

Social Relationships and Cumulative Physiological Dysregulation among Chinese at Advanced Ages: Findings from the CLHLS

Ting Li¹, Yang Claire Yang²,
Xiao-Ming Shi⁵, Zhao-Xue Yin⁵, and Yi Zeng^{3, 4}

¹Center for Population and Development Studies, Renmin University

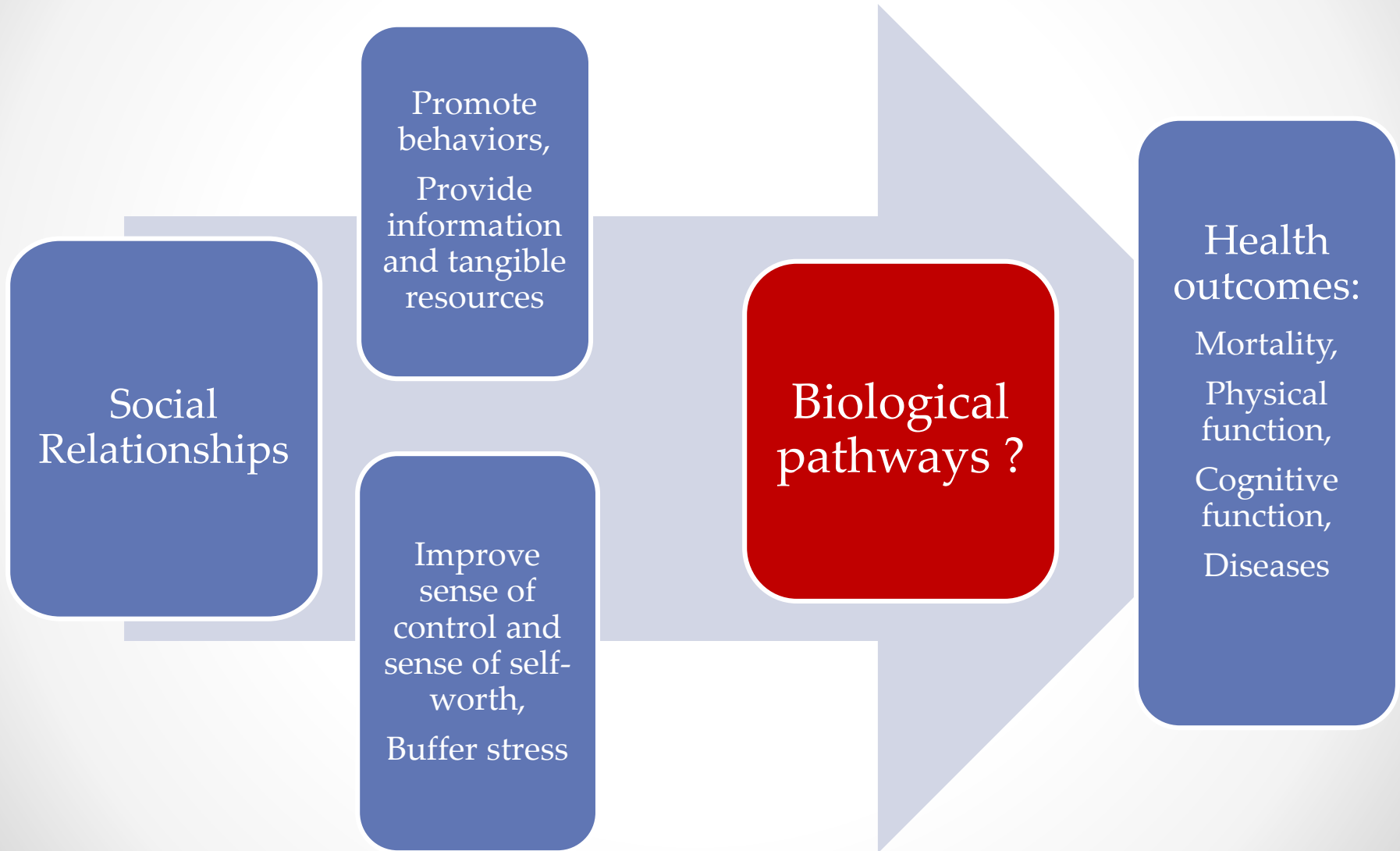
²Carolina Population Center; Department of Sociology, Lineberger Cancer Center, University of North Carolina at Chapel Hill

