Compromiso social como medida de reserva cognitiva y su relación con distintos procesos cognitivos en jóvenes universitarios

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Resumen

La literatura científica indica que un mayor compromiso social se relaciona con un procesamiento cognitivo más eficiente, debido a que dicho compromiso incrementa la reserva cognitiva. Teniendo esto en cuenta, el objetivo de la presente investigación fue identificar la relación existente entre el compromiso social (en sus dimensiones de contacto, apoyo y conflicto social) y algunos procesos cognitivos (como flexibilidad mental, planeación, fluidez verbal, velocidad de procesamiento y comprensión verbal) en jóvenes universitarios. Para esto, se realizó un estudio correlacional con un diseño transversal en una muestra de 49 estudiantes. El análisis de correlación de Spearman reveló correlaciones entre contacto social y fluidez verbal ($r = –.299$, $p = .037$), apoyo social y planeación ($r = .368$, $p = .009$), y conflicto social y velocidad de procesamiento ($r = .306$, $p = .032$). Estos resultados perfilan una asociación entre el compromiso social y algunas funciones cognitivas. A pesar de que los resultados no son del todo concluyentes, queda claro que se necesita de un estudio más detallado de estos procesos.
Palabras clave: reserva cognitiva, relaciones interpersonales, cognición.

Social engagement as a measurement of cognitive reserve and how it relates to different cognitive skills in college students

Abstract

Greater social engagement is commonly associated with more efficient cognitive processing, as it improves cognitive reserve. The aim of this research is to assess the relationship between social engagement (in the dimensions of social contact, support and conflict) and certain cognitive skills (cognitive flexibility, planning, verbal fluency, processing speed, and verbal comprehension) in young college students. This cross-sectional rank correlation study was carried out in a sample of 49 college students. Spearman's rank correlation coefficient showed relationship between: social contact and verbal fluency ($r = –.299$, $p = .037$); social support and planning ($r = .368$, $p = .009$); and social conflict and processing speed ($r = .306$, $p = .032$). The results outline a measurable relationship between social engagement and certain cognitive skills, even when said results are not entirely conclusive. Thus, the need for more detailed studies on these processes becomes clear.
Key words: cognitive reserve, interpersonal relationships, cognition.

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Compromisso social como medida de reserva cognitiva e sua relação com diferentes processos cognitivos em jovens universitários

Resumo

A literatura científica indica que um maior compromisso social está relacionado com um pensamento cognitivo mais eficiente, devido ao fato de que tal compromisso aumenta a reserva cognitiva. Levando isso em consideração, o objetivo da presente pesquisa foi identificar a relação existente entre o compromisso social (em suas dimensões de contato, apoio e conflito social) e alguns processos cognitivos (como flexibilidade mental, planejamento, fluidez verbal, velocidade de processamento e compreensão verbal) em jovens universitários. Para tanto, realizou-se um estudo correlacional com um desenho transversal em uma amostra de 49 estudantes. A análise de correlação de Spearman revelou correlações entre contato social e fluidez verbal ($r = –.299$, $p = .037$), apoio social e planejamento ($r = .368$, $p = .009$) e conflito social e velocidade de processamento ($r = .306$, $p = .032$). Esses resultados constituem uma associação entre o compromisso social e algumas funções cognitivas. Apesar dos resultados não serem completamente conclusivos, fica clara a necessidade de um estudo mais detalhado desses processos.
Palavras-chave: reserva cognitiva, relações interpessoais, cognição

Introduction

Nowadays, and for the sake of improving the standards of living, efforts are being made to expand the knowledge of those factors that may protect and foster the development of healthy communities in all aspects. When it comes to mental health, we seek to increase the body of knowledge about the diverse factors at play in the protection of people from suffering cognitive impairments associated with both regular and pathological aging, and with different pathologies that impact cognitive skills. We also seek to increase awareness of the different factors that promote healthy cognitive development from early age. Such factors include years of education, educational achievement, work complexity, environmental enrichment, leisure activities, social engagement, and others (Lojo-Seoane, Facal, Juncos-Rabadán, & Pereiro, 2014; Mayor, Amador, & Ramírez, 2008; Seeman et al., 2011; Stern, 2009; Zhou, Wang, & Fang, 2018).

