

Supplementary Material

The Characteristics of Social Network Structure in Later Life in Relation to Incidence of Mild Cognitive Impairment and Conversion to Probable Dementia

Supplementary Table 1. Baseline demographic characteristics of eligible respondents accounting for survey design

Characteristic	N (%)	Weighted N (%)	SE of Weighted Frequency (%)
Female sex	3,551 (58.42)	16,056,597 (56.37)	347,269 (0.78)
Education			
Less than high school	1,585 (26.32)	5,846,596 (20.73)	274,404 (0.89)
High school graduate or equivalent	3,088 (51.27)	15,013,666 (53.23)	447,534 (1.03)
College graduate or beyond	1,350 (22.41)	7,343,341 (26.04)	337,025 (1.18)
Race/ethnicity			
Non-Hispanic white	4,193 (68.99)	23,142,025 (81.25)	596,005 (0.86)
Non-Hispanic black	1,316 (21.65)	2,296,069 (8.06)	109,054 (0.43)
Hispanic	353 (5.81)	1,851,640 (6.50)	147,420 (0.55)
Other minorities	216 (3.55)	1,192,168 (4.18)	145,361 (0.50)
Social network structure			
Having at least one family member within a social network	4,942 (81.66)	23,653,455 (83.38)	487,194 (0.62)
Having at least one friend within a social network	1,059 (17.50)	5,485,162 (19.34)	244,393 (0.78)
Having at least one family member within a social network	1,820 (30.07)	9,145,376 (32.24)	316,538 (1.04)
Total	6,078 (100.00)	28,481,902 (100.00)	542,820
	Mean (SD), N	Weighted Mean (SD)	
Age at baseline	77.49 (7.79), 6,078	75.11 (0.10)	
Follow-up time (y)	4.72 (1.61), 6,078	4.80 (0.03)	
Social network size	1.93 (1.29), 5,709	1.98 (0.03)	
Number of family members within a social network	1.51 (1.21), 6,052	1.54 (0.02)	
Number of friends within a social network	0.25 (0.61), 6,052	0.28 (0.01)	

The analytic sample includes NHATS respondents who had at least two waves of cognitive status during the follow-up period of 2011-2016. SE, Standard error. Weighted estimates are calculated accounting for complex NHATS survey designs of weights, strata, and clusters.

Supplementary Table 2. Annual cognitive transition rates

Previous status	Latter status	Transition rate /1,000 person-year with [95% Confidence Interval]
Cognitively unimpaired	MCI	41.0 [35.5, 47.3]
MCI	Cognitively unimpaired	0.004 [1.9e-51, 1.1e+46]
MCI	Probable dementia	241.3 [189.6, 307.0]
Cognitively unimpaired	Probable dementia	51.7 [46.6, 57.3]
Cognitively unimpaired	Death	5.6 [3.4, 9.1]
MCI	Death	135.7 [98.8, 186.5]
Probable dementia	Death	176.8 [156.1, 200.2]

Numbers expressed as transition rate /1,000 person-year with [95% Confidence Interval].

Supplementary Table 3. Adjusted Hazard Ratios of demographic characteristics on cognitive decline in the multi-state survival model for social network size

