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The association between social support and cognitive function in Mexican adults aged 50 and older

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ABSTRACT

Social support networks are crucial for the health of older adults; however, personal characteristics and time of life may diminish the protective effect of social support.
Objective: to determine if the presence of social support networks were associated with cognitive impairment among Mexican adults aged 50 or older and if this relationship was different based on age.
Method: This study analyzed data from the National Representation Survey performed in Mexico, Study on Global Ageing (SAGE) wave 1. Cognitive function was evaluated by a standardized test, social support was evaluated through latent class analysis (LCA). The LCA was run to obtain three subgroups of different Social Support Levels (SSL): low, medium, and high. Logistic regression models, stratified by age, were performed to analyze the association between SSL and cognitive function.
Results: For respondents ages 71–80 y/o, there was an inverse relationship with cognitive impairment for those with medium (OR 0.23, p = 0.020) and high (OR 0.07, p = 0.000) SSL in comparison with low SSL. While social support helped to improve cognitive function in older adults aged 71–80, this same association was not observed in adults of other ages. Those younger than 70 y/o may not need such a strong support network as a result of being more self-sufficient. After 80, social networks were not enough to help diminish the negative impact of cognitive impairment.
Conclusion: Social support could improve the cognitive function of adults ages 71 and 80; suggesting there could be a window of opportunity to improve cognitive functioning for this group.

1. Introduction

By 2025, people 50 and older will exceed the number of people younger than 15 years of age (United Nation Population Division, 2015). Other medium- and low-income population countries, Mexico among them, exhibit the same demographic profile (National Institute of Statistics, 2015).

Cognitive and physical impairment is common among older adults as well as cognitive decline (7–8%) (Manrique-Espinoza et al., 2013; Mejia-Arango & Gutierrez, 2011; Sosa et al., 2012). Previously, Green, Rebok & Lyketsos (2008) and Sims, Levy, Mwendwa & Clive (2011) showed that strong social support networks were related to the maintenance of cognitive function.

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Social support networks are essential for the maintenance of physical and mental health of older adults (Salinas, Manrique & Téllez 2008; Guzmán, Huenchuan & Montes de Oca, 2003). Family relationships are the main source of social support. They provide physical, material and emotional support, and meet varying needs such as food, housing and personal hygiene (physical), self-esteem and affection (psychological), and identification, communication and sense of belonging (social) (Alvarenga, Campos, Rodrigues, Amendola & Faccenda, 2011; Gallegos-Carrillo et al., 2009).

Cross-sectional studies performed by Fratiglioni and Wang (2007), Krueger et al. (2009), Feng, Linqin and Lingzhong (2014), Bassuk, Glass and Berkman (1999) have found that people with poor support networks have a greater chance of suffering cognitive decline and developing illnesses such as dementia or Alzheimer's disease in comparison with people with more active social lives. Longitudinal studies have consistently shown the same effect (Fratiglioni, Paillard-Borg & Winblad, 2004; Zunzunegui, Alvarado, Del Ser, & Otero, 2003). Hughes, Flatt, Fu, Chung-Chou, and Ganguli (2013) reported that the presence of social support had a positive effect on cognitive function of people who already showed some degree of impairment.

Epidemiological evidence has shown that the relationship between social support and health is modified by characteristics such as age, sex, socio-economic status, education, residence (urban/rural), co-morbidities, and others (Montes de Oca, 2006; Scott & Wenger, 1996; Stringhini et al., 2012).

Age is particularly relevant in social support network research even though it has been traditionally incorporated as a confounding variable. Studies by Antonucci et al. (2002), Antonucci et al. (2004) described how the structure of social support networks have changed over time and Schnittker (2005) described a differentiating effect of social support and cognitive impairment based on age.

Results from a cohort study of adults aged 35 to 85 showed that social support networks were related to better cognitive capacity exclusively in young adults (Seeman, Miller-Martinez, Stein-Merkin, Lachman, Tun, & Karlamangla, 2011). Previous works indicated a positive effect on the relationship between functional capacity and stress, and results varied by age (Alvarenga et al., 2011; Stringhini et al., 2012). The main objective of this study was to determine if the presence of social support networks were associated with cognitive function among Mexican older adults aged 50 and older and if this relationship varied by age group.

