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Family Reciprocity by Older  
Singaporeans

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## **ABSTRACT**

Reciprocity is a powerful social motivation. What do older people give to their family in return for help received? We use data from the Panel on Health and Aging of Singaporean Elderly, Wave 2 (2011; persons ages 62+; N=3,103). Giving and receiving help are with family members other than spouse in the past year. Types of help are tangibles (money, food/clothes/other material goods) and nontangibles (housework/cooking, babysitting grandchildren, emotional support/advice, help for personal care, help for going out). Multivariate models predict giving help, using predictors about the older person's sociodemographic features, time commitments, availability of receivers and other givers, psychosocial features, illness/disability, and receiving help. Results show that older people give time and effort (nontangibles) in return for money and material goods (tangibles). This aligns with contemporary Singapore circumstances: Older people typically have ample time but limited financial resources, whereas their family members (often midlife children) have more ample financial resources but limited time. The 2011 results replicate and extend prior ones for 1995 and 1999, signaling continuing family reciprocity in a modernizing society.

## INTRODUCTION

Reciprocity is a strong and abiding principle in social relationships. When someone gives you a material gift or service, you often feel that more than "thank you" should be offered in return. That may not happen soon, or in the same exact manner, but the motivation to reciprocate persists for a long time. As people return favors and goods for those received, reciprocity makes for powerful bonds of amity and trust in social communities.

Social exchange and reciprocity occur in all arenas of social life, ranging across work, play, family, love relationships, organization management, and more. This analysis studies *within-family social exchanges*, asking how older persons who receive tangibles (money or material goods) and nontangibles (services of time and effort) reciprocate back to their family. We study these family exchanges in Singapore. Results here (2011) are compared with prior ones (1995, 1999; Verbrugge and Chan, 2008) to assess replication of the main conclusions.

## BACKGROUND

### Reciprocity

The theoretical springboard of this analysis is social exchange theory, first proposed by Simmel (1907, 1922). A central premise of social exchange is reciprocity, namely, that people want and try to "give in return" for gifts and services received. Social exchange theory and reciprocity have been elaborated over a century, with increasing empirical orientation (Blau 1964; Gouldner 1960; Homans 1961; Kolm 2008; Kranton 1996; Molm 2003; Molm, Collett and Schaefer 2007; Purdam and Tranmer 2014; Thomése *et al.* 2005).<sup>1</sup>

Specific motivations underlying reciprocity are diverse, including obligation, altruism, emotional attachment, self-interest, social productivity, future benefits, and more (Beel-Bates, Ingersoll-Dayton and Nelson 2007; Fingerman *et al.* 2009; Horioka *et al.* 2016; Kolm 2008; Molm 1997; Silverstein, Conroy and Gans 2012). There can be multiple, conflicting, and negative motivations in a given exchange (Parrott and Bengtson 1999; Pillemer *et al.* 2007). The classic definition of reciprocity (Gouldner 1960) includes both contingent (I give to you because you gave to me) and noncontingent (moral norms and love) motivations for reciprocity. Types of giving and receiving behaviors include things, time, effort, space, overt affection, stated appreciation, and more.

Almost all empirical research on reciprocity studies *behaviors*, assessing observed links between receiving and giving actions. *Motivations* (net positive, negative, or nil) are inferred from those links. Experimental research designed to demonstrate specific motivations gets close, assessing both behavior differences among study groups and attitudes about other participants (Jung *et al.* 2014; Malmendier, te Velde and Weber 2014; Molm, Schaefer and Collett 2007).

We study giving and receiving help by older Singaporeans with their family members in the past year. Links between receiving and giving constitute evidence about the types and strength of reciprocity within families. We categorize giving/receiving behaviors into tangibles and nontangibles. *Tangibles* are money and food/clothes/other material goods. *Nontangibles* are services requiring time and effort, such as babysitting, housework, cooking, personal care, accompanying someone out of the house for appointments or errands, offering emotional support, and providing advice.

We integrate our results with classic Asian themes of coresidence, filial piety, and intergenerational transfers in the Discussion.

## **Replication**

Replication is deemed a fundamental goal of scientific research. It is often an explicit purpose of research in the biological and physical sciences, but seldom in the social sciences (Bronstein 1990; Earp and Trafimow 2015; Hueffmeier, Mazei and Schultze 2016; Schmidt 2009). This may be due, in part, to the impossibility of exact replication in social research. Locales, samples, dates, items, and statistical techniques vary; something always differs from an initial analysis. But replication can be broadened to mean "similar results". Do different surveys produce the same conclusion?

A main purpose of this analysis is to replicate a prior one about social exchange within Singapore families (Verbrugge and Chan 2008). The prior analysis drew items from many places in the data to test reciprocity. By contrast, in this analysis, the survey was designed with social exchange in mind, and the data are high quality for the topic. We compare results in the Discussion.

## **METHODS**

### **Data source**

The data source is Wave 2 (2011) of the Panel on Health and Aging [sic] of Singaporean Elderly (PHASE). PHASE is a nationally representative longitudinal survey of older Singaporeans ages 60 and older in 2009 (Malhotra *et al.* 2010). In Wave 1 (2009), 4,990 persons were interviewed (ages 60+; response rate 69.4%). In Wave 2 (2011), 3,103 of them were interviewed again (now ages 62+; response rate 67.5% for alive located persons). In Wave 2, extensive questions on giving and receiving help were introduced, and we use those data here.

### **Dependent variables: giving help**

The dependent variables are types of help given by an older person to his/her family. Respondents were asked if they provided the following to any family members in the past 12 months: babysit grandchildren, money, housework or cooking help, food or clothes, and emotional support or advice. Family members are household members except spouse. Question wording implied the same household, but was not

restricted to that, and responses occasionally referred to other kin living elsewhere. Money can be regular, occasional, or holiday gifts. "Food or clothes" is called material goods in the analysis. We classify the five give help items into two types: tangibles (money, material goods) and nontangibles (babysit, housework/cooking help, emotional support/advice). The items are dichotomous (yes 1, no 0).

### **Independent variables**

Predictors reflect abilities, resources, and motivations to give help. We choose sociodemographic features of the older person, time commitments, availability of potential receivers of help and other potential givers of help, psychosocial features, illness and disability, and receipt of help.