Transition	Baseline Age [95% CIs]	Male [95% CIs] ¹	High School Graduate [95% CIs] ²	College Graduate [95% CIs] ²	Non-Hispanic black [95% CIs] ³	Hispanic [95% CIs] ³	Other Minorities [95% CIs] ³	Social network size [95% CIs] ⁴
Unimpaired - MCI	1.17 [1.14, 1.19]	1.15 [0.89, 1.48]	0.26 [0.19, 0.35]	0.19 [0.13, 0.28]	2.39 [1.79, 3.20]	2.81 [1.70, 4.63]	1.89 [1.04, 3.46]	0.92 [0.82, 1.03]
Unimpaired - Probable dementia	1.14 [1.12, 1.16]	1.31 [1.01, 1.69]	0.43 [0.32, 0.58]	0.27 [0.18, 0.41]	1.41 [1.01, 1.96]	2.32 [1.55, 3.49]	1.88 [1.00, 3.51]	0.95 [0.86, 1.06]
Unimpaired - Death	1.01 [0.97, 1.06]	1.03 [0.56, 1.87]	0.75 [0.36, 1.55]	0.43 [0.17, 1.11]	0.45 [0.12, 1.69]	5.4e-05 [9.4e-71, 3.11e61]	0.46 [0.004, 48.33]	1.03 [0.83, 1.28]
MCI - Unimpaired	1.16 [1.11, 1.21]	1.34 [0.77, 2.32]	0.06 [0.01, 0.25]	7.7e-06 [8.5e-70, 6.9e-58]	1.28 [0.67, 2.46]	2.40 [0.97, 5.93]	0.07 [3.5e-05, 138.47]	1.26 [0.98, 1.62]
MCI - Probable dementia	1.02 [0.99, 1.05]	0.67 [0.41, 1.09]	1.61 [0.92, 2.81]	1.62 [0.84, 3.13]	0.62 [0.34, 1.12]	0.71 [0.25, 2.03]	0.46 [0.15, 1.42]	0.82 [0.67, 0.99]
MCI - Death	0.98 [0.94, 1.02]	2.09 [1.14, 3.84]	2.08 [1.04, 4.17]	2.37 [0.10, 5.60]	1.10 [0.49, 2.47]	0.64 [0.19, 2.14]	1.55 [0.39, 6.10]	1.13 [0.91, 1.42]
Probable dementia - Death	1.07 [1.04, 1.09]	1.29 [0.96, 1.73]	1.06 [0.78, 1.44]	0.74 [0.45, 1.23]	0.98 [0.70, 1.38]	0.57 [0.32, 1.01]	0.33 [0.07, 1.49]	1.04 [0.92, 1.17]

Adjusted Hazard Ratios [95% confidence interval] are estimated by our multi-state survival model accounting for baseline age, gender, education, race/ethnicity, and social network size of the respondents.

¹ Compared to females.

² Compared to respondents having less than a high school diploma.

³ Compared to Non-Hispanic whites.

⁴ Compared to respondents having one less social network member.

Supplementary Table 4. Adjusted Hazard Ratios of demographic characteristics on cognitive decline in the multi-state survival model for having at least one friend within a social network

Transition	Baseline Age [95% CIs]	Male [95% CIs] ¹	High School Graduate [95% CIs] ²	College Graduate [95% CIs] ²	Non-Hispanic black [95% CIs] ³	Hispanic [95% CIs] ³	Other Minorities [95% CIs] ³	Having at least one friend within a social network [95% CIs] ⁴
Unimpaired - MCI	1.16 [1.14, 1.18]	1.27 [0.99, 1.63]	0.28 [0.21, 0.39]	0.18 [0.12, 0.27]	2.36 [1.75, 3.17]	3.31 [1.99, 5.50]	2.73 [1.67, 4.46]	1.01 [0.73, 1.41]
Unimpaired - Probable dementia	1.14 [1.12, 1.16]	1.04 [0.85, 1.27]	0.47 [0.37, 0.60]	0.34 [0.25, 0.47]	1.67 [1.31, 2.13]	2.10 [1.46, 3.03]	1.60 [0.90, 2.85]	0.48 [0.33, 0.71]
Unimpaired - Death	0.98 [0.92, 1.03]	1.00 [0.55, 1.84]	0.71 [0.32, 1.59]	0.48 [0.18, 1.29]	0.52 [0.16, 1.70]	5.5e-05 [6.1e-94, 5.0e84]	0.001 [1.5e-93, 5.2e86]	0.76 [0.32, 1.79]
MCI - Unimpaired	1.15 [1.10, 1.20]	1.25 [0.72, 2.17]	0.10 [0.03, 0.37]	1.6e-05 [1.4e-92, 1.8e-82]	1.22 [0.59, 2.50]	3.42 [1.42, 8.22]	0.61 [0.12, 3.06]	1.03 [0.41, 2.61]
MCI - Probable dementia	1.01 [0.98, 1.05]	0.71 [0.43, 1.19]	1.68 [0.86, 3.31]	1.76 [0.84, 3.69]	0.71 [0.35, 1.43]	0.96 [0.35, 2.67]	0.59 [0.17, 2.04]	0.51 [0.20, 1.30]
MCI - Death	0.99 [0.95, 1.02]	2.04 [1.19, 3.48]	2.02 [1.10, 3.72]	1.79 [0.81, 3.94]	0.77 [0.40, 1.51]	0.41 [0.11, 1.53]	1.11 [0.45, 2.72]	2.58 [1.47, 4.51]
Probable dementia - Death	1.06 [1.04, 1.07]	1.23 [0.96, 1.58]	1.27 [0.98, 1.65]	0.97 [0.66, 1.42]	0.97 [0.74, 1.28]	0.66 [0.41, 1.05]	0.21 [0.05, 0.99]	0.75 [0.41, 1.36]