The interest in studying this subject matter derives from the ongoing demographic transition process, tending towards population ageing, which has resulted in a higher prevalence of conditions common in old age, such as dementia. If the necessary prevention policy is not developed, then current tendencies towards longevity may represent greater challenges, since a population high in unhealthy older adults will require more social security and special care resources. This would translate into greater costs that might eventually lead to a global socioeconomic crisis (Lojo-Seoane et al., 2014; Mayor, Amador, & Ramírez, 2008) that would impoverish the quality of life of thousands of people.

The cognitive reserve model sets forth that a series of cognitively stimulating activities enacted throughout life will create a reserve capacity, which seems to have a protective or optimizing effect on the execution of cognitive skills in all stages of life, but particularly so in old age (Stern, 2009). Cognitive reserve is defined by Stern as the ability to optimize execution through the differential recruitment of brain networks, which may reflect the use of alternative cognitive strategies.

Some evidence suggests that the elements of risk and protection could be cumulative throughout life, impacting cognitive skills during old age and manifesting as cognitive reserve (Nithianantharajah & Hannan, 2009). However, Stern (2009) proposes that this cognitive reserve can also have an important impact during youth. In any case, very few studies have been carried out in young populations with the aim of understanding how the capacity to cope with cognitive deterioration is built from an early age.

No consensus has been achieved as to what are the variables or indicators that favor the development of cognitive reserve, although the following indicators are frequently included: education, literacy, bilingualism and overall mental ability; sociodemographic indicators such as socioeconomic status, own occupation and the occupation of parents; indicators directly related to health, such as nutrition and physical activities; performing cognitively stimulating activities, including writing, listening to music, painting, reading and participating in diverse cultural activities; and activities related to social factors, such as volunteering and having a socially active life (Lojo-Seoane et al., 2014, Manly et al., 2003, Mayor et al., 2008, Scarmeas & Stern, 2003, Soto-Añari, Flores-Valdivia, & Fernández-Guinea, 2013).

Social relations rank among the less analyzed cognitive reserve indicators in the available literature. However, given their relevance, they very well may have a preponderant role in the development and maintenance of cognitive reserve throughout life. Some researches explore the association between different facets of social relations, such as their type, diversity, content, the social engagement that characterizes

them, as well as the self-perception of the affective content of these interpersonal relationships (Seeman et al., 2011) and the effects that occur on various cognitive processes and mental health in general. A large body of research has shown the importance of social relations and physical and mental health (Gardner, 2014, Gariépy, Honkaniemi, & Quesnel-Vallée, 2016, Zainab & Naz, 2017, Zuelsdorff et al., 2018).

Different associations have been identified, such as a protective effect against cognitive deterioration, and the optimization of cognitive functions, mainly in older adults (Barnes, Mendes de Leon, Wilson, Bienias, & Evans, 2004, Bassuk, Glass, & Berkman, 1999; Bennett, Schneider, Tang, Arnold, & Wilson, 2006, Berkman, 2000, Fratiglioni, Paillard-Borg, & Winblad, 2004, Krueger & Wilson, 2009, Marioni et al., 2015, Nelson, Noonan, Goldberg, & Buchwald, 2013, Pillemer & Holtzer, 2016, Rodriguez-Laso, Zunzunegui, & Otero, 2007, Saczynski, 2006, Seeman et al., 2011, Seeman, Lusignolo, Albert, & Berkman, 2001, Tun, Miller-Martinez, Lachman, & Seeman, 2013, Wilson et al., 2007, Zhou et al., 2018, Zunzunegui, Alvarado, Del Ser, & Otero, 2003).

A social relation should be understood as a reciprocal engagement based on interactions, providing the basis for specific types of trust between individuals (Grossetti, 2009). The effect that social relations can have on the human brain and also on cognitive functions is undeniable, as human beings are social creatures with special ability for higher order cognitive and communication processes. It has been suggested that these higher order skills may have partly evolved from the need to keep track of social relations, thus guiding complex social behavior (Adolphs, 2003).