2. Subjects and methods

2.1. Sample

Our sample was obtained from SAGE, a cross-sectional, nationally representative survey of adults aged 50 and older, which comes from a parallel multicenter study performed in other countries (Kowal et al., 2012). The aim of the SAGE survey was to compare respondents, ages 18–49 to those 50 and older. However, only respondents in the national representative sample aged 50 and older from Mexico were considered in our research. This sample was obtained in wave 1 (2009–2010) and the sample design for Mexico was probabilistic, multistaged, stratified, and clustered. The strata considered were: city/metropolitan area, urban/rural, housing, and households with people aged 50 and older. Our sample included 2211 respondents.

2.2. Variables

2.2.1. Cognitive function

A battery of cognitive tests was used to measure cognitive performance. In order to measure objective indicators of various aspects of cognition, these tests were developed and validated for the Latin Population. The first test was the 1987 Memory Wechsler Scale (Wechsler, 1987) that was based on successive number repetition to test memory. Second, verbal fluency was tested by the interviewee's capacity to mention as many words as possible in one minute. The third test was for immediate and delayed memory and was tested using the CERAD Neuropsychology Battery (Morris et al., 1989), which consisted of saying ten words in order to the interviewee and requiring repetition of the remembered words. Each test provided segments to develop a factor analysis with which a single factor provided a general score. This score was then converted to a percentage scale where 100% meant the most impaired. Afterwards, Cognitive Function was divided into tertiles where the highest was compared to the other two; therefore, a dichotomous variable was created.

2.2.2. Social support levels

Social Support Index, Trust Index, and Social Cohesion Index were used to construct a Latent Class Analysis that were used as indictors to determine the SSL.

2.2.2.1. Social network index. Proposed by Heaney and Israel (1996) and Berkman and Glass (1996), the Social Network Index was developed from the following questions: 1) What is your marital status? 2) How often do you attended a religious service? 3) Generally speaking, would you say that you can trust strangers? 4) Have you ever attended a group meeting? Answers were dichotomized by Yes = 1 and No = 2. Each one was added to develop a 4-level variable, where 0 represented the worst and 4 represented the best social network.

2.2.2.2. Social cohesion index (SCI). Based on the Durkheim (1893) Theory of Social Capital, SCI was built with the modified version of Ramlagan, Peltzer, and Phaswana-Mafuya (2013), which consisted of the sum of 9 items: How often in the last 12 months have you: (1) Attended any public meeting in which there was discussion about local or school affairs? (2) Met personally with someone you consider to be a community leader? (3) Attended any group, club, society, union or organizational meeting? (4) Worked with other people in your neighborhood to fix or improve something? (5) Had friends over to your home? (6) Been in the home of someone who lives in a different neighborhood than you do or had them in your home? (7) Socialized with coworkers outside of work? (8) Attended religious services? (9) Gotten out of the house/your dwelling to attend social meetings, activities, programs or events or to visit friends or relatives? Scores were calculated using a Likert scale. Responses were assigned a value and then added to obtain a general score. The score was then converted into a percentage, and 100% represented the highest degree of social cohesion.

2.2.2.3. Trust Index. Developed and used for the first time, it was constructed using the sum of 6 items: (1) Do you think you can trust or do you think you do not need to be very careful when dealing with people? (2) Do you have someone you believe you can trust? (3) Would you say that you can trust people in your neighborhood? (4) In relation to strangers, would you say that you can trust them? (5) Generally, how safe from crime and violence do you feel when you are alone at home? (6) How safe do you feel when walking down your street alone after dark? Scores were calculated using a Likert scale. Responses were assigned a value and then added to obtain a general score. The score was then converted into a percentage, where 100% represented total trust.

2.2.3. Co-variables

Sex (men/women), age, marital status (with partner/without partner), place of residency (urban/rural), education (years of,

classified as elementary, secondary (middle school), high school and college or university), and household members (number and socioeconomic status), were generated through a multi-step process. The Bayesian post-estimation method was used to generate continuous income estimates (Ferguson et al., 2003).