³Center for the Study of Aging and Human Development and the Geriatric Division of School of Medicine, Duke University

⁴Center for Study of Healthy Aging and Development Studies, National School of Development, Peking University

⁵Division of Chronic Disease Control and Community Health, Chinese Center for Disease Control and Prevention

Background



Background: Complexity in the social relation

measures

Multidimensional:

structural, functional (objective)

appraisal (subjective)

Hierarchical:

different distances from different social contacts

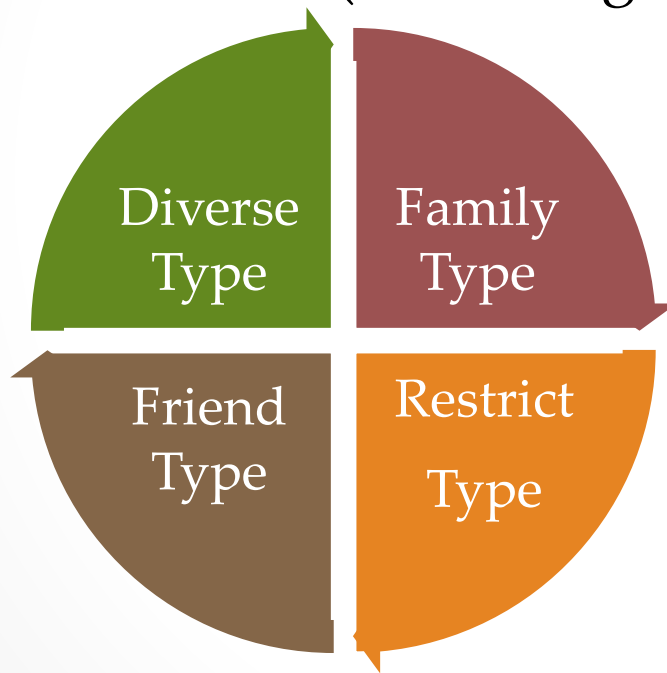
Dynamic:

change with age

Background: Person-centered Typology

Approach

Classify individuals into social network types based on objective measures (clustering analysis)