Social experiences have an impact on the physiological responses of the brain. It has been suggested that the protective effect on cognitive impairment derived from participating in social activities occurs due to the fact that these activities enable communication and interpersonal interactions, which in turn produce an amount of cognitive stimulation that through daily activities can help in the reduction of cognitive deterioration (Berkman, 2000). It should be noted that the effects of social relations have been found to depend on the nature of these. That is to say, social support would imply benefits, while social conflict and tension with people in social networks would imply negative consequences (Gariépy et al., 2016; Kiecolt-Glaser & Newton, 2001; Liao et al., 2014).

Seeman and his team propose social engagement as a multidimensional construct that refers to the quantitative and qualitative aspects of social interactions (Seeman et al., 2001, 2011, Tun et al., 2013). At the National Survey of Midlife Development in the USA, MIDUS I (1995/1996), and its second iteration, MIDUS II (2005/2006), Seeman and his team assessed three dimensions of social engagement: social contact, social support and social conflict, and how they relate to the executive function. They found that backgrounds with higher frequency of social contacts and supportive interactions were positively associated with executive functions. Conversely, tension or conflict and the decrease in social contacts associated negatively with said functions (Cornwell & Laumann, 2015; Seeman et al., 2011; Segel-Karpas & Lachman, 2016).

It has also been found that perceived social support is a clear indicator of better cognitive functioning (Pillemer & Holtzer, 2016; Seeman et al., 2001), whereas negative social perceptions are associated with low performance in a wide range of cognitive skills, including processing speed and the executive function (Tun et al., 2013). On the other hand, how wide social networks are relates to overall mental health: large networks are linked to higher levels of mental health (Rodriguez-Laso et al., 2007, Umberson & Karas, 2010), reaching so far as to even modify the association between pathology and cognitive functioning (Bennett et al., 2006). Research in the field of gerontology has determined that different configurations of social networks and social support impact on neuropsychological levels. For example, participation in social networks of congregation or diversity has been significantly associated with good mental health and lesser likelihood to suffer from cognitive impairment (Marioni et al., 2015). Similarly, social engagement levels in older adults can predict the risk of developing cognitive impairment and other conditions (Barnes et al., 2004, Bassuk et al., 1999, Holtzman et al., 2004, Krueger & Wilson, 2009; Liao & Scholes, 2017; Wilson et al., 2015; Zunzunegui et al., 2003), and even the risk of suffering from dementia (Bennett, Arnold, Valenzuela, Brayne, & Schneider, 2014; Marioni et al., 2015; Saczynski, 2006; Skakkebæk et al., 2017; Zhou et al., 2018). Seeman and colleagues also inform on the possibility that these associations, either positive or negative, between support or other aspects of social interaction and cognitive skills may also be evident in youth and not only in older adults (Seeman et al., 2011).

It is important to point out that the association between social engagement and better cognitive functioning varies throughout the different domains or subcomponents of social engagement and throughout the different specific cognitive skills (Nelson et al., 2013). Studies that analyze the relationship between social engagement and cognitive skills take into account different functions; for example, memory, reasoning, verbal fluency, vocabulary, spatial visualization and processing speed are positively related to social contact and support (La Fleur & Salthouse, 2017; Seeman et al., 2011); and processing speed relates negatively

to social conflict (Tun et al., 2013). A global index of cognitive functioning that considered memory, attention, language and visuospatial skills showed positive relation to positive social interaction and to perceived emotional support (Pillemer & Holtzer, 2016). Likewise, a global index of cognitive functions that considered episodic memory, semantic memory, perceptual speed and visuospatial ability showed positive relation to the size of social networks (Wilson et al., 2007).

Taking into account how important executive functions are for human beings to accomplish complex goals, particularly when such require a novel approach (Lezak, Howieson, Bigler, & Tranel, 2012), understanding to a greater extent how these functions relate to social engagement, viewed as a measurement of cognitive reserve, is of great value.