The sociodemographic variables are gender, age (62-64, 65-69, 70-74, 75+), ethnic group (Chinese, Malay, Indian/Other), marital status (married, widowed, other nonmarried), education (no formal education, primary, secondary, above secondary), housing type (public housing 1-2 rooms, 3 rooms, 4 rooms, 5+ rooms/private housing), perceived income adequacy (much difficulty to meet expenses; some difficulty to meet expenses; just enough money, no difficulty; enough money, with some left over). Income adequacy does not signify income level; "just enough" and "enough with some left over" can be true for rich or poor people.

For time commitments, we use employment status (not working, working part-time, working full-time). No other information about time commitments exists in the questionnaire.

Availability of potential receivers, and presence of other potential givers, can affect how readily an older person (R) gives help. We created five variables about household members: numbers of R's children in the household, R's grandchildren there, other household members ages 19-59, other household members ages 60+, and maids. "Other household members" include R's spouse if in the age range, and exclude R's children, grandchildren, and maids. Maids are common in Singapore households of many income levels for cooking, cleaning, and child/elder care. Thus, the five items are mutually exclusive.

Psychosocial features such as loneliness, depression, personal mastery, and social network support affect motivations to give help to others. Perceived loneliness is measured by the UCLA loneliness scale (Hughes *et al.* 2004) (3 items; range 3-9; Cronbach's  $\alpha$  for Wave 2 data = .86). Depression symptoms are measured by the Center for Epidemiologic Studies Depression scale (Kohout *et al.* 1993) (11 items; range 0-22;  $\alpha$  = .75). Personal mastery is measured by the Pearlin Mastery Scale (Pearlin and Schooler 1978) (5 items; range 5-20;  $\alpha$  = .88). Frequency and intimacy of social contacts outside the household reflect social network support, measured by the Lubben Social Network Scale (Lubben 1988; Lubben and Gironde 2004) (12 items; range 0-60;  $\alpha$  = .87). For PHASE surveys, items about contacts and felt intimacy with relatives were modified from the original "relatives" to "relatives not living with you". Psychosocial items were asked only for self-response interviews, and skipped in proxy interviews.

Illness and disability are measured by self-rated health (very healthy, healthier than average, of average health, somewhat unhealthy, very unhealthy), vision and hearing (no difficulty, difficulty with one of them, difficulty with both), chronic conditions (count of 18 physician-diagnosed conditions), physical limitations (count of nine upper and lower extremity problems), ADL disabilities (activities of daily living; count of seven health-related difficulties in ADLs without personal or device assistance), and IADL disabilities (instrumental activities of daily living; count of health-related difficulties in seven IADLs without personal or device assistance). Simply stated, ADLs concern personal care, and IADLs concern household management.

Receiving help is the key predictor for the analysis. Respondents were asked if they received these from any family members in the past 12 months: money, housework help, food, clothes, or other material goods, "physical care (e.g., help with eating, bathing, toileting, moving around the house)", "help to go to the doctors, marketing, shopping, go out to visit friends, using public transportation", and emotional support or advice. Family members are household members except spouse. Money can be regular, occasional, or holiday gifts. "Food, clothes, or other material goods" is called material goods in the analysis. "Physical care" is called ADL help in the analysis, and "help to go [to places]" is called IADL help. We classify the six receive help items into two types: tangibles (money, material goods) and nontangibles (housework help, ADL help, IADL help, emotional support/advice). The items are dichotomous (yes 1, no 0).

The roster of predictors is purposely large so that results of receiving help (X) on giving help (Y) are well-controlled and robust. Interactions (e.g., whether receive-give relationship is affected by age) are not studied, because they are not substantively central and would expand the set of predictors.

## **Design features**

Key features of analysis design are as follows: First, the data are about social exchanges among *family members*. The focal person is an older adult, and what s/he gives to and receives from family. Although family exchanges are central for older persons, they do not compass all valued exchanges (other social arenas). Second, the data are about *behaviors*. We infer positive motivations to reciprocate when the results show behavioral evidence of it. Third, the social exchanges are *contemporaneous*. Receiving and giving behaviors are "in the past year". The data cannot assess causal ties of giving in return for receiving in that period, and or lagged reciprocity over years or decades. Fourth, we study links between *specific receive help and give help behaviors*. This allows us to locate tailored exchanges (such as, perhaps, babysitting given for money received).

## Procedures

Sampling weights for Wave 2 were calculated to adjust for nonproportional sampling (at Wave 1; age and ethnicity) and selective nonresponse (at both Waves 1&2; regression-based; age, gender, and ethnicity). Dependent variables had no missing data. Predictors had little missing data (exception shortly), and we coded such cases to the mode. Psychosocial measures had substantial missing data due to proxy interviews (N=291; 9.4%). Multiple imputation by chained equations (Raghunathan *et al.* 2001) was used to create ten imputed datasets on which to run statistical analyses when psychosocial items are included. Combination rules specified in Rubin (1987) adjusted for the variability of coefficients and standard errors between datasets.

Relationships between predictors and dependent variables were estimated using the Stata MICE procedure (StataCorp [sic] 2013). We started with bivariate relationships using logistic regression, then moved to multivariate logistic regressions. Models are for each type of giving help (Y) separately. Predictor effects are shown by odds ratios (OR). Significance levels are \*\*\* P<.001, \*\* P<.01, \* P<.05. Only statistically significant findings are stated in Results, with their OR and significance level.

Pseudo R-squared values for models were generated by Stata for full-sample models (N=3,103). A straightforward method to produce them for models with imputed data is not currently available, so when psychosocial features are included, we use complete-case models (N=2,812) instead. Fortunately, predictor effects for models using N=2,812 and N=3,103 are almost identical, so this is acceptable.

## HYPOTHESES

The analysis has four hypotheses. Hypothesis 1 is about reciprocity, namely, the links between receiving help and giving help. Hypothesis 2 is about the most common types of family reciprocity for older persons. Hypothesis 3 is about how other predictors besides receive affect giving help. Hypothesis 4 is about replication of results.

*Hypothesis 1: Strong reciprocity exists between receiving and giving help.* Empirically, we expect statistically significant positive relationships between receiving help and giving help. And we expect that *receiving help is the strongest predictor of giving help, compared to other predictors.* Hypothesis 1 is the keystone hypothesis of the analysis.

*Hypothesis 2: For older persons, giving nontangibles (time and effort) for received tangibles is a typical form of reciprocal exchange.* In return for money and material goods, older people tend to give services that entail their time and effort (physical, mental, emotional).