2.3. Data analysis

In order to identify subgroups of respondents with similar patterns of social support, we created the variable *social support* through LCA with the Software Latent Gold 3.0.6 (Statistical Innovations Belmont, MA). We used LCA because there was no current information regarding cutoff points in the Social Network Index.

The assumption behind LCA was that a certain number of profiles could be identified and that, based on these profiles, respondents could be grouped into a smaller number of clusters known as latent classes, recognized by adjustment indicators (Table 1). For a given latent class model, parameter estimates included a class membership probability, which could be thought of as a prevalence that reflects the likelihood that a characteristic is endorsed by an individual given membership in that class.

LCA seemed to provide a good analytical approach to our objectives because it did not rely on traditional modeling assumptions; this is a technique that could handle categorical data, and compared to factorial analysis, did not require making judgments about the orthogonality of the variables.

An exploratory analysis was done on the variables. Cognitive function was categorized into quartiles and a bivariate analysis was performed from these categories. A one-way analysis of variance (ANOVA) for continuous variables and X^2 for categorical variables were used to study bivariate associations with; age, marital status, sex, level of education, residence, number of household members, income, and level of social network.

Multiple logistic regression analyses were used for estimation of Cognitive Impairment Variables to obtain Odds Ratios (OR). We created a model for each age group (50–60, 61–70, 71–80 and 81–90). Due to the complexity of the SAGE design, the analysis was adjusted with the appropriate expansion factors using svy commands in STATA 12.0. We considered $p < 0.05$ and $p < 0.10$ to report significant and marginally significant associations.

3. Results

Our sample included 2211 respondents. Mean age was 62.3 (SD 9.9) and women made up 53.6% of the sample (CI 95%, 46.9–60.0). The majority lived in urban residences 78.6% (CI 95%, 78.6–84.9). The mean education level was 6.0 (SD 4.3) and the majority, 72.6% (CI 95%, 65.9–78.4), had a partner. Respondents reported an average of 4.7 (SD 2.4) household members (Table 2).

Table 2 presents comparative analyses on cognitive function broken into quartiles. Bivariate analysis showed that those in the highest quartile (greatest impairment) were older ($p = 0.001$), had less education ($p=0.001$), and had fewer household members ($p = 0.001$). Associations with marital status, sex or social networks were not statistically significant.

Fig. 1 presents the social support indexes for three distinct profiles, where each class has different mean points as shown on the X axis: low (40.4%, CI 95% 32.7–48.5), medium (52.6%, CI 95% 44.9–60.1) and high (7.0%, CI 4.6–10.4).

Multiple Logistic Regression analyses stratified by age group are shown in Table 3. The variables that predicted a significant relationship with cognitive impairment were: income, social support, educational level and place of residency. In 50–60 y/o respondents, the odds for impairment of cognitive function decreased for those with medium and high income levels (OR 0.39, $p = 0.060$ and OR 0.20, $p = 0.040$ respectively). Among 61–70 y/o adults, only the highest income level showed the same outcome (OR 0.18, $p = 0.000$).

For respondents 71–80 y/o, cognitive function was significantly affected by medium (OR 0.23, $p = 0.020$) and high (OR 0.07, $P = 0.000$) social support levels. In the same age group, secondary school (OR 0.31, $p = 0.080$) and high income levels (OR 0.38, $p = 0.040$) had a marginal effect on cognitive function. In particular, living in a rural environment increased the chance for cognitive impairment in respondents aged 80+ (Table 3).

The estimation of multiple logistic regression models was plotted. Probability of cognitive impairment increased with age. Respondents with less support showed a greater chance for developing cognitive impairment than those with higher support. Aging modifies this relationship, which was more evident around 70+ y/o. There were not statistically different effects between young and older adults (Fig. 2).

Table 1
Model Selection Criteria.

Class solution	No. of Parameters	LL	BIC[LL]	P
1 class	12	−10016.50	20125.41	0.000
2 class	16	−9743.71	19610.64	0.000
3 class	**20**	**−9710.35**	**19574.72**	**0.005**
4 class	24	−9701.02	19586.88	0.042

LL = log likelihood.
BIC = Bayesian Information Criterion.
Bold text identify the three latent classes, $p < .05$.