The executive function can be defined as a set of skills and abilities involved in generating, planning, controlling, regulating, executing and readjusting those behaviors and cognitive skills needed to achieve complex objectives (Lezak et al., 2012). These functions begin to develop during the first year of life and from there all throughout it. Even in adult life, these functions can still be sharpened and improved by adequate stimulation (Rosselli, Jurado, & Matute, 2008). Flores, Ostrosky and Lozano (2014) include the following, among others, as executive functions: cognitive flexibility, which is the ability to inhibit a wrong cognitive response or strategy, curbing the tendency to use it repetitively, and to generate an appropriate alternative response for the specific task; sequential planning ability, which is the ability to execute a series of steps in an orderly manner, so that together they lead to a specific goal; and verbal fluency, which reflects how efficient the individual is in articulating the greatest possible number of words within a certain time limit, under a specific criterion.

Processing speed and verbal comprehension are two other cognitive skills that have been studied in relation to cognitive reserve, and both can be understood using the field definitions provided by Weschler for the WAIS-IV scale. According to it, the processing speed scale is the measure of the person's ability to explore, sequence and discriminate simple visual information in a quick and correct manner; the verbal comprehension scale is a measure of the concept formation and verbal reasoning processes, as well as of the knowledge acquired from the environment.

Taking into account the background given above, the purpose of this paper was to assess the relationship between social engagement and the executive function (cognitive flexibility, sequential planning and verbal fluency), processing speed and verbal comprehension in young Mexican adults. By extrapolating the findings in the younger population with those in older adults, it was expected that greater social contact and social support would be related to higher scores in the executive function, processing speed and verbal comprehension; conversely, greater social conflict was expected to be associated with lower scores in the executive function, processing speed and verbal comprehension.

Method

A cross-sectional rank correlation study was carried out (Fernández, Hernández & Baptista, 2010). The research protocol was approved by the Ethics Committee (registration number CEI-PSI/006/2016) of the institution where the research was conducted. All participants signed an informed consent form.

Participants

A non-probabilistic convenience sampling was carried out. The sample consisted of 49 public university young students with normal vision and hearing, or corrected to normal levels. Through a structured interview taking some criteria from the frontal damage neuropsychological test included in BANFE-2 (Flores et al., 2014), the exclusion criteria of this study were ruled out from the sample: history of neurological or psychiatric disturbances, neurodevelopmental disorders (intellectual deterioration, learning disorders, attention-deficit/hyperactivity disorder, etc.), physical pathologies (sleep disorders, heart conditions, epilepsy and head trauma) and the use of illegal drugs. Finally, alcohol abuse was ruled out through the Alcohol Use Disorders Identification Test (AUDIT; Cremonte, Ledesma, Cherpitel, & Borges, 2010). No test was applied to rule out any unfavorable emotional condition, other than those already mentioned.

The 32.7% of the participants were women and 67.3% were men, ages between 18 and 27 years old, averaging 20.82 (SD = 2.01).

Instruments

The social engagement questionnaire is an instrument that measures social engagement differentially in the areas of family, friends and couple. With this questionnaire, three measures were obtained: an indicator of social contact that reflects the frequency of interpersonal interactions that the participant keeps with the contact groups; an indicator of social support that reflects harmonious social interactions; and an indicator of social conflict that reflects the interactions of tension and conflict.

For its elaboration, the measurements from MIDUS I (1994/1995) and MIDUS II (2005/2006) were used as

reference. Since it is not validated for Mexican population groups, a pilot application of the instrument was carried out as part of this research in a sample of 27 students with characteristics similar to those of the sample used for this paper: young male and female psychology students of a public university; Cronbach's alpha obtained was .806. In this paper's application, a Cronbach's alpha of .801 was obtained.

Executive functions were assessed with some subtests of the BANFE-2 (Flores et al., 2014). Card Sorting was used to assess cognitive flexibility, Tower of Hanoi to evaluate sequential planning, and verbal fluency was assessed with the Verbal Fluency Task. The BANFE-2 has been validated for its use in Mexican population groups. The reliability reported by the manual for these tests is .80.

