Original article

Living with the elderly is related to a better performance in the recognition of facial expressions of emotion among older individuals

Bruna Moretti Luchesi[1,2], Marcos Hortes Nisihara Chagas[3], Allan Gustavo Brigola[1], Ana Carolina Ottaviani[1], Érica Nestor Souza[1], Estefani Serafim Rossetti[1], Mariélli Terassi[1], Nathalia Alves de Oliveira[1], Sofia Cristina Iost Pavarini[1,3]

[1] Graduate Program in Nursing, Federal University of São Carlos (UFSCar), São Carlos, SP, Brazil
[2] Campus de Três Lagoas, Federal University of Mato Grosso do Sul (UFMS), Três Lagoas, MS, Brazil.
[3] Department of Gerontology, Federal University of São Carlos (UFSCar), São Carlos, SP, Brazil.

Institution where the study was conducted: Graduate Program in Nursing, Federal University of São Carlos, Rod Washington Luís, km 235 – 13565-905 – São Carlos, SP, Brazil.

Received: 01/12/2018 – **Accepted:** 07/18/2018
DOI: 10.1590/0101-60830000000164

Abstract

Background: Cohabitation with the elderly may bring benefits to social relationships and exert an influence on the recognition of facial expressions of emotion. **Objective**: Compare emotion recognition skills between a cohabitation group (CHG) of older adults who live with a dependent elderly individual and a non-cohabitation group (NCHG) of older adults who do not live with an elderly individual. **Methods**: Interviews were conducted with 62 older adults in the CHG and 56 in the NCHG. The two groups were similar with regard to gender, age, schooling, degree of dependence, cognitive performance, and depressive symptoms. A dynamic task with six emotions (anger, disgust, happiness, surprise, sadness, and fear) and four levels of intensity was administered to evaluate the recognition of facial emotions. **Results**: The CHG performed better than the NCHG regarding the correct identification of emotions, specifically surprise (60%), disgust (60%, 80%, and 100%), fear (80%), and sadness (80% and 100%). **Discussion:** Cohabitation with an elderly individual seems to offer benefits to older adults in terms of recognizing facial expressions of emotion.

Luchesi BM et al. / Arch Clin Psychiatry. 2018;45(4):82-7

Keywords: Facial recognition, emotions, cognition, aged.

Introduction

There is evidence of the existence of six basic emotions: anger, disgust, happiness, surprise, sadness, and fear. Although other emotions can be recognized, these six emotions have been predominantly used in studies aimed at evaluating the perception of facial expressions[1]. The ability to recognize emotion based on facial expressions can be evaluated using static and dynamic images. Dynamic tests involving images of faces that go from a neutral expression to increasing intensities of a given emotion are closer to real-life interactions, which may enhance the accuracy of perceptions[2,3].

A review of the literature reveals that there is an age-related deficit in recognizing facial expressions of emotion, especially fear, sadness, and anger. Happiness and surprise are also affected, but to a lesser extent. The ageing process also seems to have a positive effect on the recognition of disgust, although this advantage has not been confirmed statistically[4]. Using a dynamic test, one study found that older adults performed poorer than adults with regard to the recognition of anger, fear, happiness, sadness, and total score[5]. Another investigation found that the increase in age was associated with less accuracy regarding fear, anger, and sadness, higher accuracy for disgust, and no difference with regard to happiness or surprise[2].

The perception of emotions is an important aspect of social interactions and interpersonal communication[1,5]. Being able to identify what others are feeling enables one to respond properly, avoid conflicts and regulate emotions. The social-input model suggests that the communication of emotions verbally and through facial and body expressions helps regulate and respond to social interactions[6]. In contrast, deficits in emotion recognition can have a negative impact on social behavior[7].

The social-input model holds that the elderly have a better perspective of their social relationships, since they have a greater ability to solve problems. They can set aside negative aspects in moments of tension and have greater resilience when conflicts arise. These aspects alter the response to various stimuli and affect how emotions are presented and recognized[6]. The emotional experience is a complex blend of thoughts, reflections, behaviors and actions of the elderly and their social network[6]. Therefore, older people cohabitating with other older people are in an environment of better relationships and consequently may have a better emotional experience.

