# Social networks in ADRD



Brea L. Perry Department of Sociology Indiana University, Bloomington

## Social connectedness preserves cognitive function in older adults



#### SOCIAL ENGAGEMENT AND COGNITIVE FUNCTION IN OLD AGE

#### Kristin R. Krueger

Rush Alzheimer's Disease Center and Department of Behavioral Sciences, Rush University Medical Center, Chicago, Illinois, USA

#### Robert S. Wilson and Julia M. Kamenetsky

Rush Alzheimer's Disease Center and Departments of Neurological Sciences and Behavioral Sciences, Rush University Medical Center, Chicago, Illinois, USA

#### Lisa L. Barnes

Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, Illinois, USA

#### Julia L. Bienias, and

Rush Institute for Healthy Aging and Department of Internal Medicine, Rush University Medical Center, Chicago, Illinois, USA

#### David A. Bennett

Rush Alzheimer's Disease Center and Department of Neurological Sciences, Rush University Medical Center, Chicago, Illinois, USA

#### Abstract

We exami multiple co Social netv in linear re social supp related to associated

"More frequent participation in social activities and a higher level of perceived engagemer social support were associated with higher level of cognitive functioning."

#### $\rightarrow M$ The effect of social networks on the relation between Alzheimer's disease pathology and level of cognitive function in old people: a longitudinal cohort study

#### David A Bennett, Julie A Schneider, Yuxiao Tang, Steven E Arnold, Robert S Wilson

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Article

whiched Online Background Few data are available about how social networks reduce the risk of cognitive impairment in old age. We April 4, 2006 aimed to measure this effect using data from a large, longitudinal, epidemiological clinicopathological study 00:10.1016/51474-4422(0 ethods 89 elderly people without known dementia participating in the Rush Memory and Aging Project underwen

annual clinical evaluation. Brain autopsy was done at the time of death. Social network data were obtained by enter (DA Report MD structured interview. Cognitive function tests were Z scored and averaged to yield a global and specific measure of

cognitive function. Alzheimer's disease pathology was quantified as a global measure based on modified Bielschowsky silver stain. Amyloid load and the density of paired helical filament tau tangles were also quantified with antibodyspecific immunostains. We used linear regression to examine the relation of disease pathology scores and social networks to level of cognitive function. Pathology () A Schneider),

"Even at more severe levels of Chicago, IL, USA; and Neurobiology and University of Per Philadelph (S E global disease pathology, cognitive function remained higher for participants with larger network sizes. A similar modifying association was observed with tangles."



#### Figure 1: Predicted association between pathology and global cognitive function score proximate to death

Upper=global Alzheimer's disease pathology. Lower=PHFtau tangles. Red line=90th percentile of social network size (13 participants). Blue line=10th percentile of social network size (two participants). Dotted lines indicate 95% CIs. Both models controlled for age, sex, education, and main effects for social networks and each pathological index.

# Social and biological mechanisms remain unclear and contested

- Absence of unifying theory of social risk and resilience
- Measurement heterogeneity and imprecision
  - Number of relationships
  - Frequency of social contacts
  - Perceived social support
  - Participation in social activities
  - Subjective loneliness
  - Marital status

## Social and biological mechanisms of social connectedness

#### **Social Bridging**

*Definition:* Access to and engagement with peripheral, irregular, or heterogeneous social ties

Biological mechanism: Exposure to novel social stimuli that are cognitively enriching builds cognitive reserve against neurodegeneration

#### **Social Stress**

Definition: Distress resulting from losses or exits from relationships and social roles, or dysfunction and strain in ongoing relationships

Biological mechanism: Hypersecretion of stress hormones affects inflammation, amyloid deposits, neuroplasticity, and neurodegeneration

#### **Social Bonding**

*Definition:* Social roles, sense of belonging, and emotional support and affirmation accessible through close relationships and primary social units

Biological mechanism: Affects cortisol and oxytocin levels, and buffers the effects of stress on the brain

#### **Social Influence**

*Definition:* Process by which an individual's attitudes, beliefs, or behavior are modified by the presence or action of others

*Biological mechanism:* Health behaviors associated with inflammation, and amyloid deposits, neuroplasticity, and neurodegeneration



Precision measurement of social connectedness

# Personal social network methods disaggregate distinct dimensions of social connectedness

- Collects data about the individual people in the social network
- Yields data on the structure, function, and composition of individuals' social networks



# Personal social network methods disaggregate distinct dimensions of social connectedness

# Step 1: Elicit names of people in the personal network ("alters")



### **Social Bridging**

Thinking about yesterday, who were the people you talked to or spent time with for more than five minutes, whether you are close to them or not?

### **Social Bonding**

Who are the people in your life with whom you discuss important matters? Who are the people you can really count on?

## **Social Stress**

Who are the people who are a burden to you or who make your life difficult?

## **Social Influence**

Who are the people who are always talking about your mental and physical health and trying to get you to do things about them?

# Personal social network methods disaggregate distinct dimensions of social connectedness

Step 1: Elicit names of people in the personal network ("alters")Step 2: Ask follow-up questions about each alter



## **Social Bridging**

*Is [NAME] the same race or ethnicity as you?* 

## **Social Bonding**

Does [NAME] tell you they care what happens to you?

## **Social Stress**

Does [NAME] hassle you, cause problems, or make life difficult?

#### **Social Influence**

Does [NAME] give you suggestions when you have a problem about what you should do?

# Personal social network methods disaggregate distinct dimensions of social connectedness

Step 1: Elicit names of people in the personal network ("alters")

Step 2: Ask follow-up questions about each alter

Step 3: Determine how alters are connected to each other



## **Social Bridging**

Racial and educational heterogeneity Presence of weak ties Low density (i.e., interconnectedness) Diversity of social roles Low mean frequency of contact

### **Social Bonding**

Mean number of support functions High mean closeness High density (i.e., interconnectedness) Strong relationship with spouse and children Proportion kin

#### **Social Stress**

Mean of hassles/causes problems Number of burdensome ties Ego is caregiver to one or more ties

### **Social Influence**

Proportion of alters who advise Proportion of health regulators Mean number of alters who exercise regularly

# Insights from personal social network analysis

## Social Networks in Alzheimer's Disease Study (SNAD)

## **Social Bridging**

*Definition:* Access to and engagement with peripheral, irregular, or heterogeneous social ties

*Biological mechanism:* Exposure to novel social stimuli that are cognitively enriching builds cognitive reserve against neurodegeneration

## Is social bridging associated with consensus diagnosis?



## Is social bridging associated with subjective cognitive decline?



# Is bridging network typology associated with subjective cognitive decline and cognitive function?



\*K-means cluster on network size, density, kinship, emotional closeness, contact frequency

*Note.* Difference are not significant if the 95% CI overlaps with the solid references line. Differences in probabilities are in comparison to 'No SCD + cognitively normal. Probabilities are derived from logistic regression model controlling for age, sex, education.

## Is social bridging associated with cognitive reserve (CR)



#### **Residual method for measuring CR**

Visualization of network characteristics by CR



Does social bridging mediate the relationship between educational attainment and cognitive function and decline?



Bridging explains **29.2%** of the educational disparity in MoCA and **23.5%** of the educational disparity in CCI



0.6

Are socioeconomic characteristics of older adults' residential neighborhoods associated with cognitive function?



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