The rest of the cognitive skills were assessed with some subtests of the WAIS-IV scale (Whechsler, 2012). The subtests of Symbol Search (reliability of .81, as reported by the test manual) and Coding (reliability of .86, as reported by the test manual) were used to measure processing speed. Finally, the Vocabulary subtest was used (reliability of .92, as reported by the test manual) to measure verbal comprehension. The WAIS-IV has been validated for its use in Mexican population groups.

Procedure

A public call to participate was made in a campus of a Mexican public university. Those interested in participating read and signed the informed consent form. The sessions were individual and were carried out in appropriate spaces for such purpose. Each participant attended a single session. An interview was conducted to verify that those interested in participating matched the inclusion criteria. The social engagement questionnaire was applied by means of an interview. The tests were applied and ranked according to the standardized form given in the manuals. Both the interview and the tests were carried out by trained personnel. Finally, a database was created, in which the answers were coded, and the SPSS software package (SPSS 16.0 for Windows, SPSS Inc., Chicago, IL) was used for all relevant analyses.

Data Analysis

Descriptive statistical analyses were carried out in order to know certain characteristics such as frequencies, percentages, mean, median and standard deviation of the assessed variables, and of the characteristics of the population, such as age and sex. For the purpose of analyzing the relationship between social engagement and some cognitive skills in young people, bivariate correlations were conducted. The Spearman's rank correlation coefficient test was selected after conducting the normality analysis of the variables, since they did not show normal distribution.

Results

This section presents the results obtained from the research, starting with the descriptive statistics results of each assessed variable. First, social engagement (in the dimensions of social contact, social support and social tension or conflict), followed by the executive function (cognitive flexibility, sequential planning ability and verbal fluency), and finally cognitive skills (processing speed and verbal comprehension). After that, results are presented on the degree of association between the three dimensions of social engagement and the executive function, processing speed and verbal comprehension, respectively.

Social engagement

Table 1 shows the descriptive statistics obtained from the social engagement data, taking into account the dimensions of social contact, social support and social conflict, in the categories of family, friends, couple and total. It should be pointed out that when it comes to the social support variable, higher scores implied lower social support; and for the social conflict variable, higher scores implied less conflict, since the format of the original questionnaire was kept as a base for the modified version applied in this study.

Overall, the greatest social contact among participants was noted in the "family" area; however, and as reported,

Table 1.
Social Engagement Descriptive Statistics

Area	Social Contact		Social Support		Social Conflict	
	M (SD)	Mdn	M (SD)	Mdn	M (SD)	Mdn
Family	3.59 (.762)	4.00	6.71 (2.092)	7.00	10.88 (2.360)	11.00
Friends	3.53 (.739)	4.00	6.29 (1.860)	6.00	12.20 (2.041)	12.00
Couple	2.39 (1.891)	4.00	3.63 (3.053)	4.00	7.96 (6.409)	11.00
Total	3.18 (.65)	3.33	5.57 (1.59)	5.33	10.30 (2.53)	10.00

Note. Descriptive statistics of social engagement data in the dimensions social contact, social support and social conflict, under the categories of family, friends, couple and total. In the social support variable, higher scores translate into lesser social support; in the social conflict variable, higher scores translate into less conflict.

this is the area in which the participants express to receive the less social support. The greatest support is received from the "couple" area. As for conflict, the "friends" area is the one showing the less conflict, and the greatest conflict is reported in the "couple" area. It should nonetheless be noted that only 36.73% of participants expressed having a couple, and so the reported results may not be relevant.

Table 1 shows narrower spread of social contact than in the case of social support and social conflict. It was also noted that in the areas of social contact, social support and social conflict, the "couple" category ranked lower; this because out of 48 participants, 18 did not have a formal or informal romantic relationship. Also, the social conflict area showed higher scores in the "friends" category, since higher scores in this area mean lesser social conflict; this shows that in this sample there is less social conflict in friendship relationships, when compared to family and friends relationships.

Cognitive skills results

For the purpose of describing and for comparison with other research, Table 2 shows the means, standard deviations and medians of the measures taken into account in this study. The data presented includes cognitive flexibility, with the Card Sorting test scores; sequential planning, with the Tower of Hanoi test scores; verbal fluency; processing speed with the Symbol Search and Coding subtests scores; and verbal comprehension with the Vocabulary subtest score.