Besides intra-generational cohabitation, the ageing of the population has led to an increase in the number of older adults who play the role of caregiver to other older adults[8]. Considering older couples, it is possible that the one with greater functional capacity takes on the role of caregiver at some point due to the high prevalence of chronic diseases in this age group. The literature shows that elderly caregivers may be more susceptible to the negative impacts of offering care than younger caregivers, especially with regard to psychosocial aspects[9,10]. However, studies indicate that there may be benefits related to the role of caring, such as a higher degree of self-efficacy, enriched everyday life, a better relationship with the care recipient, feelings of accomplishment, the learning of new skills, personal and spiritual growth, and reciprocity[11,12]. In one study, caregivers even reported little or no strain[6]. Moreover, a number of population-based studies found that caregivers had reduced mortality and increased longevity than non-caregivers[13] and that offering support reduced the risk of death in older adults[14].

The recognition of emotions based on facial expressions is essential to those who live with others and is also important to decision making related to the care process. A dependent elderly individual who cannot communicate or use body expressions is limited to using facial expressions to alert the caregiver with regard to a need or potential danger or simply to demonstrate gratitude and affection for the caregiver.

Given the importance of the early identification of deficits in emotion recognition skills, the potential benefits of living with an elderly individual, and the relevance of emotion recognition in the intra-generational context, the aim of the present study was to

Address for correspondence: Bruna Moretti Luchesi, Universidade Federal de Mato Grosso do Sul (UFMS), Campus Três Lagoas. Av. Ranulpho Marques Leal, 3484 – 79613-000 – Três Lagoas, MS, Brazil. Telephone: (+55 67) 3509-3744. Email: bruna_luchesi@yahoo.com.br

compare emotion recognition skills between older adults who live with an elderly individuals and older adults who did not live with an elderly individual.

We hypothesized that the cohabitation group would recognize facial expressions of emotion more accurately than the non-cohabitation group, regardless of the emotion. When an elderly person lives with another elderly person, especially when care is required, the ability to recognize facial expressions of emotion is necessary more often.

It is important to identify groups that are more likely to have exhibit greater accuracy in terms of the recognition of emotions based on facial expressions in order to design interventions aimed at enhancing this ability in more disadvantaged groups.

Methods

Participants

The sample consisted of older adults registered at primary healthcare services in the city of São Carlos, which is located in the southeastern region of Brazil. The city has an estimated population of 243,765 residents (2016 estimate).

Two groups were formed: a cohabitation group (CHG) of older adults who lived with elderly individuals and a non-cohabitation group (NCHG) of older adults who did not live with other elderly individuals. The inclusion criteria for the CHG group were 1) 60 years of age and older, 2) registry at a primary healthcare service in the city, 3) normal or corrected-to-normal vision, 4) living with an elderly individual at home, and 5) being the most independent elderly person living at home. Independence was defined as requiring less assistance on basic or instrumental activities of daily living, which was assessed using the Katz Index[15] and Lawton and Brody's Scale[16], respectively. For the NCHG group, the inclusion criteria were 1) 60 years of age and older, 2) registry at a primary healthcare service in the city, 3) normal or corrected-to-normal vision, 4) not living with other older person (age ≥ 60 years) in the same home, and 5) being as independent as the individuals selected for CHG. The exclusion criteria for both groups were uncorrected self-reported visual deficits or a self-reported neurological disorder. We chose the most independent elderly person in the household considering that elderly people in the NCHG would be comprised of more independent individuals. This was confirmed by the similar scores on the scales of instrumental and basic activities of daily living.

The sample size was calculated based on a pilot study conducted with nine individuals meeting the criteria for the CHG and nine meeting the criteria for the NCHG registered at primary healthcare services. Considering mean and standard deviation values in the pilot sample, a 5% level of significance (alpha = 0.05), and 80% power, a minimum of 102 participants (n = 51 in the CHG and n = 51 in the NCHG) would be representative for comparisons between the two groups. To compensate for a possible 20% dropout rate, a convenience sample of 65 participants was selected for each group. The participants were from different areas of the city. Three were excluded due to visual deficits, two were excluded due to neurological disorders and seven did not complete the task. Thus, final sample consisted of 118 community-dwelling older adults (n = 62 in the CHG and n = 56 in the NCHG). Figure 1 displays the flowchart of the sample selection process.

Data collection

All participants signed a statement of informed consent. This study received approval from the ethics committee of the Federal University of São Carlos, Brazil.