*Hypothesis 3: Giving help is more common by older persons with strong social and psychosocial resources, and less common by those with health and functional problems.* Specifically, for sociodemographic features: Older females do more family tasks (babysit and housework/cooking) than older men, whereas older men provide more tangibles (money,

material goods); no gender difference posited for providing emotional support/advice (women might offer more emotional support, and men more advice, so we opt for no difference). Giving help decreases with age, from early 60's to very old ages. Nonmarried persons give less help than married ones. With increasing education, family tasks decrease, while other services (money, material goods, emotional support/advice) increase. Housing type reflects financial resources, and giving help increases with number of rooms. Similarly, giving help increases with income adequacy. For time commitments: As work commitments increase, family tasks given by older persons decrease, whereas other services (money, material goods, emotional support/advice) increase. For availability: Giving help is more likely when there are more potential receivers, and less likely when there are other potential givers. For psychosocial features: Giving help decreases with more loneliness and depression, and increases with more personal mastery and social network support. For illness and disability: Giving help declines for worse health, more vision/hearing difficulty, more chronic conditions, more functional limitations, more ADL disability, and more IADL disability.

Hypothesis 4: *This analysis replicates the earlier finding that older Singaporeans give their time for money received.* We expect this to hold true for 2011, as well as 1995/1999. Because the new data are more extensive and better quality, the prior "time for money" result might be elaborated.

## RESULTS

### Sample descriptives

In the Wave 2 PHASE survey, half of the respondents are ages 75+ (45.2%; mean age 74.1) and a majority are female (54.5%) (Table 1). Respondents are largely Chinese (71.5%), married (57.0%), and have no formal or primary education (70.8%). The majority live in a 4-room or larger public flat (64.4%) and report adequate income to meet needs (90.4%). Most respondents are not employed (81.1%).

Many respondents live with one or more of their own children (66.1%; includes children's spouses), but only a minority live with any of their grandchildren (28.6%). A majority live in households with other people ages 60+ (53.4%; likely their own spouse), but seldom with others ages 19-59 (8.7%; such as niece/nephew). About one-fifth have a maid(s) in the household (17.3%).

Overall, the older Singaporeans feel little loneliness or depression, have strong personal mastery, and have moderate social network support (means in Table 1). Remarkably, they do not vary much in psychosocial features; top quartile values are close to means, and coefficients of variation are small (Table 1 footnote).

The majority of respondents rate their health as "average" (61.5%), and the majority have no vision or hearing difficulty (66.6%). Most have one or more chronic conditions (88.7%; mean 2.54) and half have some physical limitation (49.5%), but disability is uncommon (16.3% ADL, 21.1% IADL).

**Table 1.** Predictors of giving help to family (Singaporeans ages 62+)

|   | <u>Percent or mean</u> |
|---|------------------------|
| Sociodemographic:   |                        |
| Gender (% female)   | 54.5                   |
| Age (mean)  | 74.1                   |
| 62-64   | 11.4                   |
| 65-69   | 22.3                   |
| 70-74   | 21.1                   |
| 75+   | 45.2                   |
| Ethnic group (%)  |                        |
| Chinese   | 71.5                   |
| Malay   | 17.4                   |
| Indian/Other  | 11.1                   |
| Marital status (%)  |                        |
| Married   | 57.0                   |
| Widowed   | 36.6                   |
| Other nonmarried  | 6.4                    |
| Education (highest level completed; %)                        |                        |
| No formal education   | 35.3                   |
| Primary   | 35.5                   |
| Secondary   | 21.6                   |
| Above secondary   | 7.6                    |
| Housing type (%)  |                        |
| Public housing 1-2 rooms                                      | 8.6                    |
| Public housing 3 rm   | 27.0                   |
| Public housing 4 rm   | 32.0                   |
| Public housing 5+ rm or private housing                       | 32.4                   |
| Perceived income adequacy (%)                                 |                        |
| Much difficulty to meet expenses                              | 1.4                    |
| Some difficulty to meet expenses                              | 8.2                    |
| Just enough money, no difficulty                              | 67.0                   |
| Enough money, with some left over                             | 23.4                   |
| Time commitments:   |                        |
| Employment (%)  |                        |
| Not working   | 81.1                   |
| Working part-time   | 8.4                    |
| Working full-time   | 10.5                   |
| Availability of receivers and other givers:                   |                        |
| No. of R's children in household <sup>a</sup> (mean)          | 1.14                   |
| Any (%)   | 66.1                   |
| No. of R's grandchildren in household <sup>a</sup> (mean)     | 0.56                   |
| Any (%)   | 28.6                   |
| No. of other household members aged 19-59 <sup>b</sup> (mean) | 0.10                   |
| Any (%)   | 8.7                    |
| No. of other household members aged 60+ <sup>b</sup> (mean)   | 0.55                   |
| Any (%)   | 53.4                   |
| No. of maids in household (mean)                              | 0.18                   |
| Any (%)   | 17.3                   |
| Psychosocial features: <sup>c</sup>                           |                        |
| Loneliness (3-9; mean)  | 3.31                   |
| Depression (0-22; mean)                                       | 2.61                   |
| Personal mastery (5-20; mean)                                 | 14.8                   |
| Social network support (0-60; mean)                           | 22.8                   |

|   |      |      |
|---|------|------|
| Illness and disability:                 |      |      |
| Self-rated health (1-5; mean)           |      | 2.93 |
| Very healthy (%)                        |      | 3.6  |
| Healthier than average                  |      | 18.4 |
| Of average health                       |      | 61.5 |
| Somewhat unhealthy                      |      | 14.0 |
| Very unhealthy                          |      | 2.5  |
| Vision and hearing (%)                  |      |      |
| No difficulty                           |      | 66.6 |
| Difficulty with one of them             |      | 20.9 |
| Difficulty with both                    |      | 12.5 |
| Chronic conditions (0-18; mean)         |      | 2.54 |
| One or more (%)                         |      | 88.7 |
| Physical limitations (0-9; mean)        | 1.42 |      |
| One or more (%)                         |      | 49.5 |
| ADL disabilities (0-7; mean)            |      | 0.49 |
| One or more (%)                         |      | 16.3 |
| IADL disabilities (0-7; mean)           |      | 0.58 |
| One or more (%)                         |      | 21.1 |
| Receive help from family: <sup>d</sup>  |      |      |
| Receive money (%)                       |      | 80.8 |
| Receive housework help (%)              |      | 29.8 |
| Receive material goods (%)              |      | 45.7 |
| Receive ADL help (%)                    | 4.6  |      |
| Receive IADL help (%)                   |      | 26.0 |
| Receive emotional support or advice (%) |      | 35.9 |

*Notes:* Data source is the Panel on Health and Aging [sic] of Singaporean Elderly, Wave 2 (2011). N=3,103. R - respondent. rm – rooms. Unweighted data.