In the case of criteria for perseverative errors card sorting, deferred perseverative errors card sorting, maintenance errors card sorting, Tower of Hanoi moves, Tower of Hanoi error 1, Tower of Hanoi error 2, Tower of Hanoi total errors and verbal fluency intrusions, the standard deviation was greater than the mean. This because of the presence of atypical cases with scores farther from the average, either lower or higher (See Table 2).

Results on the correlations between social engagement and cognitive skills

Table 3 shows the correlations found between the assessed cognitive skills and social contact, social support and social conflict.

Table 2.
Cognitive Skills Descriptive Statistics.

Executive Function: Cognitive Flexibility		
Measure	M (SD)	Mdn
Card Sorting Matches	46.51 (9.16)	49.00
Card Sorting Errors	10.94 (3.96)	10.00
Card Sorting Perseverative Responses	4.67 (5.39)	3.00
Card Sorting Deferred Perseverative Responses	1 (1.36)	.00
Card Sorting Maintenance Errors	0.47 (0.819)	.00
Card Sorting Time	338.18 [a] (112.08 [a])	313.00
Executive Function: Sequential Planning		
Tower of Hanoi Moves	34.22 (50.38)	24.00
Torre de Hanoi Error A	0.51 (1.02)	.00
Torre de Hanoi Error B	0.37 (1.51)	.00
Tower of Hanoi Total Errors	0.88 (1.78)	.00
Tower of Hanoi Time	109 [a] (63.09 [a])	98.00
Executive Function: Verbal Fluency		
Verbal Fluency Matches	20.29 (6.04)	20.00
Verbal Fluency Intrusions	0.08 (0.27)	.00
Verbal Fluency Perseverative Responses	0.63 (0.95)	.00
Processing Speed		
Symbol Search Scalar Score	10.24 (1.877)	10.00
Coding Scalar Score	10.69 (1.960)	10.00
Verbal Comprehension		
Scalar Score Vocabulary	7.41 (1.48)	7.00

Note: [a] measured in seconds, per the manual. Descriptive statistics of cognitive flexibility data (Card Sorting); sequential planning (Tower of Hanoi); verbal fluency (Verbal Fluency Task); processing speed (Symbol Search and Coding); and verbal comprehension (Vocabulary). Corresponding measurements added in matches, different types of errors according to the subtest and execution time in seconds. BANFE-2 subscales show the standardized scores, and WAIS-IV subtests the scalar scores.

Table 3.
Correlations between cognitive skills and social contact, social support and social conflict.