The following data were collected between May 2016 and March 2017:

- Socio-demographic characteristics: gender, age (continuous), marital status (with or without a partner), schooling (continuous), personal income (in Brazilian currency, continuous), and number of residents in the home (continuous).
- Dependence level: the Katz Index[15] was used to evaluate the performance on basic activities of daily living (possible range 0-6, with higher scores indicating greater dependence) and the Lawton and Brody Scale[16] was used to evaluate the degree of dependence with regard to instrumental activities of daily living (possible range 7-21, with higher scores indicating less dependence).
- Cognitive status: Addenbrooke's Cognitive Examination-Revised (ACE-R) was used for the assessment of cognitive status, which addresses five domains – attention & orientation, memory, fluency, language and visuospatial ability. The total score ranges from zero to 100, with higher scores representing better cognitive status (continuous)[17].
- - Depressive symptoms: the 15-item Geriatric Depression Scale (GDS)[18] was administered. The final score ranges from zero to 15, with higher scores indicating more depressive symptoms (continuous).
- Recognition of emotions: the Emotion Recognition Task (ERT) was employed, which is a computer-assisted test with video clips of images that morph from a neutral face to different intensities of a given facial expression. The participant sees four Caucasian young adults (two men and two women) expressing six emotions (anger, disgust, happiness, surprise, sadness, and fear) at four different emotional intensities (0-40%, 0-60%, 0-80%, and 0-100%) and chooses from among the six response options offered. The length of each video depends on the emotional intensity and ranges from approximately 1 second (40%) to 3 seconds (100%). The face remains on the screen until the respondent chooses an answer. The instructions and verbal labels of the six emotions were read to illiterate participants. The participant enunciated the emotion and the examiner clicked on the corresponding response. There was no time limit for responding (the next face only appeared when the previous response was given). The presentation starts with lower intensities and then proceeds to higher intensities. Three practice trials were given to each participant before the test. The ERT was displayed on a 14-inch computer screen. The sum of correct answers determines the final score and ranges from 0 to 96, which corresponds to the number of faces displayed. It is also possible to calculate the score for each emotion (range: 0 to 16) and each level of intensity (range: 0 to 24)[1,5].
- Cohabitation characteristics (only for the CHG): the question focused on who was the other elderly individual at home (spouse or other). We also asked whether the participant cared for the elderly person who lived in the same home and, if so, how many hours were spent per day on care-related activities regarding the other individual.

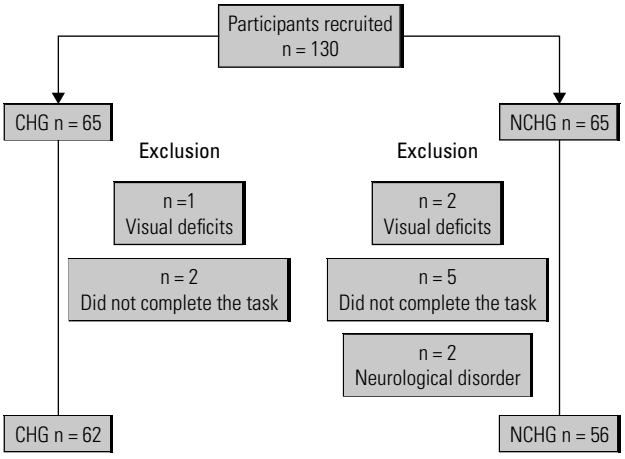

Figure 1. Flowchart of sample selection, São Carlos, Brazil, 2017.

Data analysis

The SAS program (version 9.2 for Windows) was used for the analysis. The data were expressed as absolute frequency, percentage, mean, standard deviation, and median. The chi-square test was used to compare the categorical variables between the two groups and the Mann-Whitney test was used to compare the ranking on numerical variables, which did not exhibit normal distribution. Repeated-measures ANOVA was used to compare the ERT scores between two groups (CHG X NCHG), six emotions (anger x disgust x happiness x sadness x surprise x fear) and four intensities (40% x 60% x 80% x 100%). Tukey's post hoc test was used for comparisons between groups and profile tests by contrasts were used for comparisons within subjects for the six emotions and four intensities. For such, the variables were transformed into ranks due to the non-normal distribution. The significance level was set at 5% ($p \leq 0.05$).

Results

Table 1 shows the characteristics of the participants. The groups were similar regarding gender, age, schooling, degree of dependence, ACE-R and GDS. The CHG had more participants living with a partner, lower personal income and more residents living in the home, which was expected due to the inclusion criteria.

Table 2 displays the mean and standard deviation values of correct responses for each level of intensity and each of the six emotions.

Figure 2 displays the mean scores for each emotion on all levels of intensity.

