U.S. Regional Differences in Cognitive and Happy Life Expectancy[1]

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Background

- Why do we study HLE?
  - Partly to gauge whether improved QOL is accompanying gains in life expectancy
- In recent years, research on happiness has experienced resurgence
  - If you want to estimate (not necessarily understand) QOL, why not just ask people whether they're happy?
  - Arguably, one's subjective assessment of their SWB is a more valid measure of QOL than objective ones
- BUT, there are other reasons to study HLE
  - Cost forecasting, understanding health inequality, etc.
  - Also to understand contemporary and emergent health issues

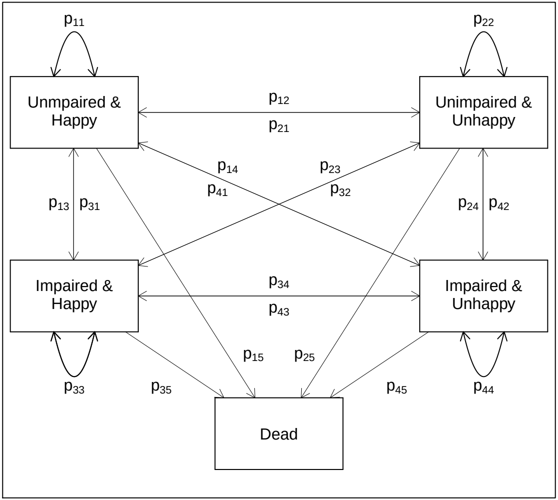
Background, cont'd

- One major emergent concern is cognitive impairment
- Although incidence/age>65 prevalence of CI is decreasing overall prevalence is increasing because of population aging
- CI plays a major role in affecting at least one dimension of QOL
- Questions:
    1. Can people be happy even when cognitively impaired?
    2. Which is longer: happy life or cognitive life expectancy?
    3. Are there birth/current regional differences in happy and cognitive life expectancy?

       We know that early life conditions impact later life health, including development of conditions that predict cognitive impairment

Approach: Multistate Methods

- 20 possible transitions at each age
- We will estimate using a Bayesian approach
- Yields posterior of dimension 247+: (13 x vars * 19 y vars)
- Size of space requires reconfiguring original Bayesian approach



Expanding the Bayesian Approach

- Difficulties with Bayesian approach
  - Original approach only handles two living states: must expand dimensionality, and that is difficult in a Bayesian setting
  - Original approach required starting state as a covariate; doesn't work for partially absorbing states because of perfect prediction (not a problem here, but is in some state spaces)
- Why not use other approaches?
  - Bootstrapping approaches can handle this state space *in theory* but not in reality: (1) low prevalence states for data bootstrapping and (2) asymptotics not met in high dimension for sampling from implied sampling distribution
  - Bayesian approach can incorporate prior information
  - Bayesian approach yields direct probabilistic interpretation

Methods

1. Set up multinomial logit model with all transitions minus 1: 19 transitions as outcomes; 13 covariates, incl. intercept.
2. Sample 1000 sets of parameters, β using an independence sampler
    - Gibbs sampler for multinomial probit originally used does not work because of dimensionality of error correlation matrix
3. For each β: Generate 23 (ages 65-109+, by=2) age-specific transition probability matrices, $P_{(5\times5)}$
    - covariates set to nonHispanic white married females
    - region set to all possible birth-current combinations (16 sets of 1000 life tables)
4. For each of the 16,000 collections of 23 age-specific P matrices, generate multistate life tables

Multistate Life Tables

- Standard calculations:

Calculation	Notes
$p_{x,x+1}$	obtained via inverting mlogit link
$l_{x+1} = l_x P_{x,x+1}$	each l_x is 1×5
$L_x = 2 * (l_x + l_{x+1})/2$	linear method (2 year interval)
$T_x = \sum_{i=x}^{\Omega} L_i$	
$e_x = T_x / l_x$	5 state expectancies, including death*

- State expectancies can be aggregated to obtain cognitive life expectancy and happy life expectancy
- Population based tables (radix determined by transition in first spell)

Data: Health and Retirement Study

- Panel with biennial waves from 1998-2012
- Only folks age 65+ and interviewed in 1998 or later
- Only folks born in the US who do not live abroad at any point
- Only one person per household
- Data set consists of spells $n = 42,369$ spells:

Predictors (in person year file)

Variable	Descriptives
Age	75.8(7.7)[65,109]
Male	40%
Black	15%
Other	2%
Hispanic	4%
Married	47%
Birth Region (S reference)	39%
NE	21%
MW	31%
W	9%
Current Region (S reference)	41%
NE	16%
MW	27%
W	17%