<sup>a</sup> Including their spouses.

<sup>b</sup> Including R's spouse; excludes R's children, R's grandchildren, and maids.

<sup>c</sup> These features have low variability for older Singaporeans: Top-quartile values are 4+ for loneliness, 5+ for depression, 17+ for personal mastery, and 31+ for social network support. Coefficients of variation (standard deviation divided by mean; also called relative standard deviation) are small, 0.284 for loneliness, 1.050 for depression, 0.178 for personal mastery, and 0.422 for social network support.

<sup>d</sup> "In the past 12 months, did you receive [X] from any of your family members, other than your spouse?" Material goods wording is "food, clothes, or other material goods". ADL help (activities of daily living) wording is "physical care (e.g., help with eating, bathing, toileting, moving around the house)". IADL help (instrumental activities of daily living) wording is "help to go to the doctors, marketing, shopping, go out to visit friends, using public transportation". Items are arranged here as stated in the questionnaire.

## Receiving and giving help

For *receiving help*, most older Singaporeans received money from family members in the past year (80.8%) (Table 1). About half received material goods (45.7%), followed by emotional support/advice (35.9%), housework help (29.8%), IADL help (26.0%), and least often ADL help (4.6%) (Table 1). For *giving help*, older Singaporeans were most likely to provide money to family members (38.7%; includes holiday gifts), followed by emotional support or advice (29.8%), babysitting grandchildren (18.9%), housework or cooking help (14.7%), and least often, material goods (9.8%) (Table 2).

**Table 2.** Rates of giving help to family (Singaporeans ages 62+)

|                                  | Per cent who gave help<br>in past 12 months <sup>a</sup> |
|----------------------------------|--|
| Babysit grandchildren            | 18.9   |
| Give money                       | 38.7   |
| Give housework or cooking help   | 14.7   |
| Give material goods              | 9.8  |
| Give emotional support or advice | 29.8   |

*Notes:* Data source is the Panel on Health and Aging [sic] of Singaporean Elderly, Wave 2 (2011). N=3,103 except babysit (just for persons with grandchildren, N=2,505). Unweighted data.

<sup>a</sup> "In the past 12 months, did you provide [X] to any of your family members, other than your spouse?" Babysit wording is "have you provided assistance to baby sit your grandchildren?" Housework or cooking help wording is "housework help or help with cooking" ("housework help" for receive help item). Material goods wording is "food or clothes" ("food, clothes, or other material goods" for receive help item). The survey designers intended give and receive items to be identical in scope. Items are arranged here as stated in the questionnaire.

Older Singaporeans typically receive help more than they give help. Comparing rates in Tables 1 and 2, the difference is about 2:1 for money (receive:give). Housework also has a 2:1 ratio. For material goods, the receive:give ratio is nearly 5:1. But for emotional support/advice, receiving and giving are coequal in frequency; the ratio is 1:1; we return to this in the Discussion.

### **Bivariate links between receiving and giving help**

Bivariate models use each receive help item to predict each give help item (30 regressions; Table 3). The great majority of effects linking receive and give are statistically significant (79%). And, the majority of significant effects are positive (61%), in line with reciprocity. Two overall results stand out. First, *older adults who receive tangible help are especially likely to give nontangible help*. We call this "nontangibles for tangibles". Specifically, older persons who receive money are much more likely, than those who do not, to help with babysitting grandchildren (OR=1.69<sup>\*</sup>) and help with housework (2.63<sup>\*\*\*</sup>). Older persons who receive material goods are more likely to help with housework (2.98<sup>\*\*\*</sup>) and give emotional support/advice (4.01<sup>\*\*\*</sup>). Second, *older adults are likely to give the same type of help they have received*. We call this "same for same" -- perhaps not an excellent locution, but it characterizes this type of exchange well. Odds ratios are: receive housework help with give housework help 3.74<sup>\*\*\*</sup>, emotional support/advice with same 23.4<sup>\*\*\*</sup>, money with same 2.10<sup>\*\*\*</sup>, and material goods with same 4.55<sup>\*\*\*</sup>.

We also estimated models with the whole set of six receive help items to predict each give help item (5 regressions). We call them chunk models. Remarkably, results for significance, positive/negative odds ratios, and even size of odds ratios are very similar to the simple bivariate models (results available on request). The substantive findings about "nontangibles for tangibles" and "same for same" are repeated.

**Table 3.** Bivariate effects of receiving help from family on giving help to family (Singaporeans ages 62+)

|                             | Give help (Y)         |                              |                               |                     |                     |
|-----------------------------|-----------------------|------------------------------|-------------------------------|---------------------|---------------------|
|                             | Babysit grandchildren | Give housework/ cooking help | Give emotional support/advice | Give money          | Give material goods |
| Receive help (X):           |                       |                              |                               |                     |                     |
| Nontangibles:               |                       |                              |                               |                     |                     |
| Receive housework help      | 0.53 <sup>***</sup>   | 3.74 <sup>***</sup>          | 4.81 <sup>***</sup>           | 1.04                | 1.58 <sup>***</sup> |
| Receive ADL help            | 0.64 <sup>***</sup>   | 0.33 <sup>*</sup>            | 0.89                          | 0.52 <sup>**</sup>  | --                  |
| Receive IADL help           | 0.33 <sup>***</sup>   | 2.02 <sup>***</sup>          | 1.99 <sup>***</sup>           | 0.74 <sup>**</sup>  | 0.64 <sup>*</sup>   |
| Receive emot.support/advice | 0.71 <sup>**</sup>    | 2.53 <sup>***</sup>          | 23.4 <sup>***</sup>           | 0.75 <sup>**</sup>  | 1.33 <sup>*</sup>   |
| Tangibles:                  |                       |                              |                               |                     |                     |
| Receive money               | 1.69 <sup>**</sup>    | 2.63 <sup>***</sup>          | 1.14                          | 2.10 <sup>***</sup> | 0.94                |
| Receive material goods      | 1.22                  | 2.98 <sup>***</sup>          | 4.01 <sup>***</sup>           | 1.09                | 4.55 <sup>***</sup> |

Notes: Data source is the Panel on Health and Aging [sic] of Singaporean Elderly, Wave 2 (2011). N=3,103. Weighted data. Odds ratios from bivariate models. The receive and give items are arranged by nontangibles first, then tangibles (differs from questionnaire order; see Tables 1 and 2). -- Cannot be estimated due to a zero cell in 2x2 table.