4. Discussion

The study showed an association between social support and cognitive impairment in older adults. Our results revealed a significant association between medium and high levels of social support and a decreased possibility to present cognitive impairment for respondents aged 71–80. Other variables with a significant effect were: sex, education and place of residence.

Antonucci et al. (2002) and Ajrouch, Blandon, and Antonnucci (2005) described how social networking changed with age and had an impact on health. Circumstances throughout life such as: economic status, education, health, and adaptation capacity were conditions which impacted cognitive capacity in older adults (Dulcey 2010). Older adults required greater material support than emotional support, whereas younger adults were more likely to reach out to family and friends to share their emotions and problems (Fuller-Iglesias, Webster, & Antonucci, 2015).

Different findings suggested that social support was one of the determinants of cognitive function, and lonely people had a greater possibility to present cognitive disturbances; however, different studies demonstrated that there was variability in these effects. In our study, we did not differentiate between types of social support; nevertheless, the evidence suggests that emotional support has been positively associated with multiple indicators of cognitive functioning (Glymour et al., 2008; Krueger et al., 2009; Seeman et al., 2001).

Instrumental support showed positive and negative associations, (Dickinson et al., 2011; Seeman et al., 2001). Although this support type provided practical assistance, it also contributed to stress and feelings of inadequacy (Uchino, 2009). Ellwardt, Aartsen, Deeg, Steverink (2013) found that cognitive decline was inversely associated with emotional support, and instrumental support was not protective against cognitive decline, instead there were indications for faster decline.

Stringhini et al. (2012) and Berkman and Glass (2000) described how social support in older adults fostered a greater effect on

Table 2
Respondent Characteristics by Cognitive Function Quartiles.

Variable	Mean (SD)/Proportion [CI]	Cognitive Function Quartiles Mean (SD)/Proportion [CI]				Test, F/X^2, p
		1 n = 407	2 n = 408	3 n = 407	4[a] n = 408	
Age	62.31 (9.9)	59.9 (7.5)	61.5 (9.3)	65.2 (10.9)	71.6 (10.3)	F = 31.20, p = 0.000
Married/Cohabitating	72.6 [65.9–78.4]	72.2 [58.83–82.55]	78.3 [65.96–87.06]	62.2 [46.1–76.05]	62.1 [52.78–70.65]	X^2 = 1.94, p = 0.1340
Women	53.6 [46.9–60.0]	45.49 [28.7–63.4]	54.5 [37.5–70.5]	50.8 [41.5–59.9]	54.5 [47.6–61.3]	X^2 = 1.16, p = 0.3139
Years of Education	6.0 (4.3)	5.7 (3.6)	4.2 (3.8)	5.3 (2.7)	4.0 (2.9)	F = 5.40, p = 0.0013
Urban	78.6 [78.6–84.9]	91.7 [86.6–94.9]	65.5 [44.3–81.9]	73.8 [59.5–84.3]	59.9 [48.8–70.0]	X^2 = 6.38, p = 0.0036
No. Household Members	4.7 (2.4)	4.5 (2.0)	4.5 (1.9)	4.5 (2.6)	4.3 (2.7)	F = 5.51, p = 0.0003
Income	0.91 (.4)	.22 (.4)	−.07 (.4)	−.01 (.4)	−.19 (.4)	F = 25.75, p = 0.0000
Social Support	40.4	91.7	65.5	73.8	59.9	
Low	[32.8–.48.5]	[86.6–94.9]	[44.3–82.0]	[59.6–84.3]	[48.8–70.0]	
Medium	52.6 [45.0–60.1]	8.28 [5.0–13.4]	34.48 [18.1–55.7]	26.25 [15.7–40.5]	40.15 [30.0–51.2]	X^2 = .47, p = 0.6778
High	7 [4.6–10.4]	7.1 [3.2–14.8]	7.1 [3.4–14.4]	2.7 [1.3–5.4]	3.5 [1.6–7.6]	

SD = Standard Deviation.
CI = Confidence Interval 95%.
[a] Impaired Cognitive Function.