The mean scores differed significantly between the two groups [$F(1,116) = 16.33$; $p < 0.001$], with the CHG performing better (mean: 52 ± 8.7) than the NCHG (mean: 45 ± 10.3). Tukey's post hoc test showed that groups differed with regard to surprise 60% (CHG: 1.7 ± 1.1; NCHG: 1.1 ± 1.0), disgust 60% (CHG: 2.8 ± 1.2; NCHG: 2.2 ± 1.4), disgust 80% (CHG: 3.2 ± 1.1; NCHG: 2.5 ± 1.4), disgust 100% (CHG: 3.4 ± 0.9; NCHG: 2.9 ± 2.4), fear 80% (CHG: 1.2 ± 1.0; NCHG: 0.7 ± 1.0), sadness 80% (CHG: 1.4 ± 1.1; NCHG: 1.0 ± 1.0), and sadness 100% (CHG: 1.8 ± 1.2; NCHG: 1.0 ± 1.2). No significant differences were found regarding happiness or anger.

However, interactions between group and type of emotion, between group and level of intensity, and among type of emotion, level of intensity and group did not differ significantly. This indicates that although cohabitation led to an improved performance, there were no differential effects across the groups with regard to discerning different types of emotion or levels of intensity.

A significant effect was found for the six emotions [$F(5,580) = 233.87$; $p < 0.001$], with better accuracy regarding happiness (mean: 15.5 ± 2.2) and anger (mean: 11.0 ± 2.8) as well as poorer accuracy regarding sadness (mean: 4.7 ± 3.2) and fear (mean: 3.5 ± 2.8). A significant effect was also found for the levels of intensity [$F(3,348) = 124.65$; $p < 0.001$], indicating that emotions portrayed at 40% intensity were harder to recognize than the other intensity levels.

Table 1. Descriptive characteristics of older caregivers (n = 62) and older non-caregivers (n = 56), São Carlos, Brazil, 2016/2017

	CHG (n = 62)	NCHG (n = 56)	p
Gender (Female)*	91.9%	82.1%	0.11
Age, years (mean ± SD)**	69.7 ± 5.5	70.1 ± 6.7	0.88
Schooling, years (mean ± SD)**	4.1 ± 3.5	3.2 ± 2.7	0.34
Marital status (with partner)*	85.5%	12.5%	**< 0.01**
Personal income[1], R$ (mean ± SD)**	1020.5 ± 897.6	1312.1 ± 671.7	**< 0.01**
Number of residents in home (mean ± SD)**	3.1 ± 1.6	2.4 ± 1.6	**< 0.01**
Katz Index (mean ± SD)**	0.11 ± 0.3	0.16 ± 0.4	0.45
Lawton and Brody's Scale (mean ± SD)**	19.9 ± 1,5	19.2 ± 2.5	0.19
ACE-R**	64.5 ± 15.2	63.1 ± 17.8	0.66
GDS**	3.6 ± 2.6	3.8 ± 2.7	0.88
Care recipient (spouse)	85.5%	-	-
Hours/day in care activities (mean ± SD)	5.8 ± 4.1	-	-

* Chi-square test; ** Mann-Whitney test.

SD: standard deviation; CHG: cohabitation group; NCHG: non-cohabitation group; ACE-R: Addenbrooke's Cognitive Examination-Revised; GDS: Geriatric Depression Scale.

Table 2. Mean and standard deviation values of correct responses for each level of intensity, each of the six emotions, and total score according to group, São Carlos, Brazil, 2016/2017

	CHG (n = 62)		NCHG (n = 56)		p
Level of intensity	Mean	SD	Mean	SD	
40%	9.7	2.9	8.7	2.4	**0.03**
60%	13.2	2.6	11.1	3.2	**< 0.01**
80%	14.4	2.5	12.3	3.3	**< 0.01**
100%	14.7	2.7	12.8	3.6	**< 0.01**
Emotion					
Happiness	13.6	2.1	13.4	2.3	0.91
Surprise	6.6	3.1	5.1	3.1	**0.01**
Disgust	11.0	3.0	9.0	4.4	**0.02**
Fear	4.0	3.0	3.0	2.6	**0.05**
Anger	11.4	2.7	10.5	2.9	0.14
Sadness	5.4	3.2	3.9	3.1	**0.01**
Total	52.0	8.7	45.0	10.3	**< 0.01**

CHG: cohabitation group; NCHG: non-cohabitation group; SD: standard deviation.