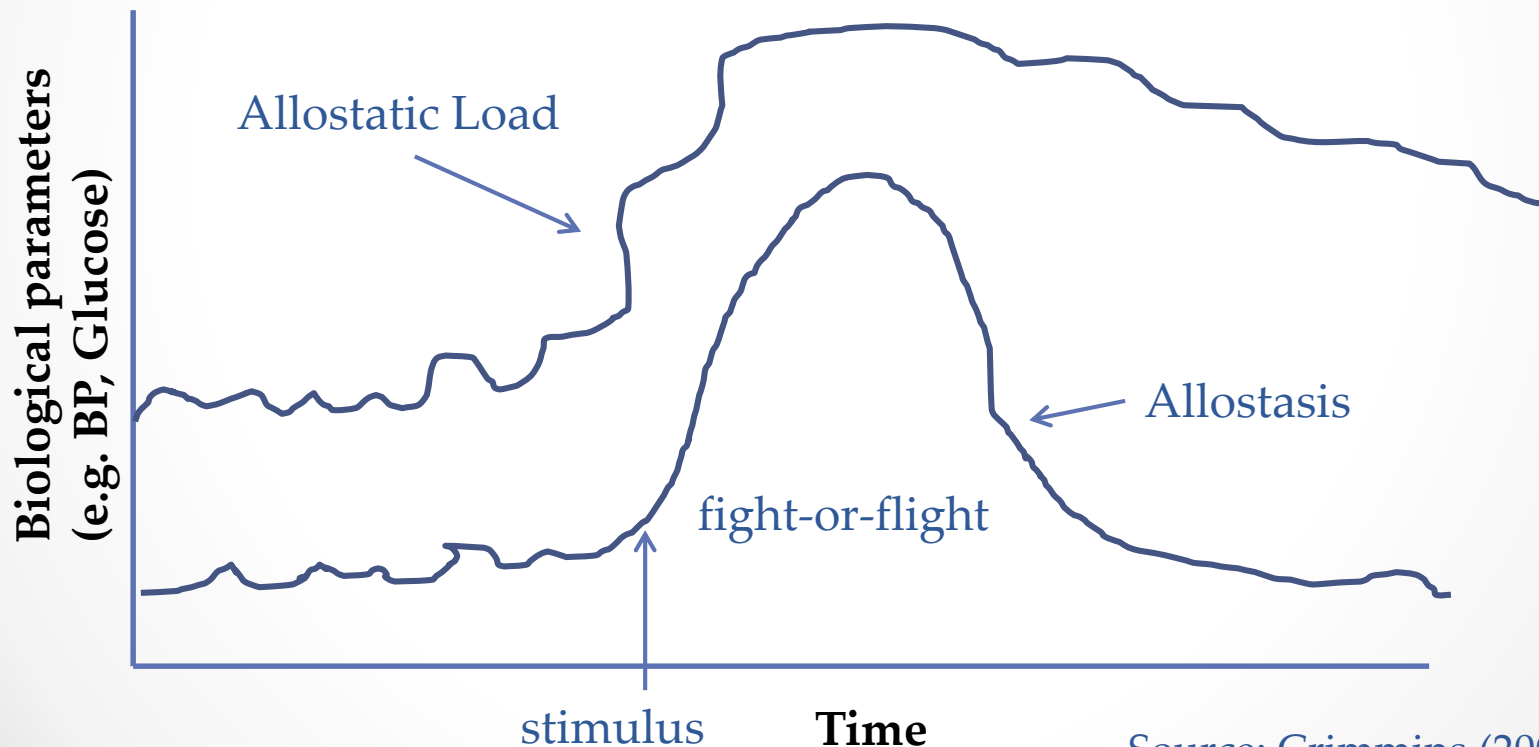


(Fiori, Antonucci and Akiyama 2008, Fiori, et al. 2006, Fiori, et al. 2007, Litwin 1997, 2001, Litwin and Shiovitz-Ezra 2011, Wenger 1991)

Parsimonious summary of structural and functional properties

Background: Physiological Dysregulation

- Allostasis (Sterling and Eyer, 1988): organism maintains its internal stability by changing biological parameters to cope with environmental demands



Source: Crimmins (2007)

Background: Allostatic Load

Social relationships → Allostatic Load → Health outcomes

- AL has been demonstrated to be a significant predictor for:
 - Overall and cause-specific mortality (Seeman et al. 2001, 2004; Gruenewald, et al. 2006; Karlamangla et al. 2006)
 - Cognitive functioning decline (Seeman et al. 1997; Goldman et al. 2006)
 - Physical functioning decline (Seeman et al. 2001; Karlamangla et al. 2002)
- Limited populations:
 - Wisconsin Longitudinal study; MacArthur Studies of Successful Aging (Seeman et al. 2002)
 - Social Environment and biomarkers of Aging Study in Taiwan (Seeman et al. 2004; Gleib et al. 2007)
- Modest or weak correlations to social relations

Research questions

- Can stable network types be discerned among the Chinese oldest old population?
- The association between social network types and the AL?
 - Heterogeneity
 - Aging effects (disengagement theory)
 - Cultural effects (family values/obligations in the Chinese society)
 - Sex differences (biological and social differences)
 - Does the appraisal aspect mediate the association?