	Social Contact				Social Support				Social Conflict			
Measure	Family	Friends	Couple	Total	Family	Friends	Couple	Total	Family	Friends	Couple	Total
Executive Function: Cognitive Flexibility												
Card Sorting Matches	-.11	.14	.05	.05	.26	.01	-.01	.14	-.03	.04	-.01	.01
Card Sorting Errors	.03	-.1	-.07	-.09	-.25	.01	.02	-.14	.01	-.19	-.03	-.07
Card S. Perseverative Responses	-.09	-.24	.05	-.02	-.16	.02	.09	-.03	-.05	-.04	.09	.04
Card S. Deferred Perseverative Resp.	.19	-.23	.07	.08	-.24	-.03	.03	-.07	.12	.14	.09	.12
Card Sorting Maintenance Errors	.05	-.26	.01	-.01	.02	.11	.26	.2	-.01	-.11	.07	.06
Card S. Total Errors	.08	-.17	-.01	-.03	-.27	-.03	.05	-.13	.03	-.04	.05	.03
Card Sorting Time	-.02	.08	-.03	.01	.07	.13	-.02	.04	-.06	.16	-.11	-.05
Executive Function: Sequential Planning												
Tower of Hanoi Moves	.08	.13	-.03	.08	.04	.11	.04	.09	-.08	.05	.02	-.01
Torre Error 1	.04	-.01	-.16	-.18	-.1	-.01	-.07	-.16	-.08	-.03	-.06	-.14
Torre Error 2	-.01	-.23	-.04	-.14	.24	.37**	-.02	.15	-.2	-.06	-.13	-.17
T. of H. Total Errors	.05	-.05	-.02	-.06	.07	.15	-.04	-.02	-.2	.02	.01	-.09
Tower of Hanoi Time	.12	.2	.01	.14	.02	.09	-.05	.01	-.01	.01	.01	.03
Executive Function: Verbal Fluency												
Verbal Fluency Matches	.06	.14	.05	.18	.03	-.2	.21	.08	-.24	.01	.09	.01
V. Fluency Intrusions	.19	-.29*	.27	.17	.08	.22	.18	.23	-.06	-.06	.13	.16
V. Fluency Pers. Resp.	-.22	-.13	.04	-.03	-.04	.05	.07	.01	-.12	-.14	.08	.02
V. Fluency Total Errors	-.16	-.197	.12	.03	.02	.14	.12	.1	-.17	-.18	.11	.05
Processing Speed												
Symbol Search[a]	-.12	-.04	.11	.05	-.03	-.07	.15	.14	.30*	.2	.18	.31*
Coding[a]	.1	-.12	.04	.05	.16	.12	.13	.17	-.03	-.11	-.08	-.01
Verbal Comprehension												
Vocabulary[a]	-.04	.09	.04	.04	-.02	-.07	-.01	-.03	.03	-.05	-.04	.06

Note. Correlations between social contact, social support and social conflict (in the family, friends, couple and total categories) and the cognitive flexibility (Card Sorting), sequential planning (Tower of Hanoi), verbal fluency (Verbal Fluency Task), processing speed (Symbol Search and Coding), and verbal comprehension (Vocabulary) executive functions. *p < .05; **p < .01; [a] Scalar Score

For social contact, a weak but significant negative correlation (r = -.299, p = .037) was found between social contact in the "friends" area and a measure of verbal fluency: intrusions (speaking a word that does not correspond to the correct category), wherein the greater the social contact in the "friends" area, the lesser the intrusions.

In terms of social support, a weak but significant positive correlation (r = .368, p = .009) was found between social support in the "friends" area and on the sequential planning measures: Tower of Hanoi error B (placing a larger disk on top of a smaller one, contrary to instructions), wherein the greater the social support score in the "friends" area —lesser support relationships— the more type B errors in the Tower of Hanoi.

For social conflict, a weak but significant positive correlation (r = .306, p = .032) was found between the total score (encompassing in a single measure the three contact areas, family, friends and couple) and the Symbol Search subtest, wherein the greater the social conflict score —lesser conflict relationships— the better the execution on the subscale. Finally, a weak but significant positive correlation (r = .302, p = .035) was found between social conflict in the "family" area and the Symbol Search subtest, wherein the lesser the conflict relationships, the better the execution on the subscale.

Discussion

The results hereby presented outline an association between social engagement and some cognitive skill measures in the group of young students that participated; this taking into account social contact, support and conflict, particularly in the areas of friends and family. However, not all the cognitive skill measures assessed display such relationship. The cognitive skill measures that did display a relation to social engagement were only intrusions in verbal fluency, Hanoi Tower error B in sequential planning and the scalar score of the Symbol Search subtest in processing speed. It is also important to note that the correlations observed are in all cases weak.

According to the available literature, it was expected that greater social contact and social support would be correlated to better performance in the assessed cognitive skills. It was indeed found that a higher frequency of social contact in the "friends" area is associated with fewer errors of intrusion in verbal fluency. It is likely that the correlation between verbal fluency and frequency of social contact reflects that constant social contact implies participation in activities that involve the use of communication resources and skills, exercising the communicative capacity in such a way that it becomes more efficient, as hypothesized by Berkman (2000) and McEwen (2007).

It was also found that lesser social support in the "friends" area is associated with more errors in sequential planning. This could be explained under the premise that the cumulative history of an individual and his social interactions, or the lack of them, have consequences on the adaptation of the brain and cognitive systems, which in turn intervene in how an individual perceives, interprets and remembers (Tun et al ., 2013).