Significance levels: \*\*\* P<.001, \*\* P<.01, \* P<.05, else P≥.05.

### Multivariate links between receiving and giving help

Full multivariate models include all predictors for each give help item (5 regressions; Table 4). We state the reciprocity results first, then effects for the other predictors.

**Reciprocity.** The majority of effects linking receive and give are statistically significant (55%). And, the majority of significant effects are positive (69%), in line with reciprocity. *The substantive findings about "nontangibles for tangibles" and "same for same" are repeated.* For the first, older adults who receive money are more likely, than those who do not, to help with babysitting grandchildren (OR=1.71<sup>\*</sup>). Those who receive material goods are more likely to babysit grandchildren (1.80<sup>\*\*\*</sup>), help with housework/cooking (1.89<sup>\*\*\*</sup>), and give emotional support/advice (1.92<sup>\*\*\*</sup>). These results vary only a little from the initial bivariate models; thus, controls for other predictors have only modest impact. For the second, older adults are likely to give the same type of help they received. The odds ratios are: receive housework help with give housework help 2.78<sup>\*\*\*</sup>, emotional support/advice with same 19.9<sup>\*\*\*</sup> [sic], money with same 2.03<sup>\*\*\*</sup>, and material goods with same 6.29<sup>\*\*\*</sup>. Same-for-same effects are very similar to the initial bivariate models; they do not erode with inclusion of other predictors.

**Negative and nil results.** Some results go against reciprocity (31% of significant effects), showing that when older persons receive help of a given type, they are unlikely to give help of another type. This occurs for receive housework with give babysit (OR=0.57<sup>\*\*</sup>), receive IADL care with give money (0.75<sup>\*</sup>), receive emotional support/advice with give money (0.68<sup>\*\*\*</sup>) and (the reverse) receive money with give emotional support/advice (0.62<sup>\*</sup>), and receive money with give material goods (0.66<sup>\*</sup>). These negative relationships appear in initial models and persist in full ones.

**Table 4.** Multivariate models of giving help to family (Singaporeans ages 62+)

|  | Give help (Y)         |                              |                               |            |                     |
|--|-----------------------|------------------------------|-------------------------------|------------|---------------------|
|  | Babysit grandchildren | Give housework/ cooking help | Give emotional support/advice | Give money | Give material goods |
| Sociodemographic:                          |                       |                              |                               |            |                     |
| Gender (female; ref male)                  | 0.98                  | 11.02***                     | 1.06                          | 2.31***    | 1.40                |
| Age  |                       |                              |                               |            |                     |
| 62-64                                      | 4.95***               | 2.39***                      | 2.47***                       | 1.09       | 2.58***             |
| 65-69                                      | 4.55***               | 2.57***                      | 1.97***                       | 0.88       | 2.12***             |
| 70-74                                      | 3.27***               | 2.12***                      | 1.29                          | 1.18       | 1.36                |
| 75+ (ref)                                  |                       |                              |                               |            |                     |
| Ethnic group                               |                       |                              |                               |            |                     |
| Chinese (ref)                              |                       |                              |                               |            |                     |
| Malay                                      | 0.47***               | 0.68                         | 3.36***                       | 1.49**     | 0.40***             |
| Indian/Other                               | 0.53*                 | 0.86                         | 2.65***                       | 0.72*      | 0.51*               |
| Marital status                             |                       |                              |                               |            |                     |
| Married (ref)                              |                       |                              |                               |            |                     |
| Widowed                                    | 0.84                  | 2.70***                      | 0.95                          | 0.76       | 1.12                |
| Other nonmarried                           | 0.34                  | 2.14*                        | 0.81                          | 0.51**     | 0.82                |
| Education                                  |                       |                              |                               |            |                     |
| No formal education (ref)                  |                       |                              |                               |            |                     |
| Primary                                    | 1.16                  | 1.11                         | 1.20                          | 1.03       | 0.94                |
| Secondary                                  | 1.36                  | 1.03                         | 1.59                          | 1.06       | 1.48                |
| Above secondary                            | 1.65                  | 1.63                         | 2.91***                       | 1.50*      | 1.94*               |
| Housing type                               |                       |                              |                               |            |                     |
| Public housing 1-2 rm (ref)                |                       |                              |                               |            |                     |
| Public housing 3 rm                        | 1.08                  | 1.26                         | 0.94                          | 1.07       | 1.10                |
| Public housing 4 rm                        | 1.46                  | 1.46                         | 0.82                          | 1.02       | 1.07                |
| Public housing 5+ rm<br>or private housing | 1.40                  | 1.37                         | 1.08                          | 1.28       | 1.41                |
| Perceived income adequacy                  |                       |                              |                               |            |                     |
| Much difficulty                            | 1.28                  | 3.33*                        | 1.36                          | 0.35       | 4.15                |
| Some difficulty                            | 2.00**                | 1.87**                       | 2.01**                        | 0.79       | 2.00*               |
| Just enough (ref)                          |                       |                              |                               |            |                     |
| More than enough                           | 1.22                  | 1.17                         | 1.50*                         | 1.28*      | 1.52*               |

## Time commitments:

## Employment

Not working (ref)

Working part-time 0.64\* 1.19 1.08 0.90 1.35

Working full-time 0.39\*\*\* 0.70 1.03 1.59\*\* 1.41

Availability of receivers  
and other givers:

No. R's children in hh 0.97 1.61\*\*\* 1.02 0.89\* 1.11

No. R's gdchildren in hh 1.63\*\*\* 0.99 1.11 1.22\*\*\* 1.16

No. other hh mbrs 19-59 1.58 1.41 1.04 1.05 1.37

No. other hh mbrs 60+ 1.25 1.85\*\* 1.02 0.79 1.11

No. maids in hh 0.72 0.46\*\*\* ---- --

## Psychosocial features:

Loneliness 1.31\*\*\* 0.94 0.97 0.88\* 1.25\*

Depression 0.95 0.95 0.90\*\* 0.97 0.92\*

Personal mastery 1.07\* 0.96 0.92\* 1.00 1.05

Social network support 1.03\*\*\* 1.01 1.01 0.99\* 0.99

## Illness and disability:

Self-rated health<sup>a</sup> 0.73\*\* 0.85 0.78\* 1.12 0.97

## Vision and hearing

No difficulty (ref)