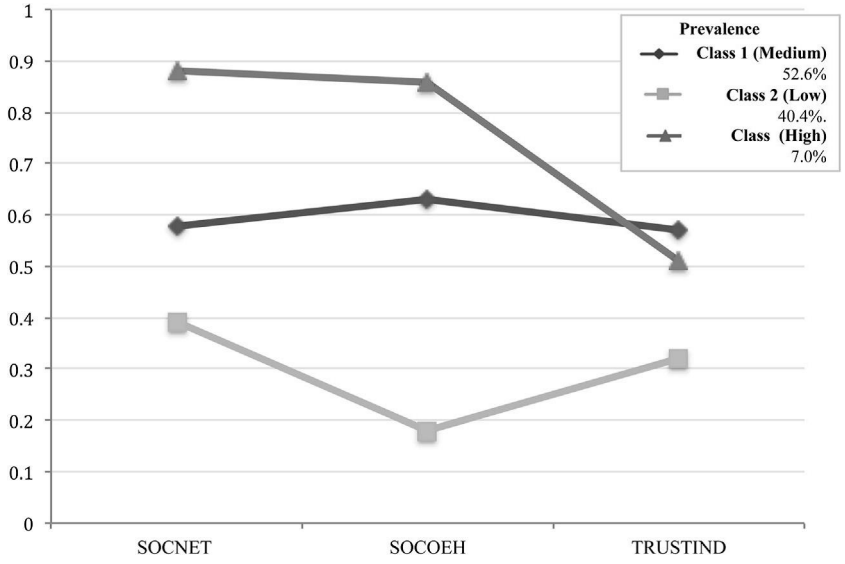

Fig. 1. Profiles of social networks: results of latent class analysis.

cognitive function. Our research showed a decreased probability of cognitive impairment with greater social support for respondents aged 71–80; this agreed with the longitudinal study results of Seeman et al. (2011). However, a decreased probability for cognitive impairment was not present for adults younger than 71 y/o or older than 80 y/o. It is possible that respondents younger than 70 y/o could be less vulnerable to diseases due to their capability to cope with adversities, thus making them less dependent on social networks.

Our findings for adults ages 80+ were consistent with the results from Eisele et al. (2012), where no significant association was found in 80+ y/o. One possibility for this might be that cognition was already affected for this age group. Some authors argued that intensified support was a response to growing needs of the older adult, because cognitive decline had already developed (Ellwardt, Aartsen, Deeg, &, Steverink, 2013).

Ramlagan et al. (2013) analyzed SAGE data from South Africa where they studied how social capital (sociability, trust and solidarity, and safety, among others) modified cognitive capacity. They found that better cognitive functioning was associated with younger age, higher educational level, greater wealth, and higher social capital (being married or cohabiting, high trust and solidarity, higher civic engagement, etc.).

The relationship between social support and health could be described by two principal theories: 1) Mental stimulation improves cognitive strategies and increases neuronal growth which contributes to cognitive reserves through activation and strengthening of neurobiological pathways. 2) Social Support

Table 3
Odds Ratios for Impaired Cognitive Function among Mexican Adults aged 50 and older by age group.

	50–60 years n = 540			61–70 years n = 871			71–80 years n = 566			>80 years n = 182		
	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	C
Social Support												
Low	Ref											
Medium	3.13	0.13	0.7 –13.9	0.9	0.75	0.5 –1.8	0.23	0.02	0.01 –0.7	0.55	0.31	0.2 –1.8
High	–	–	–	1.69	0.44	0.5 –6.4	0.07	0.00	0.0 –0.4	–	–	–
Sex	1.04	0.94	0.4 –2.9	1.22	0.47	0.7 –2.1	0.75	0.50	0.32 –1.7	0.7	0.57	0.2 –2.4
Education												
Primary	Ref											
Secondary	1.00	0.99	0.3 –3.6	1.09	0.89	0.3 –3.6	0.31	0.08	0.1 –1.2	0.37	0.32	0.1 –2.7
High school	0.93	0.96	0.1 –10.9	1.06	0.91	0.4 –2.8	0.43	0.32	0.1 –2.3	0.19	0.13	0.0 –1.7
Income												
Low	Ref											
Medium	0.39	0.06	0.2 –1.0	0.78	0.42	0.4 –1.4	1.06	0.92	0.3 –3.3	2.03	0.38	0.4 –10.0
High	0.20	0.04	0.1 –0.9	0.18	.00	0.1 –0.4	0.38	0.04	0.2 –0.9	4.63	0.10	0.8 –28.3
Rural/Urban	1.26	0.72	0.4 –4.4	1.49	0.26	0.8 –3.0	1.82	0.20	0.7 –4.6	5.62	0.00	1.6 –17.1

CI = Confidence Interval 95%.
Sex = 1 male.