Furthermore, it was expected that greater social conflict would be correlated to worse execution in cognitive skills. In this sense, it has been noted that the lower the presence of conflict relationships, the better the execution on the Symbol Search subscale. This could be understood as a possible expression of the favorable effect of the absence of social conflict on processing speed. The results obtained were consistent with the work of Tun and his team (2013), who found an association between the social conflict variables and processing speed, which may indicate that processing speed is particularly vulnerable to the effects of social tension not only in older adults, but also in young people. The results were also partially consistent with the work of Seeman and his colleagues, as both studies agree in highlighting the correlation between social engagement, especially social conflict, and cognition before old age (Seeman et al., 2011).

The evidence of a correlation between social engagement and cognitive skills in young people could be inconclusive. Such results contrast with those reported in older adults, wherein social engagement is a variable that is significantly associated with cognitive performance (Barnes et al., 2004, Bassuk et al., 1999, Holtzman et al. ., 2004, Krueger & Wilson, 2009, Zhou et al., 2018, Zunzunegui et al., 2003). It appears so, that social commitment may not be as relevant to cognitive efficiency in young people, even though there is evidence that less conflictive interpersonal relationships are associated with faster processing speed. Although this research did find an overall weak relationship between social engagement and cognitive skills, this area still requires further research before the possible association of these variables and their expression in youth can be denied.

Next, we present some factors that might have conditioned the results and even influenced that the correlations proposed in the hypotheses were not found:

Regarding research design, no comparisons were made between groups. The possible optimizing effect of social engagement might be evidenced more clearly when comparing large high cognitive reserve groups with large low cognitive reserve ones, or groups of young adults against older adults, confronting them with increased demand

tasks. This type of tasks would have allowed to compare the performance of the participants and appreciate the possible optimizing effect of cognitive reserve (Mayor et al., 2008, Stern, 2009). Also in terms of design: this being a cross-sectional research, it is not possible to corroborate the cumulative effect of cognitive reserve evaluated from social engagement.

As for the limitations of the instruments applied, no test was applied in order to rule out any unfavorable emotional condition, as part of the exclusion criteria. When it comes to the measurements of cognitive skills, raw scores of some of the subtests that make up the BANFE-2 (Flores, Ostrosky, & Lozano, 2014) were used as a reference for the performance of executive functions. However, the BANFE-2 battery does not provide individual indexes or scalar scores for its subtests, only global performance indexes. Nor does it provide more specific information such as reaction times, which are generally more likely to differ between groups.

For the measurement of social engagement, the applied questionnaire assessed only a moment of the participants' life cycle, not their entire history of social interactions; the latter would better reflect the effect of cognitive reserve, since it is cumulative. Only 36.73% of the participants stated having a romantic relationship, and so the reported results for the "couple" area may not be relevant. The limitations of this questionnaire when it comes to the standardization of results and their interpretation should also be considered, since only the instrument was tested through a pilot test. It is also important to remember that social engagement is a multidimensional construct, the way in which it is conceptually defined and then used is directly related to the results obtained.

The sample assessed for this study consisted in a small number of participants and was obtained from a non-probabilistic convenience sampling. All participants had a common minimal academic training to homogenize to a certain extent their performance in the subtests applied, considering that education measured in years of formal education is the variable for which there is the most evidence of its relation to the optimization of cognitive skills (Mayor et al., 2008).

As the sample was entirely composed of university students, the results are not solid enough in terms of representation for them to be generalized to all types of young people independently of their academic training. Finally, it is possible that the effects of cognitive reserve are not visible enough at the stage of development in which the participants were, or at least not in relation to the cognitive skills assessed in this study.

It should be pointed out that in order to arrive at results that can be generalized and contribute to specify which type of stimulus favor the optimization of cognitive skills in young and healthy population groups, future research will need to analyze how social variables, such as the different dimensions of social engagement, relate to different cognitive skills in different contexts, populations and moments of the life cycle. This research is a starting point in which the relevance of the study of these topics in relation to mental health is underlined.

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