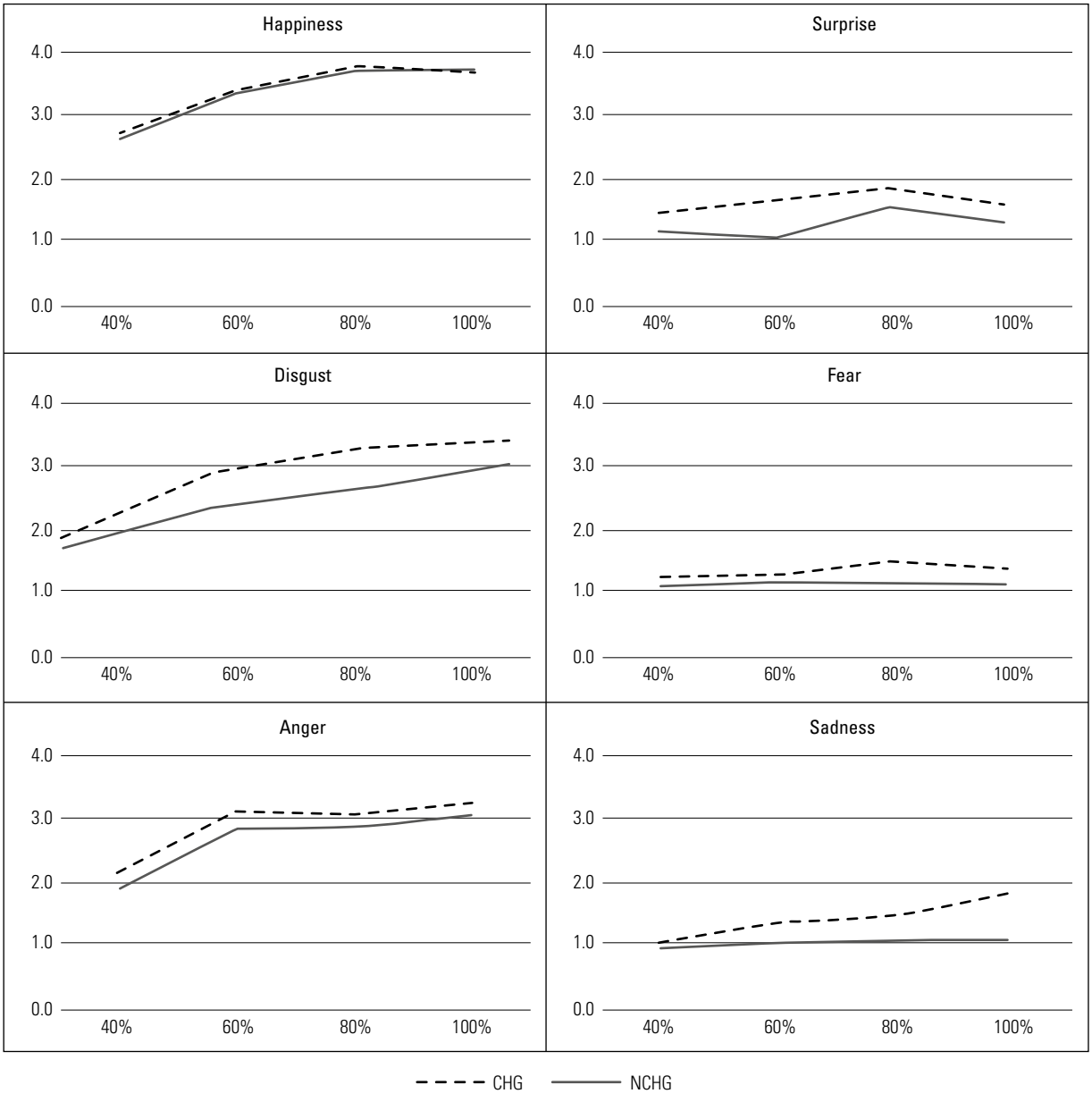

Figure 2. Mean scores according to emotion, level of intensity and group, São Carlos, Brazil, 2016/2017.

A significant interaction was found between the type of emotion and level of intensity [F (15,1740) = 14.75; p < 0.001], as the difference between the levels of intensity depended on the type of emotion and vice versa. For example, for the intensity of 100%, differences were found among fear, happiness, sadness, and surprise, with poorer results regarding the recognition of fear. On this intensity level, no differences were found between fear and anger or fear and disgust. No significant differences among intensity levels were found regarding fear. On the other hand, differences among intensity levels were clear regarding disgust (40% < 60% < 80% < 100%).

Discussion

The purpose of this study was to investigate whether older adults living with a dependent elderly individual (n = 62) differ from older adults not living with an elderly individual (n = 56) on a dynamic emotion recognition task with six emotions and four levels of intensity. The findings demonstrated the following: 1) the CHG performed better than the NCHG regarding the correct identification of emotions (52 ± 8.7 and 45 ± 10.3, respectively); 2) the differences were specifically with regard to surprise (60%), disgust (60%, 80%, and 100%), fear (80%), and sadness (80% and 100%); 3) the two groups performed similarly with regard to recognizing happiness and anger; 4) no significant interaction among group, type of emotion, and intensity was found; 5) happiness was identified the most accurately and fear was identified the least accurately in both groups; 6) emotions expressed at 40% intensity were more difficult to recognize; and 7) a significant interaction was found between type of emotion and level of intensity.