Outcomes

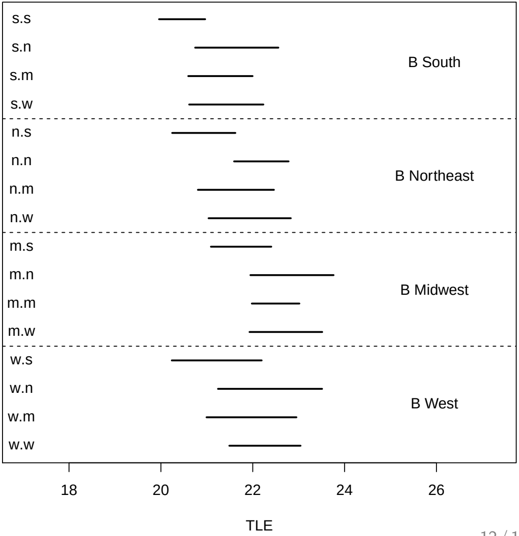
- Happiness (0,1):
  - Taken from CESD depression item
  - Wording: "Now think about the past week and the feelings you have experienced. Please tell me if each of the following was true for you much of the time this past week. Much of the time during the past week I felt happy."
  - If missing: most proximate response
- Cognitive Impairment (0,1):
  - Based on Crimmins et al (2016): Immediate and delayed recall of 10 words; 5 trials of serial 7s and backward counting
  - Range 0-27; impaired if below 12
  - If missing: 2+ IADLs

Observed Transitions

	CH	CU	IH	IU	Dead
Cognitive-Happy	19,469	1420	3690	396	1578
	(.73)	(.05)	(.14)	(.01)	(.06)
Cognitive-Unhappy	1326	886	300	284	312
	(.43)	(.29)	(.10)	(.09)	(.10)
Impaired-Happy	2186	200	5726	529	2144
	(.20)	(.02)	(.53)	(.05)	(.20)
Impaired-Unhappy	194	139	504	611	475
	(.10)	(.07)	(.26)	(.32)	(.25)
Dead	0	0	0	0	ALL

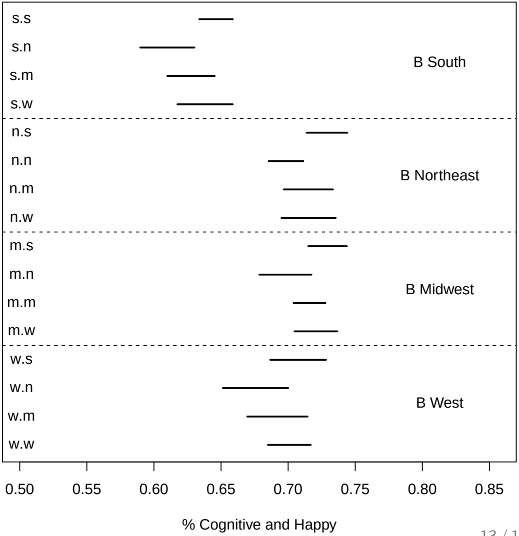
Results: Total Life Expectancy

- TLE varies a little by region: from 20-22 years
- Current southerners have lowest
- Variation suggests we look at percentages in states



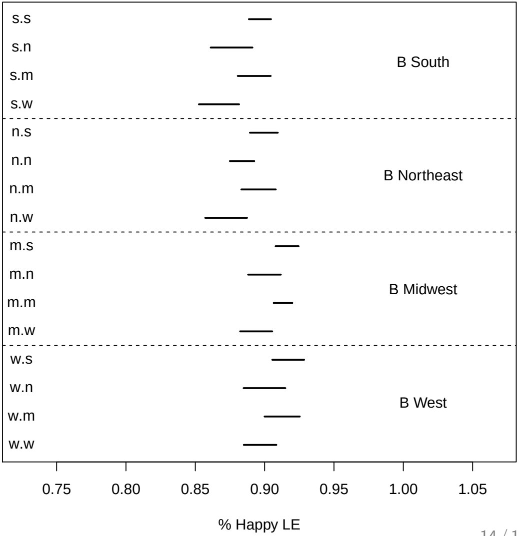
Results: Cognitive and Happy LE

- Southern born have lower CHLE
- Little variation based on current region



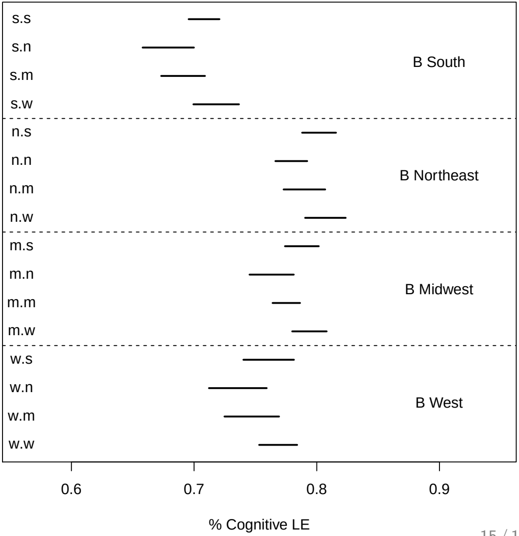
Results: Happy LE

- Lower CHLE for southern born does not seem to be due to differences in happiness