Difficulty with one 1.59\*\* 2.05\*\*\* 1.39 0.67\*\*\* 1.02

Difficulty with both 1.43 2.09\*\* 1.66\* 0.42\*\*\* 1.12

No. chronic conditions 0.94 1.01 1.07 1.06\* 1.01

No. physical limitations 0.98 0.92 1.06 0.99 0.90

No. ADL disabilities 0.30\*\* 0.62\*\*\* 0.81\* 0.95 0.76

No. IADL disabilities 0.91 0.81\* 0.80\*\* 0.95 0.64\*

## Receive help from family:

## Nontangibles:

Receive housework help 0.57\*\* 2.78\*\*\* 1.90\*\*\* 1.20 1.58\*

Receive ADL help 1.77 0.70 0.64 1.10 --

Receive IADL help 0.72 1.29 1.10 0.75\* 0.93

Receive emot.support/advice 0.80 1.54\* 19.9\*\*\*[sic] 0.68\*\*\* 0.90

## Tangibles:

Receive money 1.71\* 1.34 0.62\* 2.03\*\*\* 0.66\*

Receive material goods 1.80\*\*\* 1.89\*\*\* 1.92\*\*\* 1.02<sup>ns</sup> 6.29\*\*\*

|                         |           |           |            |            |            |
|-------------------------|-----------|-----------|------------|------------|------------|
| R-squared: <sup>b</sup> |           |           |            |            |            |
| Bivariate models        | .002-.026 | .003-.057 | <.001-.325 | <.001-.015 | <.001-.076 |
| Chunk models            | .051      | .096      | .366       | .024       | .099       |
| Full models             | .207      | .302      | .435       | .085       | .188       |

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*Notes:* Data source is the Panel on Health and Aging [sic] of Singaporean Elderly, Wave 2 (2011). N=3,103. Weighted data. Odds ratios from full models. ref - reference group (odds ratio = 1.00). rm - rooms. hh - household. Receive and give items are arranged by nontangibles first, then tangibles (differs from questionnaire order; see Tables 1 and 2). ---- Not relevant for this Y. -- Cannot be estimated due to a zero cell in 2x2 table.

<sup>a</sup> Used as a continuous variable; higher score is worse health.

<sup>b</sup> Bivariate models use each receive item with each give item (we show the range of 6 R-squared values for each Y). Chunk models use the whole set of 6 receive items for each Y. Full models have all predictors.

*Significance level:* \*\*\* P<.001, \*\* P<.01, \* P<.05, else P≥.05.

Some relationships between receive and give are nil (45% of all effects), in that receiving X has no effect on giving Y. They deserve substantive scrutiny, but statistical chance and skewed items (low variation) can also play strong roles. Nil effects occur mainly for receive ADL/IADL help with all give help Y's. ADL/IADL items are highly skewed, and we consider that the likely reason for no detectable effects.

**Other predictors besides receive.** The other predictors reflect abilities, resources, and motivations for giving help to family. Overall, their effects are less strong than expected. Only 38% of the estimated effects are statistically significant. But on the plus side, the majority of those (73%) are in line with hypotheses. No predictor domain (such as sociodemographic) stands out with routinely strong effects. Two specific predictors have strong consistent effects: age (giving help decreases with increasing age, as hypothesized) and ethnic group (Chinese are more likely than other groups to babysit and give material goods, but less likely to give emotional support/advice; no stated hypothesis). Moderate effects occur for income adequacy (people with high and low income adequacy offer more help than those with just enough, as hypothesized) and ADL/IADL disabilities (less giving as disability increases, as hypothesized). But most predictors show weak, inconsistent results, that is, few significant effects, some per hypothesis and some against it. Table 4 shows effects for all predictors.

**Explained variance.** R-squareds were calculated for the bivariate models (each receive item one-by-one), chunk models (set of receive items), and full models (all predictors). R-squared values are tiny for bivariate models (range <.001-.076; one exception, .325 for receive emotional support/advice with give emotional support/advice) (Table 4). Values increase for chunk models (.051-.099; .366 for give emotional support/advice). Full models have R-squareds ranging .085-.435. The lowest value (.085) occurs for give money. Near-highest (.302) occurs for give housework/cooking, and highest (.435) for give emotional support/advice.

## DISCUSSION

How strong is reciprocity in contemporary Singapore families? Does this second look at reciprocity replicate the first one, giving confidence in the conclusions?

### Reciprocity

Reciprocity in older Singaporeans' family relationships is common. *The principal form is “nontangibles for tangibles”.* Older Singaporeans often give services requiring time and effort to their family in return for money and material goods. This aligns with contemporary Singapore circumstances. Older people typically have ample time but limited financial resources, whereas their family members (often midlife children) have more ample financial resources but limited time.

*There is also evidence of "same for same" reciprocity, such as giving money when money is received. We do not think it reflects response bias since questions about receiving and giving are in separate sections; so the receive and give questions about a specific type of behavior (such as money) are not adjacent. We could not find this "same for same" result elsewhere in the literature. It might reflect a cultural feature of Singapore families, who are often coresident (Table 1). Housework can be task sharing and done together. Money is often holiday gifts, culturally a common two-way action. Two-way behavior also holds for material goods. People shop for food for the whole family (coresidents) or give extra food to family when visiting (not coresidents). For support/advice, strong reciprocity signals that when emotional intimacy occurs, it characterizes a whole family. It is not one-sided -- perhaps an intrinsic aspect of intimacy. This mutual feature drives the high R-squared values for models that have emotional support/advice on both X and Y sides.*

Our reciprocity hypothesis was not contingent about types of giving and receiving. We expected all links between receive and give to be positive in final models. Some initial negative links might occur (for example, if ill persons receive often but give rarely), but these would turn to positive when resources and health were controlled. In fact, contrary to that, *directions of initial bivariate links stay steady to full models -- positive links stay positive, and negative ones stay negative. Thus, the data show that reciprocity is a powerful aspect of older adult's lives regardless of their sociodemographic and health status.*

Positive ties between older persons' receiving and giving help have been found in other empirical analyses, including the prior Singapore one (Verbrugge and Chan 2008; review on p. 23 therein). The result has been repeated since then (Cong and Silverstein 2008; Geurts, Poortman and van Tilburg 2012; Isherwood, Luszcz and King 2016; Lowenstein, Katz and Gur-Yaish 2007; Morgan, Schuster and Butler 1991, found recently). The particular exchange of "time for money" by older persons is also in the literature, including the prior Singapore analysis (Verbrugge and Chan 2008; review on p. 23). It has been further demonstrated since then (Cong and Silverstein 2008; Leopold and Raab 2011; Shi 1993, found recently). Thus, reciprocity and "time for money" are not distinctive to Singapore, but occur many places, perhaps worldwide.