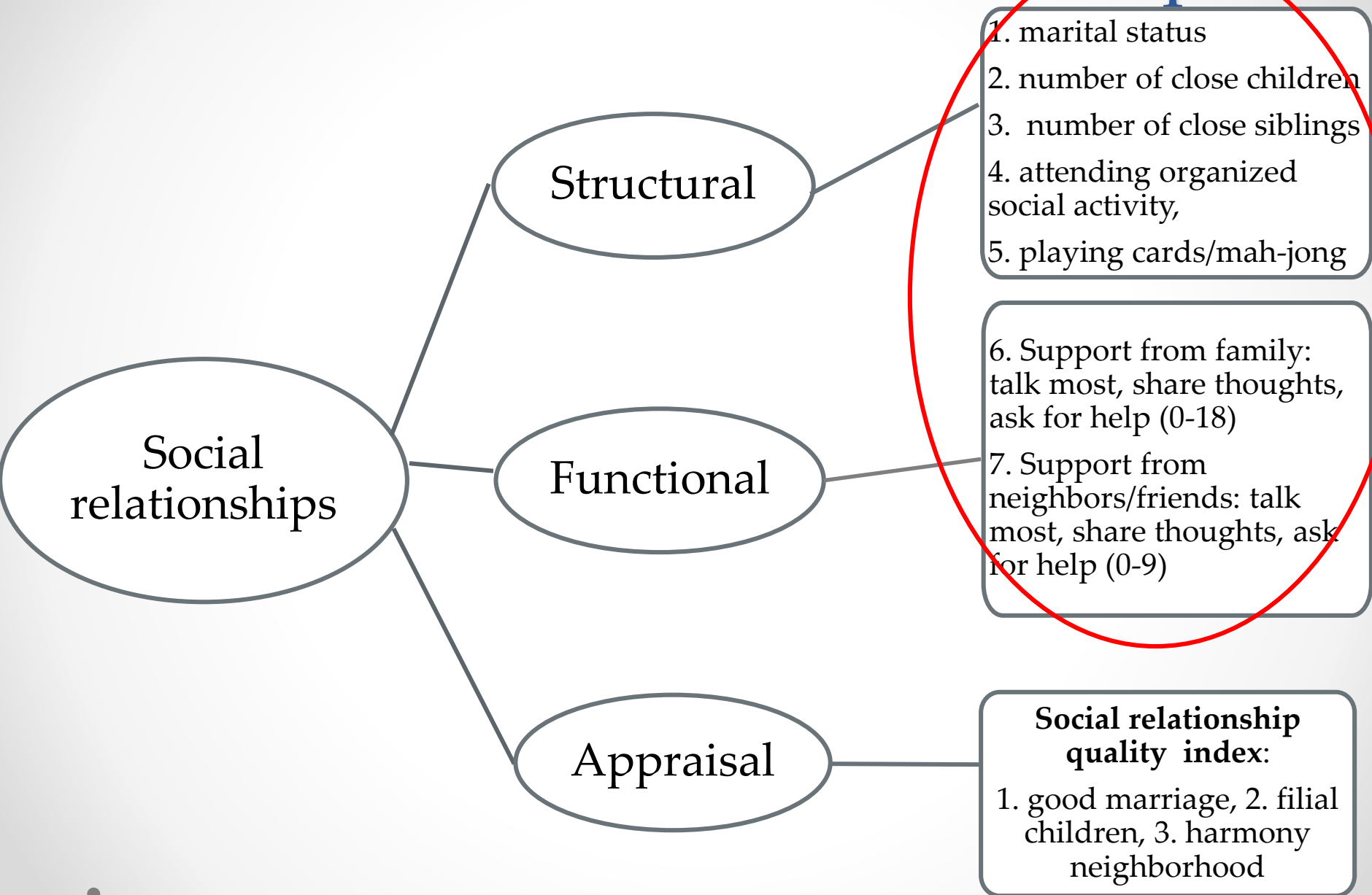
Data

- The 2008-09 wave of the Chinese Longitudinal Healthy Longevity Survey (CLHLS)
- Blood samples (N=499)
 - Age (mean=93), Female (72.8%), Rural residence (72.6%)