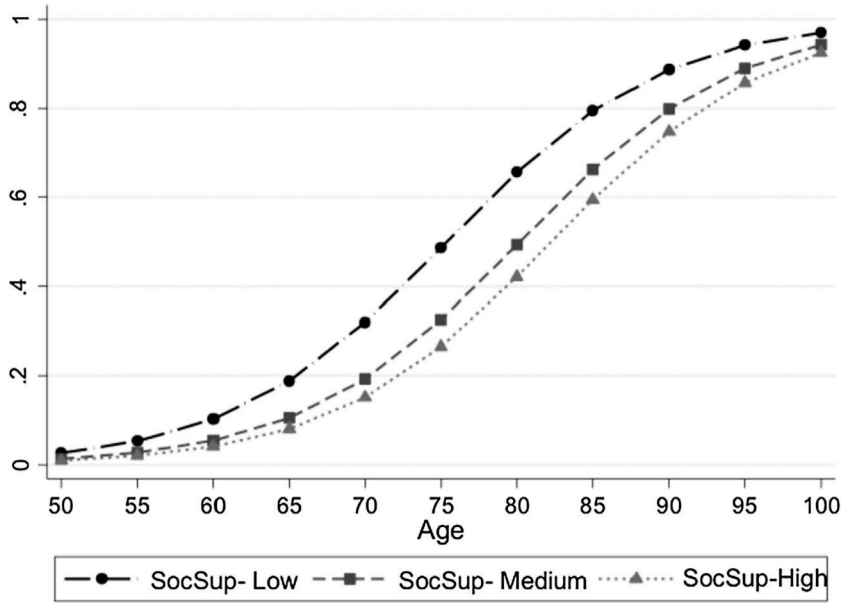

Fig. 2. Odds ratios for impaired cognitive function in association with social support levels in Mexican adults aged 50 and older.

buffering effect, where stressful situations in daily life have a lower impact, therefore reducing adverse psychological reactions. However, both models are not mutually exclusive and they are not independent forces; social support can provide stimulation and at the same time serve as a moderator to stressful events.

The design and temporality of the study did not allow for a causal path between social support and cognitive function, but through statistical analysis we controlled for possible confounders and modifiers such as education level. Higher educational levels decreased the chance for cognitive impairment. Hughes et al. (2013) hypothesized that a higher education level was related to a compensatory mechanism developed through time which protected against cognitive impairment. Respondents living in rural environments were more likely to have limited access to health services; therefore early cognitive impairment diagnoses were not as likely (Scott & Wenger, 1996; Montes de Oca, 2006).

The limitations in the study were related to a cross-sectional study design. We were unable to identify if cognitive impairment was prevented/preceded by the level of social networks. Even though cognitive function was measured using standardized tests, disease entities like mild cognitive impairment did not complete the criteria to establish a diagnosis. Despite impaired levels, specifications could not be done so we constructed an approximation variable about cognitive function to identify higher and lower levels of impairment. Finally, another limitation was that social support was analyzed as a quantitative variable so quantity and quality were not studied.

Our strengths were that the probabilistic design of the investigation was from a national representation survey, all measures were performed by standardized personnel and the tests were validated for Latin-American countries. There was a chance to identify adults ages 50 and older with impaired cognitive function. As well, as a multicenter study, it would be possible to compare the results with those obtained later, in other national contexts.

Although traditionally the literature describes the positive effects of social support on the health of individuals, it is important to consider its positive influence must be framed in the course of life of the subject, where resources change over time. The data presented here showed that there was a window of opportunity for

those aged 71–80 years old, as they appeared to benefit the most by the presence of social support. This data can provide valuable information needed to construct social and psycho-educational programs according to the needs of the population.

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