Adjusted Hazard Ratios [95% confidence interval] are estimated by our multi-state survival model accounting for baseline age, gender, education, race/ethnicity, and whether have at least one friend within a social network.

¹ Compared to females.

² Compared to respondents having less than a high school diploma.

³ Compared to Non-Hispanic whites.

⁴ Compared to respondents having no friend within a social network.

Supplementary Table 5. Adjusted Hazard Ratios of demographic characteristics on cognitive decline in the multi-state survival model for having at least one college-educated family member within a social network

Transition	Baseline Age [95% CIs]	Male [95% CIs] ¹	High School Graduate [95% CIs] ²	College Graduate [95% CIs] ²	Non-Hispanic black [95% CIs] ³	Hispanic [95% CIs] ³	Other Minorities [95% CIs] ³	Having at least one college-educated family member within a social network [95% CIs] ⁴
Unimpaired-MCI	1.16 [1.13, 1.18]	1.35 [1.05, 1.73]	0.26 [0.19, 0.36]	0.18 [0.13, 0.27]	2.29 [1.72, 3.06]	3.32 [2.07, 5.32]	2.63 [1.51, 4.58]	1.06 [0.80, 1.39]
Unimpaired – Probable dementia	1.16 [1.14, 1.17]	0.99 [0.80, 1.21]	0.56 [0.45, 0.71]	0.46 [0.33, 0.63]	1.69 [1.35, 2.11]	2.17 [1.52, 3.10]	1.43 [0.77, 2.65]	0.37 [0.26, 0.51]
Unimpaired - Death	0.99 [0.94, 1.04]	0.97 [0.50, 1.89]	0.74 [0.33, 1.65]	0.52 [0.19, 1.39]	0.40 [0.09, 1.83]	4.9e-05 [2.4e-86, 1.0e77]	0.25 [4.0e-5, 1605.2]	0.81 [0.41, 1.61]
MCI - Unimpaired	1.14 [1.10, 1.20]	1.29 [0.75, 2.22]	0.09 [0.02, 0.34]	5.3e-06 [3.8e-85, 7.5e+73]	1.16 [0.56, 2.37]	3.20 [1.34, 7.62]	0.43 [0.06, 3.11]	1.21 [0.58, 2.52]
MCI - Probable dementia	1.01 [0.98, 1.05]	0.88 [0.53, 1.45]	1.17 [0.64, 2.13]	1.27 [0.61, 2.62]	0.54 [0.28, 1.04]	0.89 [0.37, 2.12]	0.59 [0.17, 2.04]	1.27 [0.58, 2.52]
MCI - Death	0.98 [0.95, 1.02]	1.89 [1.10, 3.25]	2.70 [1.45, 5.02]	2.87 [1.30, 6.36]	1.03 [0.53, 2.00]	0.50 [0.16, 1.59]	1.12 [0.33, 3.88]	0.75 [0.40, 1.39]
Probable dementia - Death	1.06 [1.04, 1.08]	1.21 [0.94, 1.56]	1.19 [0.92, 1.54]	0.90 [0.60, 1.33]	0.92 [0.69, 1.21]	0.61 [0.38, 0.98]	0.19 [0.04, 0.94]	0.93 [0.68, 1.27]

Adjusted Hazard Ratios [95% confidence interval] are estimated by our multi-state survival model accounting for baseline age, gender, education, race/ethnicity, and whether have at least one college-educated family member within a social network.

¹ Compared to females.

² Compared to respondents having less than a high school diploma.

³ Compared to Non-Hispanic whites.

⁴ Compared to respondents who have no college-educated family member within a social network.