Measures: Allostatic Load

- 9 biomarkers:
 - systolic and diastolic blood pressure (SBP and DBP)
 - pulse rate
 - BMI
 - serum high-density lipoprotein (HDL) and HDL:total cholesterol ratio
 - fasting glucose
 - C-reactive protein (CRP)
- Sample driven algorithm for AL (Seeman et al.1997)
 - highest-risk quartile (score 1, otherwise 0)
 - AL is derived as the sum score across the 9 biomarkers (0-9)
 - Relative risk; pre-disease conditions; minor dysregulations

Measures: Social Relationships



Analytic Method

- Control variables
 - Demographics
 - SES
 - Health behaviors
 - ADLs, serious illness
- Model:
 - *K*-means clustering
 - Ordered logit model
 - Interaction term with sex – test the sex specific effects

Results: Social Network Types

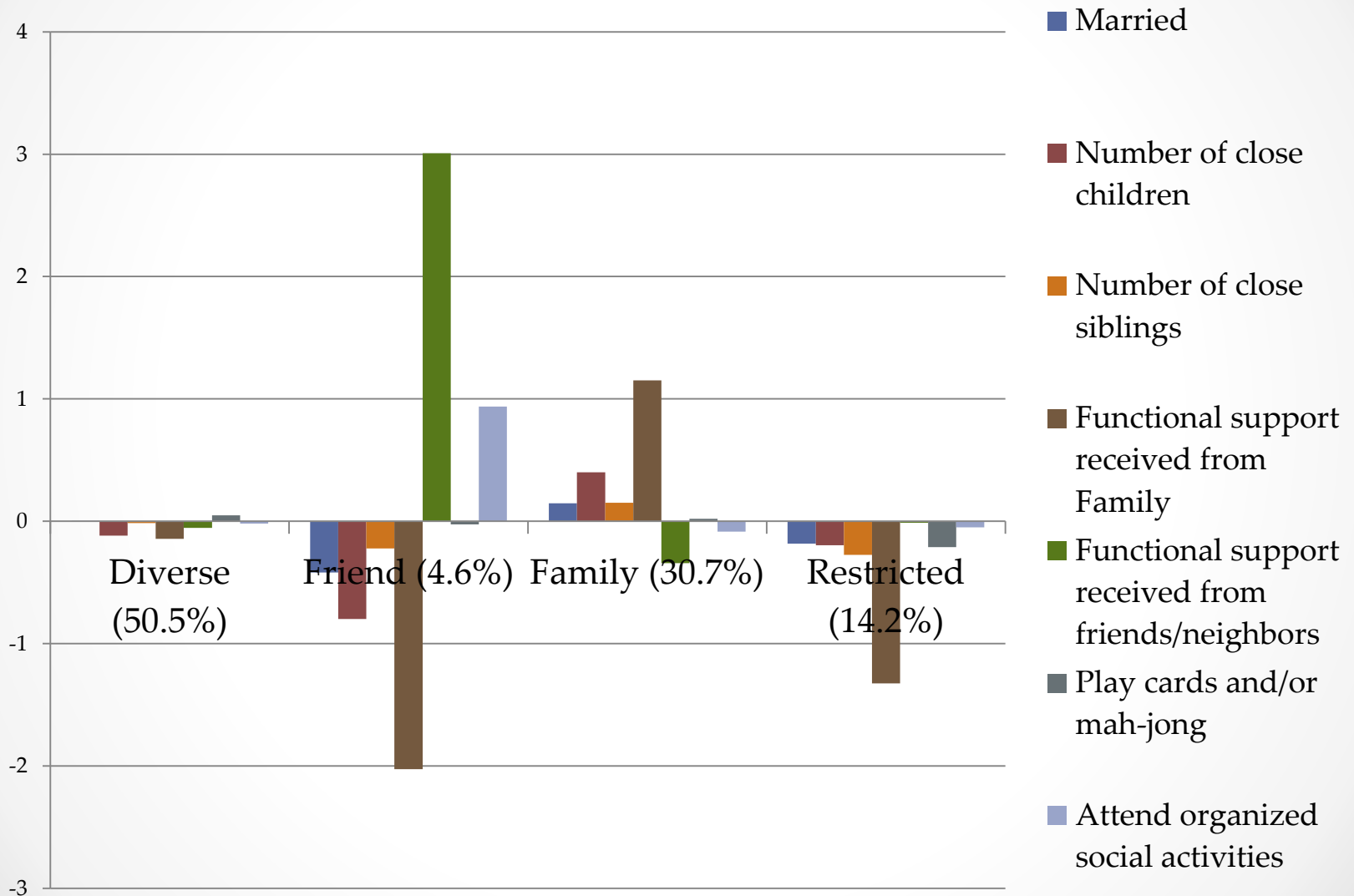
Table 2: Network delineation criteria and social network type distribution: cluster analysis