***Negative and nil.*** Strong negative links are substantively important. Some occur in the context of some positive ties, revealing that *when one exchange is very strong and positive, another in the same domain is weak*. Specifically, two-way exchange of money is common, but receiving money reduces chances of giving material goods. And two-way exchange of housework is common, but receiving housework help reduces chances of giving babysitting. Time and enthusiasm can run out! Perhaps older

people feel that enough has been given by sharing money and housework. Other negative links show that *money and emotional support/advice are not very compatible*. When one is received, chances are low of giving the other. Apparently, money and intimacy “cross swords” in social exchange.

Even nil results (nonsignificant links between receive and give) merit attention. Substantively, they suggest that certain two-way exchanges are unconnected. If repeated in other analyses, it means that some routes are quite closed in social exchange, and reciprocity motivations aim elsewhere. But statistical aspects (chance and low item variation) can also play a role. The nil results in our analysis (see Results) suggest statistical rather than substantive reasons.

**Hypotheses.** Hypotheses 1-3 are supported. We posited that reciprocity between receiving and giving help is strong. For older Singaporeans, it is moderately strong. Second, we posited that among older persons, giving nontangibles (time and effort) for received tangibles is a typical form of reciprocal exchange. That is confirmed. Third, we expected that giving help is more common when older persons have strong social and psychosocial resources, and less common when they have health and functional problems. That proves true overall, but effects are not as strong or consistent as expected. Receiving help is the central predictor of giving help, as expected.

### **Integration with Asian research on family relationships**

This analysis is about social exchange, but it links with the classic Asian topics of coresidence, filial piety, and intergenerational transfers.<sup>2</sup>

Coresidence enhances ease of reciprocity among family members. The majority (66%) of older respondents in 2011 live with their children, which may boost giving, receiving, and reciprocity. But Singapore is a small nation, so even when older parents live somewhere else, family reciprocity is not very difficult. All in all, coresidence is unlikely to be a key factor for reciprocity in Singapore.

Filial piety is a key principal in family relations in Asian societies. Filial piety is strict feelings of adult children's obligations to older parents for housing, income support, and illness/disability care. It is a *one-way notion* (child gives to parent). By contrast, reciprocity is a *two-way notion*. Where is the link? Our analysis shows that receipt of help by older persons, for whatever motives the givers have, is strongly linked to older persons' giving in return. This implies that actions motivated by filial piety (one of many motivations, but dominant in Asian societies) prompt efforts to reciprocate in some manner.

There are fundamental distinctions between intergenerational transfers (IGT) and reciprocity research. IGT research emphasizes *one-way flows of resources* in families (such as older parents giving money to their adult children). Sizes of flows are compared (such as how much money parents give to children, and vice versa), and asymmetry gets ample attention. Consequences of transfers for individual well-being are

studied. By contrast, reciprocity is about *two-way exchanges*. The focus is to and from, not just to, not just from; symmetry is the essence and evidence of reciprocity. All domains of social relations are germane, and exchange actions span things, time, space, emotions, etc. Even when families are the focus, the types of exchanges are more diverse than for IGT. Reciprocity's consequences for network structure and social cohesion are discussed.

These distinctions are large, but the fields intersect since both concern flows (one-way or two-way) of goods and services. Where is the link? Our analysis provides some one-way information: prevalences of receiving help and of giving help, and predictors of giving help. But it stretches to two-way: Certain goods and services received are tightly linked with giving something in return (positive effects; reciprocity) or not (negative and nil effects). We reiterate that causal ties cannot be demonstrated in the data, but regardless of who gives first in the family, there is impetus and evidence of giving in return.

## Replication

We approached this analysis as a replication of the first one, rather than as a view of social change. The reason is simple: The previous data were not designed with the topic of social exchange in mind, and great effort was expended to find sufficient receive help and give help items to suit a social exchange analysis. By contrast, PHASE Wave 2 was designed with family social exchange as a key topic, and items with good scope, consistent wording, and common questionnaire location were crafted. The two analyses are closely similar in other respects (predictor domains, specific predictors, statistical techniques).

What do reciprocity results look like with targeted, well-designed items about family behaviors? Results are remarkably similar in the two analyses, a little stronger statistically for 2011 but not enough to change the conclusions about reciprocity.

We compare the two analyses for statistical yield (strength of reciprocity, types of reciprocity, effects of other predictors, explained variance), then for substantive yield. From a statistical stance, for strength of reciprocity, the two analyses have similar percentages of significant effects, but the percentage of positive ones is higher for 2011. The principal form of reciprocity is similar; "nontangibles for tangibles" (2011) encompasses "time for money" (1995/1999). Strength of other predictors besides receive is about the same, with similar percentages of significant effects and effects per hypothesis. For specific predictors appearing in both analyses, their effects are similar. Explained variance for models is slightly higher in 2011 (.08 on average). Details of the comparisons are available on request. We note that prevalences of receiving/giving help for 2011 and 1995/1999 cannot be compared because the items differ so much.

From a substantive stance, results show that family reciprocity by older Singaporeans emphasizes "nontangibles for tangibles". *This includes and extends the prior result of "time for money". Thus, we*

*have replication with elaboration.* The "same for same" result is new in the 2011 analysis. It was impossible to detect in the prior one because of receive items were so dissimilar to give items. In both analyses, *receiving help is the central predictor of giving help. This implies that motivation to reciprocate is fundamental, and exceeds the impact of any other resources or features older persons have.*

Hypothesis 4 is supported. Better items boost the statistical strength of the results here, but the substantive result is the same in both analyses; older people give their time and effort in return for money and material goods. Different items for the two analyses can be seen as a benefit for replication; the main finding does not hinge on the items!