Previous research has shown that the recognition of facial expressions of emotion is more accurate with regard to happiness[5,2,4,19,20]. The emotion least accurately recognized varies among studies, but the most cited are fear[5,2,21], sadness[19,20], and anger[21]. Moreover, investigations have demonstrated that lower levels of intensity are more difficult to identify[2,19,22]. These findings are consistent with the present results. The fact that expressions of lower intensity are more difficult to identify may be the reason why the difference between the groups only appeared for emotions of greater intensity.

The majority of studies evaluating emotion recognition have sought to identify differences in accuracy between adults and elderly groups or across ages[5,2,19,21,22]. The aim of some studies was to identify differences between groups with and without neurological diseases[23,24]. Only older adults were included in the present study and were divided into those who lived with an elderly individual (cohabitation group) and those who did not (non-cohabitation group).

A normative study involving 373 healthy participants aged eight to 75 years used the ERT and found the following mean scores for each emotion in the elderly group (65 to 75 years of age): happiness (13.7), disgust (10.9), anger (9.8), surprise (7.7), sadness (5.3), fear (4.6), and total (51.9)[5]. These scores are similar to the scores achieved in the CHG, but the individuals in the present study had a lower level of schooling and the number of participants was larger.

Studies show that older adults are less accurate with regard to the recognition of some emotions, specifically negative emotions, such as fear, sadness, and anger[2–4,19,25]. In the present study, the CHG was better at recognizing fear and sadness than the NCHG, which may mean that living with an elderly individual at home leads to more opportunities for an older adult to recognize emotions based on facial expressions.

Ageing is often associated with a smaller social network. However, interactions with remaining social partners are rated as more satisfying than in younger adults. This is explained by the optimization of positive relationships, avoidance of potential conflicts, social expertise, and other aspects, such as the contributions of the social partners. Even when negative social exchanges occur, older adults tends to have ways to minimize the consequences of such exchanges[6]. Living with a dependent elderly person is a situation that can cause stress and confrontations with negativity. Therefore, the individuals in the CHG may be required to perceive negative emotions more often than those in the NCHG. Therefore, one possible explanation for the present findings is that cohabitation leads to an increased ability to recognize negative emotions in order to minimize their consequences. Furthermore, a caregiver's sense of self-efficacy contributes to the development of meaning in the experience of care, reinforces the positive aspects of caregiving[11,26], and is associated with enhanced motivation[26]. A previous study found that motivation is an important aspect of the perception of emotions, that is, experimenter-provided motivation was found to eliminate age differences in the recognition of facial expressions of emotion[21].

Disgust is an emotion that is reported to be recognized better with age[2,4] and may be even better recognized by older adults in the role of caregiver, as demonstrated by the present results. Cohabitation and providing care may lead to an improvement in the recognition of this specific emotion. Evidence suggests that older adults who receive care experience feelings of self-disgust, which can be expressed in the face. However, it seems that this feeling diminishes over time and is related to the use of coping strategies and caregiver characteristics[27]. Daily contact can enhance the ability to recognize the facial expression of disgust and then employ strategies to control the situation. This can help older adults, who become more accurate in recognizing this specific emotion, and also the care recipient, who experiences lower levels of self-disgust.

No difference between groups was found regarding anger, which suggests that cohabitation with elderly individuals does not help to recover deficits in the recognition of this emotion. The same occurred for happiness, which was the emotion that both groups correctly identified the most. According to previous studies, the recognition of happiness has a ceiling effect[4,5].

Despite the results, we should highlight the significant correlation found in the overall sample between the performance on the ERT and the number of residents in home as well as the significant difference in the comparison between ERT scores and marital status.

The mean number of residents in the home differed between groups (3.1 in the CHG and 2.4 in the NCHG) and this could be a possible explanation for the differences found. Studies show that deficits in the recognition facial expressions of emotion are associated with social isolation and difficulties in social interactions[6,7]. Therefore, living with more people may have influenced the effect found in the CHG. However, a previous study found that one's social network as well as exercise, smoking, and a healthy diet had no influence on emotion recognition among older adults[28]. It is possible that the number of people in the social network is not the only aspect that matters and that age group and the exchange of support between individuals are equally important. These interactions should be tested in future studies.

