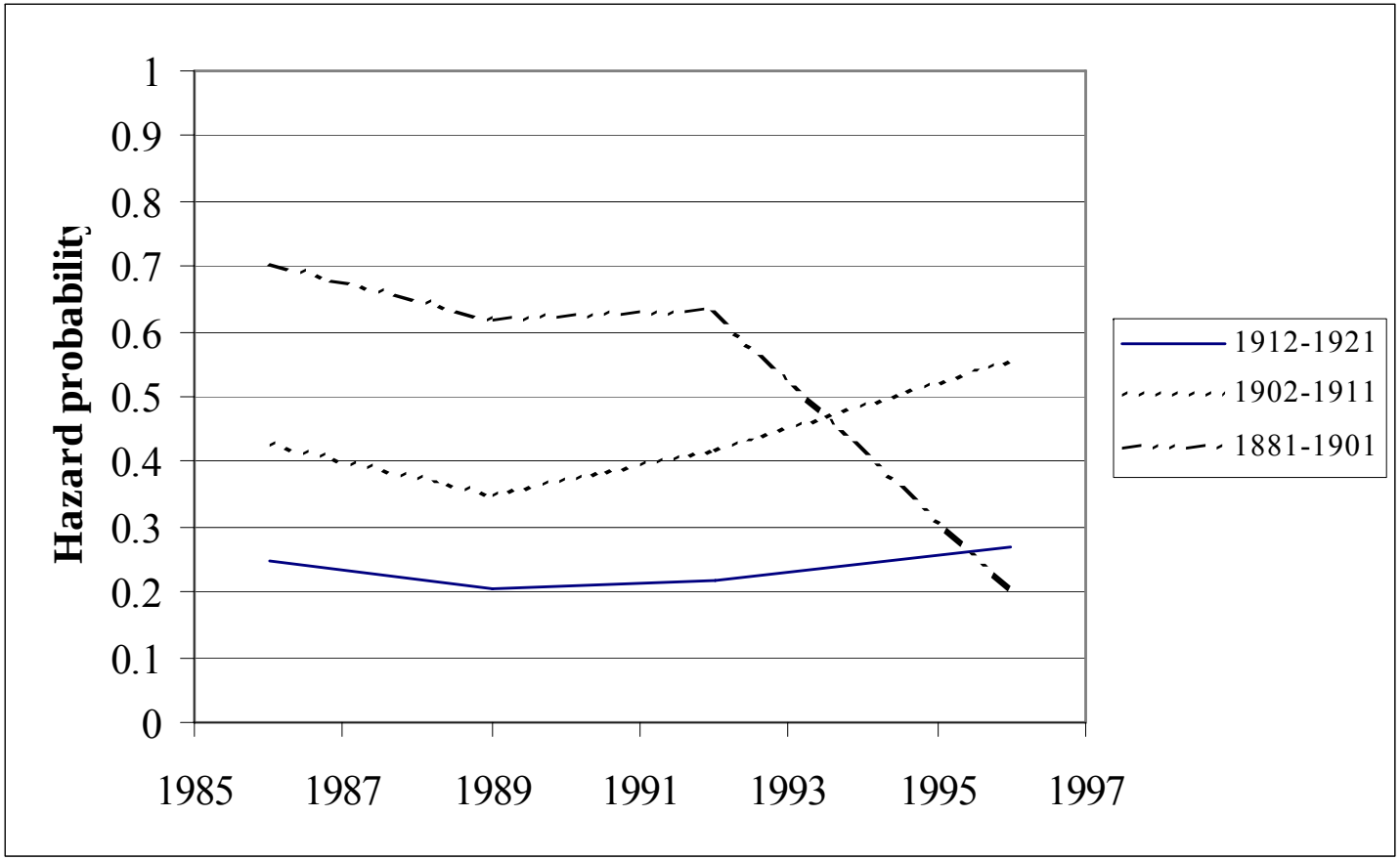
*p<.05, **p<.01, ***p<.001

Tests of Constancy Assumption

Cohort	N	Value	df
1912-1921	2,458	7.804	3
1902-1911	1,230	9.639*	3
1881-1901	279	3.388	3

*p<.05, **p<.01, ***p<.001

Predicted Probabilities for the Baseline Hazard



Ellison/Musick slide

N=3941	Model 1		
	Onset	Int.	Slope
Black	0.46***	0.21	-0.09
Female	0.21***	0.12	-0.01
Age	0.09***	0.04***	0.06***
Married	-0.12	0.50***	-0.10
Widow	-0.01	0.21	0.01
Rel. Attendance	-0.21***	-0.40***	0.05
Perc. Support	0.04	-0.02	0.02
Dep. Symptoms	0.13***	0.05***	-0.06

- Religious Attendance, religious shows/programs, religious mediation/prayer etc.