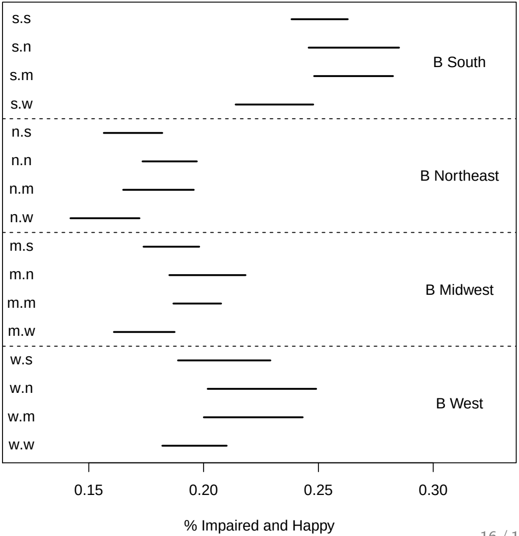
Results: Cognitive LE

- Instead, it seems to be driven by reduced cognitive life for the southern born



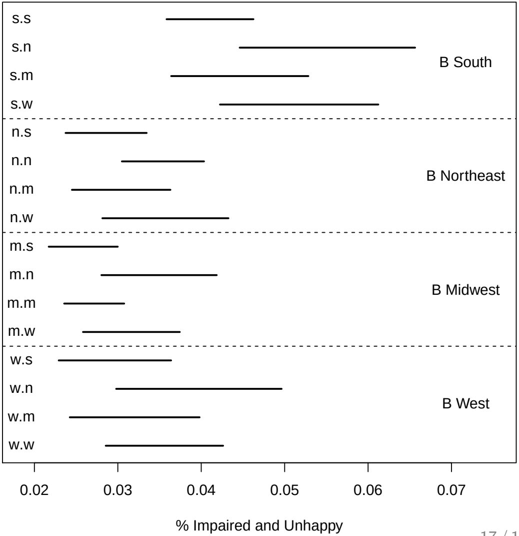
Results: Impaired but Happy LE

- Southern born have substantially higher % of life remaining impaired but happy
- Current westerners tend to have lower %, due to less happy time and more cognitive time



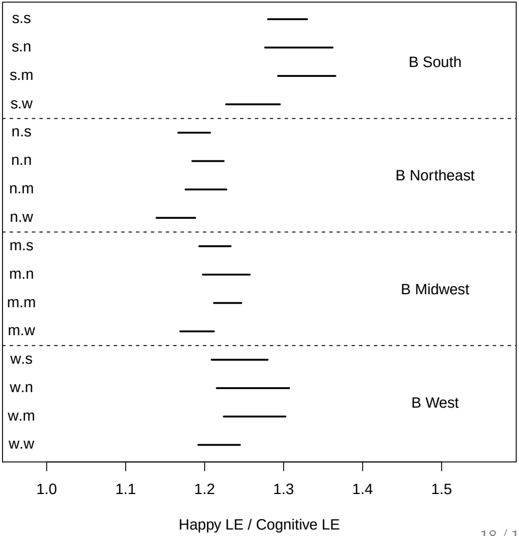
Results: Impaired and Unhappy LE

- southern born stand out here, as well, further indicating greater time spent with cognitive impairment
- very little variation by current region.



Results

- southern born spend 30% more of remaining life happy than with cognitive impairment
- persons from other birth regions spend about 20% more of their remaining life happy than with cognitive impairment



Conclusions

1. Can people be happy even when cognitively impaired?
    - Yes: shown in both the raw data but also in the life tables
    - About 18% of remaining life is cognitively impaired but happy for those born non-south
    - About 27% of remaining life is impaired but happy for those born in the south
2. Which is longer: happy life or cognitive life?
    - Happy life is longer by about 30% for those born in the south
    - Happy life is longer by about 20% for those born elsewhere
3. Are there regional differences in happy and cognitive life expectancy?
    - Yes, but they are mainly driven by birth region and not current region
    - Southern born spend more time cognitively impaired than others
    - Everyone spends about 90% of remaining life happy