Marital status also differed between groups. This may be explained by the inclusion criteria, as most of the individuals in the CHG were the spouses of the elderly individuals living in the same home. This difference should be evaluated in future studies involving married elderly people who live in the same house, but are both independent. While this is a limitation of the present study, we advocate the hypothesis that living, being married, and care may have more benefits in terms of social interactions than what is found in married couples who do not exchange care. The benefits of caring in couples have been studied previously. Researchers have found that providing care to a spouse for 14 hours or more/week was a predictor of reduced mortality for the caregiver[29] and that wives who provided care to a husband with a disability had higher levels of happiness than those who only carried out chores[30].

At the very least, we evaluated two groups that were similar with regard to a range of variables. We may conclude that living with and providing care for an older person can help recover the skill of perceiving emotions that is lost with ageing, specifically with regard to fear, sadness, and surprise, and may also enhance the identification of disgust. These differences can be explained by the opportunities for social interactions that emerge from cohabitation and care activities. Older adults in this situation are in constant contact with another elderly person. The demands of such a relationship require specific skills that may mitigate the decline in identifying emotions and may even improve emotion recognition.

Our results also suggest that it is important to continue to examine the positive influence of cohabitation. The loss or decline in the ability to recognize emotions is associated with greater psychosocial costs to patients, family members, and healthcare teams. The early identification of such deficits is important and can enable the development of proper interventions[7]. Therefore, older people who do not live with an elderly individual should be encouraged to participate in social activities and engage in care activities, such as volunteer work. Furthermore, interventions with elderly populations aimed at training the recognition of emotions are required to enable better functioning in this specific cognitive domain, which is essential to social life.

The present study has limitations that should be addressed. The use of a convenience sample does not enable the generalization of the results, despite the calculation of a representative sample. The cross-sectional design does not allow the establishment of temporal associations among the variables. Moreover, the comparison groups were extreme. Thus, other groups should be investigated, such as older adults who live with an elderly individual, but do not have a dependency relationship and also younger adults who live with and provide care for elderly individuals. Future studies should perform a more in-depth analysis of other aspects of the cohabitation context that can contribute to understanding emotion recognition, such as the number of hours of daily contact, quality of the relationship between the caregiver and elderly care recipient, and the evaluation of other individuals in the home.

The present findings offer new insights regarding the recognition of facial expressions of emotion in older adults who live with other elderly individuals. The cohabitation group demonstrated greater accuracy than the non-cohabitation group, especially with regard to surprise, disgust, fear, and sadness. The data show that the cohabitation can offer benefits to older adults, which may mitigate losses related to the ageing process and enhance social interaction skills.

Acknowledgments

The authors are grateful to the Brazilian fostering agency *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES [Coordination for the Evaluation and Improvement of Higher Education Personnel]) and *Fundação de Amparo à Pesquisa do Estado de São Paulo* (FAPESP [São Paulo Research Foundation] – nº 2017/04129-9) for funding this project.