### **Social change**

Social circumstances for older persons are changing in Singapore. The older population is becoming more financially independent and literate. From 2000 to 2010, the percent of persons ages 65+ who rely on their children as the primary source of income decreased from 75% to 63% (Department of Statistics, Singapore 2001a, 2001b, 2011). Older persons with no formal education decreased from 70% in 2000 to 60% in 2010. For social policies, Singapore has an official policy of reliance on family for care of older persons (Chin and Phua 2016; Mehta 2006; Phua 2001; Teo 2004). The policy is unlikely to change in the foreseeable future, but programmatic changes can help family members in contemporary ways for communications, care planning, and safety of older kin.

As the social composition of older Singaporeans changes, and as families respond to government programs and incentives, family ties and exchanges are likely to change as well. Speculations exceed evidence. There is little empirical research for Singapore about family values, intergenerational transfers, and family social exchange, whether cross-sectional or over time. Most existing studies are qualitative with small samples (Ingersoll-Dayton and Saengtienchai 1999; Mehta 1997, 1999; Mehta and Ko 2004; Mehta, Osman and Lee 1995; Milagros *et al.* 1995; Phua and Loh 2008), and quantitative studies with sizable samples are few (Chan 1997; Gubhaju, Chan and Østbye 2015; Ofstedal, Knodel and Chayovan 1999; Teo and Mehta 2001). The data show that commitment to family (filial piety) persists in contemporary Singapore, and authors anticipate forthcoming changes in its expression.

Comparisons across cohorts are needed to assess social change in family relations. A Singapore study has been launched (2016-7) with a new sample of persons ages 60+ and the same social exchange questions. Using PHASE and the new survey, both aggregate-level (prevalences) and individual-level (give-and-receive relationships) comparisons will be possible over time. We think "nontangibles for tangibles" will persist as the main form of reciprocity by older persons, but more exchanges of "tangibles for tangibles" will occur as their financial resources increase.

## CONCLUSION

Older Singaporeans give time and effort (physical, mental, emotional) to their family in return for money and material goods received. This is "nontangibles for tangibles". Family reciprocity is common in contemporary Singapore, and it helps maintain and enhance family cohesion and goodwill as the state modernizes.

The Singapore data used here have a good array of behaviors in family social exchanges: babysitting grandchildren, housework and cooking, help with personal care, help going away from home, emotional support/advice, money, and food/clothes/other material goods. These are classic family behaviors in Asian societies. Not included are *affective behaviors* such as stating appreciation and gratitude, courtesy and listening, embracing or touching, and saying "I love you". Also absent are *modern-life behaviors*, such as electronic communications, organizing appointments, handling paperwork, arranging house and property services, help with computers and mobile devices, and safety training. Western studies have included some of these affective and instrumental items (Geurts, Poortman and van Tilburg 2012; Lin and Wu 2014; Morgan, Schuster and Butler 1991; Parrott and Bengtson 1999). They are not yet in Asian studies. Indeed, affective items may be difficult to include in Asia where traditionally, emotions are not readily expressed and public decorum is prized (including during interviews). Nevertheless, the scope of financial, instrumental, and affective behaviors in family ties is large and has always been so. Efforts to stretch questions toward affective and modern-life behaviors will give still better views of reciprocity in older people's lives. Time and effort are probably only part of the story.

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**Author contributions.** Lois M. Verbrugge initiated the analysis and contributed to its design, statistical choices, review of outputs, reading all references, preparation of tables, and writing the manuscript. Shannon Ang contributed to analysis design, statistical choices and all computing, review of outputs, and writing the manuscript.

**Conflict of interest.** The authors have no conflict of interest relevant to this analysis.

## NOTES

<sup>1</sup> Other theories about giving and receiving behaviors, and their motivations, have been developed in economics, sociology, social psychology, and anthropology (Bengtson, Putney and Johnson 2005; Carstensen 1992; Emerson 1972a, 1972b, 1981; Garrison 1984; Marcum and Koehly 2015; Mauss 1925; Ring 1996; Thomas 2010; Wu *et al.* 2016). They do not contradict social exchange and reciprocity, but approach social relations from other perspectives. A good brief review of some other theories is in Bengtson *et al.* (2005).

<sup>2</sup> The topics were reviewed in Verbrugge and Chan (2008; pp. 6-8 therein). Recent research is taking new directions, and we update the review here. (1) Coresidence of parents and their adult children is declining due to improved financial resources of older people, migration of adult children, more residence types with care services, and the ethos of independence in late life (Pezzin, Pollak and Schone 2015; Takagi and Silverstein 2006). On the other hand, coresidence is being boosted by extended time that unmarried adult children now stay with their parents (Lin and Yi 2013; Takagi and Silverstein 2006). (2) For filial piety, there is much written about its "erosion" in Asia. But that is hard to assess -- studying felt motives for a respondent's own behavior is challenging (or impossible). Instead, studies query people's attitudes about filial piety (Chappell and Funk 2012; Cheung and Kwan 2009; Dong, Zhang and Simon 2014; Ha *et al.* 2016; Lowenstein, Katz and Gur-Yaish 2007; Lum *et al.* 2016; Silverstein, Conroy and Gans 2012; Takagi and Silverstein 2006; Tsutsui, Muramatsu and Higashino 2014). These studies suggest reshaping (not erosion) of filial piety, especially its behavioral implementation. Helping behaviors are changing worldwide to include conscious affective displays of caring and love, finding and monitoring others to care for older parents, planning and administrative tasks, and assuring security (Chan and Lim 2004; Chappell and Funk 2012; Cheung and Kwan 2009; Dong, Zhang and Simon 2014; Ha *et al.* 2016; Phua and Loh 2008; Tsutsui, Muramatsu and Higashino 2014; Wong and Chau 2006; Yi *et al.* 2015). (3) For intergenerational transfers (IGT), new emphases are their long-range scope over time and place, and psychosocial outcomes of transfers for older persons. Intergenerational giving and receiving in families is diversifying in "who, what, and when" (Antonucci and Jackson 2007; Cong and Silverstein 2011; Costanzo and Hoy 2007; Grundy 2005; Lin and Wu 2014; Lin and Yi 2013; Quashie 2015; Zuo, Wu and Li 2011). Receiving and giving help act as buffers for stress and loneliness among older persons (Lowenstein, Katz and Gur-Yaish 2007; Poulin *et al.* 2013; Thomas 2010; Wahrendorf *et al.* 2010).

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