| | Mean Values of Criterion Variables | | | | | | |
|---------------------|------------------------------------|--------------------------|--------------------------|---|---|----------------------------|------------------------------------|
| | Married | Number of close children | Number of close siblings | Functional support received from Family | Functional support received from friends /neighbors | Play cards and/or mah-jong | Attend organized social activities |
| Network type | | | | | | | |
| Diverse (50.5%) | 0.15 | 2.62 | 0.42 | 10.16 | 1.23 | 0.33 | 0.21 |
| Friend (4.6%) | <u>0.00</u> | <u>1.39</u> | 0.22 | <u>1.35</u> | 7.70 | 0.26 | 0.91 |
| Family (30.7%) | 0.20 | 3.55 | 0.58 | 16.22 | <u>0.63</u> | 0.30 | <u>0.16</u> |
| Restricted (14.2%) | 0.08 | 2.48 | <u>0.17</u> | 4.63 | 1.32 | <u>0.10</u> | <u>0.18</u> |
| Total (N=499) | 0.15 | 2.83 | 0.43 | 10.83 | 1.36 | 0.28 | 0.22 |

Note¹: Analysis of variance: married ($F=3.29, p=0.0205$), number of proximate children ($F=16.46, p<0.001$), number of proximate siblings ($F=3.38, p=0.0182$), functional support received from family ($F=998.60, p<0.001$), functional support received from friends/neighbors ($F=138.18, p<0.001$), play cards and/or mah-jong ($F=1.29, p=0.277$), attend organized social activities ($F=7.49, p<0.001$)

Note²: Numbers that appear in bold italics indicate the highest values; numbers that appear underlined indicate the lowest values for each criterion following the post hoc Turkey HSD test

Results: Social Network Types



Results

Table 4: Ordered logit regression models for social relationship indicators and allostatic load