References

1. Montagne B, Kessels RPC, De Haan EHF, Perrett DI. The emotion recognition task: a paradigm to measure the perception of facial emotional expressions at different intensities. Percept Mot Skills. 2007;104(2):589-98.
2. West JT, Horning SM, Kelli J, Foster SM, Cornwell RE. Experimental Aging Research: An International Journal Devoted to the Scientific Study of the Aging Process Age Effects on Emotion Recognition in Facial Displays: From 20 to 89 Years of Age. Exp Aging Res. 2012;38(2):146-68.
3. Ferreira CD, Torro-Alves N. Reconhecimento de Emoções Faciais no Envelhecimento: Uma Revisão Sistemática. Univ Psychol. 2017;15(5).
4. Ruffman T, Henry JD, Livingstone V, Phillips LH. A meta-analytic review of emotion recognition and aging: implications for neuropsychological models of aging. Neurosci Biobehav Rev. 2008;32(4):863-81.
5. Kessels RPC, Montagne B, Hendriks AW, Perrett DI, De Haan EHF. Assessment of perception of morphed facial expressions using the Emotion Recognition Task: Normative data from healthy participants aged 8-75. J Neuropsychol. 2014;8(1):75-93.
6. Fingerman KL, Charles ST. It Takes Two to Tango: Why Older People Have the Best Relationships. Curr Dir Psychol Sci. 2010;19(3):172-6.
7. McCade D, Savage G, Guastella A, Hickie IB, Lewis SJG, Naismith SL. Emotion recognition in mild cognitive impairment: relationship to psychosocial disability and caregiver burden. J Geriatr Psychiatry Neurol. 2013;26(3):165-73.
8. National Alliance for Caregiving. Caregivers of Older Adults: A Focused Look at Those Caring for Someone Age 50 +. 2015.
9. Jull J. Seniors Caring for Seniors. Can Assoc Occup Ther. 2010.
10. Pinquart M, Sorensen S. Spouses, adult children, and children-in-law as caregivers of older adults: A meta-analytic comparison. Psychol Aging. 2011;26(1):1-14.
11. Carbonneau H, Caron C, Desrosiers J. Development of a conceptual framework of positive aspects of caregiving in dementia. Dementia. 2010;9:327-53.
12. Lloyd J, Patterson T, Muers J. The positive aspects of caregiving in dementia: A critical review of the qualitative literature. Dementia. 2014;1-28.
13. Roth DL, Fredman L, Haley WE. Informal caregiving and its impact on health: A reappraisal from population-based studies. Gerontologist. 2015;55(2):309-19.
14. de Brito TRP1, Nunes DP2, Corona LP3, da Silva Alexandre T4, de Oliveira Duarte YA. Low supply of social support as risk factor for mortality in the older adults. Arch Gerontol Geriatr. 2017;73:77-81.
15. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged. The Index of ADL: A Standardized Measure of Biological and Psychosocial Function. J Am Med Assoc. 1963;185:914-9.
16. Lawton MP, Brody EM. Assessment of Older People: Self-Maintaining and Instrumental Activities of Daily Living. Gerontologist. 1969;9(3):179-86.
17. Carvalho VA, Caramelli P. Brazilian adaptation of the Addenbrooke's Cognitive Examination-Revised (ACE-R). Dement Neuropsychol. 2007;2:212-6.
18. Almeida OP, Almeida SA. Reliability of the Brazilian version of the geriatric depression scale (GDS) short form. Arq Neuropsiquiatr. 1999;57(2 B):421-6.
19. Leime JL, Rique Neto J, Alves SM, Torro-Alves N. Recognition of facial expressions in children, young adults and elderly people. Estud Psicol. 2013;30(2):161-7.
20. Murry MWE, Isaacowitz DM. Age differences in emotion perception: The effects of the social environment. Int J Behav Dev [Internet]. 2016. Available from: http://jbd.sagepub.com/cgi/doi/10.1177/0165025416667493.
21. Stanley JT, Isaacowitz DM. Caring more and knowing more reduces age-related differences in emotion perception. Psychol Aging. 2015;30(2):383-95.
22. Grainger SA, Henry JD, Phillips LH, Vanman EJ, Allen R. Age Deficits in Facial Affect Recognition: The Influence of Dynamic Cues. J Gerontol B Psychol Sci Soc Sci. 2017;72(4):622-32.
23. Spoletini I, Marra C, Di Iulio F, Gianni W, Sancesario G, Giubilei F, et al. Facial emotion recognition deficit in amnestic mild cognitive impairment and Alzheimer disease. Am J Geriatr Psychiatry. 2008;16(5):389-98.
24. Pietschnig J, Aigner-Wober R, Reischenbock N, Kryspin-Exner I, Moser D, Klug S, et al. Facial emotion recognition in patients with subjective cognitive decline and mild cognitive impairment. Int Psychogeriatr. 2015;28(3):477-85.
25. Mienaltowski A, Johnson ER, Wittman R, Wilson A-T, Sturycz C, Norman JF. The visual discrimination of negative facial expressions by younger and older adults. Vision Res. 2013;81(February):12-7.
26. Semiatin AM, O'Connor MK. The relationship between self-efficacy and positive aspects of caregiving in Alzheimer's disease caregivers. Aging Ment Health. 2012;16(6):683-8.
27. Laffan AJ, Millar JFA, Salkovskis PM, Whitby P. Investigating perceptions of disgust in older adult residential home residents. Aging Ment Health 2015;7863(October):1-10.
28. Ruffman T, Zhang J, Taumoepeau M, Skeaff S. Your Way to a Better Theory of Mind: A Healthy Diet Relates to Better Faux Pas Recognition in Older Adults. Exp Aging Res. 2016;42(3):279-88.
29. Brown SL, Smith DM, Schulz R, Kabeto MU, Ubel PA, Poulin M, et al. Caregiving Behavior Is Associated With Decreased Mortality Risk. Psychol Sci. 2009;20(4):488-94.
30. Freedman VA, Cornman J. Is provision of spousal care associated with well-being? New evidence from the Panel Study of Income Dynamics. Journals Gerontol Ser B Psychol Sci Soc Sci. 2014;69:861-9. 0