| Covariates | N=499 | | Model 1 | | Model 2 | | Model 3 | |
|---|----------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Social Network Type | | | | | | | | |
| Diverse (reference) | | | | | | | | |
| Friend | 1.04 | (0.48, 2.26) | 1.12 | (0.51, 2.45) | 1.05 | (0.48, 2.31) | | |
| Family | 1.49* | (1.04, 2.13) | 1.56* | (1.08, 2.25) | 1.49* | (1.03, 2.16) | | |
| Restrict | Male | 3.22* | (1.27, 8.17) | 2.78* | (1.08, 7.19) | 2.95* | (1.14, 7.64) | |
| | Female | 1.16 | (0.68, 1.98) | 1.16 | (0.65, 1.93) | 1.08 | (0.62, 1.86) | |
| Appraisal Aspect of Social Relationships | | | | | | | | |
| Overall index (0-6) | | | | | | | 0.78* | (0.62, 0.97) |
| Control Variables | | | | | | | | |
| Age | 0.99† | (0.97, 1.00) | 0.99 | (0.97, 1.01) | 0.98† | (0.97, 1.00) | | |
| Sex (Female=1) | 1.74** | (1.16, 2.61) | 1.74* | (1.12, 2.73) | 1.67* | (1.07, 2.61) | | |
| Residence (Rural=1) | 1.21 | (0.84, 1.72) | 1.16 | (0.77, 1.73) | 1.16 | (0.78, 1.75) | | |
| Education (1+ year schooling=1) | | | 1.5 | (0.92, 2.45) | 1.45 | (0.88, 2.37) | | |
| Insufficient financial support (Yes=1) | | | 1.14 | (0.78, 1.69) | 1.07 | (0.72, 1.58) | | |
| Occupation (Farmers=1) | | | 1.08 | (0.65, 1.79) | 1.12 | (0.67, 1.85) | | |
| Smoked in the past 5 years (Yes=1) | | | 0.8 | (0.50, 1.22) | 0.76 | (0.48, 1.19) | | |
| Heavy drink (Yes=1) | | | 0.37 | (0.11, 1.22) | 0.44 | (0.13, 1.44) | | |
| Regular exercise (Yes=1) | | | 0.75 | (0.49, 1.17) | 0.77 | (0.50, 1.20) | | |
| Solitary activities | | | 0.98 | (0.94, 1.03) | 0.98 | (0.94, 1.03) | | |
| ADLs | | | 0.93 | (0.82, 1.06) | 0.91 | (0.80, 1.04) | | |
| Serious illness (1+ = 1) | | | 1.26 | (0.75, 2.12) | 1.35 | (0.80, 2.28) | | |
| Model fit | -2 log L | AIC | -2 log L | AIC | -2 log L | AIC | | |
| | 1566.86 | 1588.86 | 1582.19 | 1590.19 | 1551.03 | 1593.03 | | |

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

^a: *p* value for the sex differences is less than 0.05

Summary

- A person-centered typology approach to measuring social relations
 - Utility of quantifying multidimensionality and functional specificity
 - Four basic network types in Chinese elderly population consistent with Western populations
 - Systematic variation in socio-demographic and health characteristics

Summary

- Strong associations of the AL with social relationship variables among this oldest old Chinese population
 - Objective and subjective social relationships both matter
 - Robust to the adjustment of covariates
 - Social relations have stronger and more significant associations than most control variable.

Discussion

- Sex Differences
 - Men are more vulnerable to social isolation
 - Women benefit less than men from social integration
 - Social roles: support provider
 - Cultural norm in China
 - Widowhood less detrimental

Discussion

- Lack of support for Disengagement Theory
 - Fails to identify the importance of familial ties
 - Chinese oldest old can still benefit from balanced social network structures
 - Community attachment and peer interactions are important for Chinese elderly
 - Reduced intergenerational conflicts and obligations
 - Increased control and self-esteem

Discussion

- Limitations
 - Cross-sectional data
 - Small sample size
 - Selective survival
 - Age and sex distribution: oldest old and females
 - Low rates of poor health behaviors and functioning

Acknowledgment

- National Institute of Aging K01 Award – Grant No. K01AG036745 and University Cancer Research Funds at the Lineberger Comprehensive Cancer Center of UNC-CH awarded to Dr. Yang Claire Yang
- CLHLS group

Table 1: Sample Characteristics and Allostatic load: CLHLS (2008)

| Variable | Mean or % (N=499) |
|---|----------------------|
| <u>Demographics and Health Measures</u> | |
| Age, <i>M</i> (SD) | 93.10 (12.12) |
| Sex (Female) | 72.75 |
| Residence (Rural) | 72.55 |
| Education (1+ year schooling) | 27.45 |
| Insufficient financial support (Yes) | 23.65 |
| Occupation (Farmers) | 87.37 |
| Smoked in the past 5 years (Yes) | 16.23 |
| Heavy drink (Yes) | 2.00 |
| Regular exercise (Yes) | 18.44 |
| Solitary activities (0-20), <i>M</i> (SD) | 4.58 (4.15) |
| ADLs (0-6), <i>M</i> (SD) | 0.58 (1.35) |
| Serious illness (1+) | 12.63 |
| <u>Social Relationship</u> | |
| Structural Relation | |
| Stay in marriage | 15.03 |
| Number of close children (0-9), <i>M</i> (SD) | 2.83 (1.80) |
| Number of close siblings (0-5), <i>M</i> (SD) | 0.42 (0.95) |
| Play cards/mah-jong (0-4), <i>M</i> (SD) | 0.28 (0.87) |
| Attend organized social activities (0-4), <i>M</i> (SD) | 0.22 (0.74) |
| Functional Relation | |
| Support from family (0-18), <i>M</i> (SD) | 10.83 (4.68) |
| Support from friends/neighbors (0-9), <i>M</i> (SD) | 1.36 (2.11) |
| Appraisal Relation | |
| Spouse (0-2), <i>M</i> (SD) | 1.13 (0.34) |
| Children (0-2), <i>M</i> (SD) | 1.80 (0.42) |
| Neighbors (0-2), <i>M</i> (SD) | 1.83 (0.38) |

Table 1: Continued

| Social relationship quality index (0-6), <i>M</i> (SD) | | 4.75 (0.76) |
|--|------------------|-------------------|
| Biomarkers | Mean (SD) | Cut Points |
| Fasting glucose (mg/dl) | 98.20 (30.45) | >=105.05 |
| HDL cholesterol (mg/dl) | 50.19 (12.36) | <=41.31 |
| Ratio of HDL to total cholesterol | 0.33 (0.12) | <=0.27 |
| Triglycerides (mg/dl) | 105.31 (69.91) | >=117.70 |
| Body mass index | 19.68 (4.94) | >=24.9 or <15 |
| Systolic blood press (mm Hg) | 137.25 (26.98) | >=155 |
| Diastolic blood press (mm Hg) | 79.02 (14.79) | >=91 or <60 |
| Pulse rate | 75.58 (10.08) | >=82 |
| C-reactive protein (mg/dl) | 4.84 (8.36) | >=4.40 |
| Allostatic Load (AL) | | |
| Continuous, <i>M</i> (SD) | 2.26 (1.52) | |
| Categorical (%) | | |
| 0 | 11.62 | |
| 1 | 21.84 | |
| 2 | 27.25 | |
| 3 | 19.84 | |
| >=4 | 19.44 | |

Table 3: Sociodemographics, health behaviors and functional health by network type

| Characteristic | Network Type | | | | Statistics |
|--|-----------------|---------------|----------------|-------------------|------------------------|
| | Diverse (N=252) | Friend (N=23) | Family (N=153) | Restricted (N=71) | |
| Age, <i>M</i> (SD) | 92.62 (12.98) | 96.39 (4.83) | 91.59 (12.92) | 96.97 (6.82) | $F = 3.98^{**}$ |
| Gender (% female) | 71.43 | 91.30 | 70.59 | 76.06 | $\chi^2 = 4.97$ |
| Residence (% rural) | 73.41 | 30.43 | 76.47 | 74.65 | $\chi^2 = 21.91^{***}$ |
| Education (% 1+years schooling) | 22.22 | 13.04 | 16.99 | 16.90 | $\chi^2 = 2.72$ |
| Insufficient financial support (% yes) | 23.81 | 21.74 | 11.76 | 49.30 | $\chi^2 = 37.88^{***}$ |
| Regular exercise (% yes) | 18.65 | 34.78 | 16.34 | 16.90 | $\chi^2 = 4.65$ |
| Solitary activities, <i>M</i> (SD) | 4.90 (4.38) | 5.00 (3.25) | 4.82 (4.03) | 2.77 (3.39) | $F = 5.37^{**}$ |
| ADLs, <i>M</i> (SD) | 0.61 (1.37) | 0.39 (1.12) | 0.41 (1.08) | 0.93 (1.74) | $F = 2.67^*$ |
| Serious illness (% 1+) | 12.30 | 4.35 | 11.76 | 18.31 | $\chi^2 = 3.64$ |

†p<0.1; *p<0.05; **p<0.01; ***p<0.001