

The Journal of Latin American

# Geriatric Medicine

Volume 8 – Number 2 – 2022 – Published Quarterly

ISSN: 2462-2958 / eISSN: 2462-4616 – [www.jgeriatricmedicine.com](http://www.jgeriatricmedicine.com)

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Full journal available online at: [www.jgeriatricmedicine.com](http://www.jgeriatricmedicine.com)

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ISSN: 2462-2958  
eISSN: 2462-4616  
Ref.: 7115AX222

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# The social, medical, emotional, and spiritual impact of confinement due to COVID-19 in older people

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## Abstract

**Objective:** The purpose of the study was to determine if confinement for COVID-19 has an impact on social, medical, emotional, and spiritual aspects in older people. **Methods:** A cross-sectional study, from September to October 2020 in Nuevo Leon, Mexico, including a total of 247 older people  $\geq 60$  years old that attend a Geriatric Clinic. Data were recollected by telephone, documenting demographic data, experiences with COVID-19, and telehealth consultation. Participants were classified in confined and non-confined group. **Results:** Of 247 participants, 20.6% were in the non-confined group and 79.4% were in the confined group. The mean age was  $71.9 \pm 8.2$  years. Females (59%,  $p = 0.01$ ) are more confined and those living alone (10.5%,  $p = 0.001$ ) were less confined. Non-confined group consulted in less proportion (80.4%,  $p < 0.001$ ). Confined participants were more satisfied with telehealth consultation (87.2%,  $p < 0.001$ ). In the emotional aspect were no significant differences in depression scores (78.1%,  $p=0.83$ ). Daily non-organizational religious activities (NORAs) were used to cope with confinement (67%,  $p = 0.04$ ). **Conclusions:** In our study, confinement for COVID-19 had its main impact on the medical aspect, while little impact was identified on the social, emotional, and spiritual aspects. **Originality:** This is the first study in Mexico that evaluates various aspects, mainly the spiritual in older people during confinement.

**Keywords:** Older people. Confinement. COVID-19. Telehealth.

## El impacto social, médico, emocional y espiritual del confinamiento debido a COVID-19 en adultos mayores

### Resumen

**Objetivo:** Investigar si el confinamiento por enfermedad por coronavirus 2019 (COVID-19) tiene impacto en los aspectos sociales, médicos, emocionales y espirituales en los adultos mayores. **Métodos:** Estudio transversal, de septiembre a octubre de 2020 en Nuevo León, México, que incluye un total de 247 adultos  $\geq 60$  años que asisten a una clínica geriátrica. Los datos fueron recolectados vía telefónica, documentando datos demográficos, experiencias con COVID-19 y teleconsulta. Los participantes se clasificaron en grupo confinado y no confinado. **Resultados:** De 247 participantes, el 20,6% conformó el grupo no confinado y el 79,4% el grupo confinado. La edad media fue de  $71.9 \pm 8.2$  años. Las mujeres (59%;  $p = 0.01$ ) están más confinadas y las que viven solas (10,5%;  $p = 0.001$ ) están menos confinadas. El grupo no confinado consultó en menor proporción (80.4%;  $p < 0.001$ ). Los confinados se mostraron más satisfechos con la teleconsulta (87.2%;  $p < 0.001$ ). Sin diferencia significativa en los puntajes de depresión. Se utilizaron actividades religiosas no organizacionales diarias (NORA) para enfrentar el confinamiento (67%;  $p = 0.04$ ). **Conclusiones:** En nuestro estudio el confinamiento por COVID-19 tuvo su principal impacto en el aspecto médico y poco impacto en los aspectos social, emocional y espiritual. **Originalidad:** Es el primer estudio en México que evalúa diversos aspectos, principalmente el espiritual, en adultos mayores durante el confinamiento.

**Palabras clave:** Adultos mayores. Confinamiento. COVID-19. Teleconsulta.

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Date of reception: 15-09-2022

Date of acceptance: 02-11-2022

DOI: 10.24875/LAGM.22000007

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## INTRODUCTION

On March 11, 2020, the infection of SARS-CoV-2 was declared a pandemic. With the increasing number of cases, older people were one of the most vulnerable populations<sup>1,2</sup>. Public health policies were implemented to prevent the dissemination of the virus. In Mexico, the National Program of Social Distancing was implemented in March 2020. This program consisted of basic prevention measures (frequent hand washing, greeting from a distance, cough etiquette, and effective recovery), temporary suspension of non-essential activities, the rescheduling of events of mass concentration, and protection and care of older people<sup>3</sup>.

According to the previous publications, confinement has been related to a negative impact on older people, however, there are some difficulties measuring this impact with a unique score. In 2015, Gerst-Emerson reported that socially isolated persons were more likely to seek medical assistance to satisfy their need for interaction and interpersonal stimulation<sup>4</sup>. Sepúlveda-Loyola presented a narrative review of 10 descriptive cross-sectional papers that showed the negative impact of confinement on physical and mental health. They also reported the degree of anxiety, depression, poor quality of sleep, and physical inactivity (2020)<sup>5</sup>. Despite the evidence that there are increased health complications with confinement, some discrepancies have surged. The effects of confinement in these aspects are still uncertain<sup>6</sup>.

The National Program of Social Distancing recognized older people as an at-risk population to cope with mandatory confinement and may be the most vulnerable in social, medical, emotional, and spiritual aspects is relevant to designing therapeutic and rehabilitation interventions to reduce complications.

The objective of this study is to describe differences in social, medical, emotional, and spiritual aspects in older people depending on the mandatory COVID-19 National Confinement in Mexico.

## METHODS

### *Study design*

This cross-sectional study was conducted in a Geriatric Clinic. The study protocol was approved by ethics committee and all procedures were carried out in accordance with the standards laid out in the Declaration of Helsinki. In patients who agreed to participate, verbal informed consent was documented and a telephone survey was applied.

### *Participants*

Inclusion criteria were community-dwelling individuals 60 years or older from a Geriatrics Clinic. Exclusion criteria were participants with dementia, difficulty talking, major psychiatric disease, drug or alcohol abuse, being unable according to the caregiver's opinion to perform the phone interview, and inability to provide verbal informed consent or those who lived in long-term residencies. A total of 539 were screened out of which 247 were recruited from September to October 2020 (Fig. 1).

This survey was applied by the research team members using a semi-structured interview to obtain demographic information and multiple-choice instruments chosen to evaluate the social, medical, emotional, and spiritual impact of confinement on older people. Data were collected in a digital database for statistical analysis.

### *Variables and instruments*

#### *Confinement*

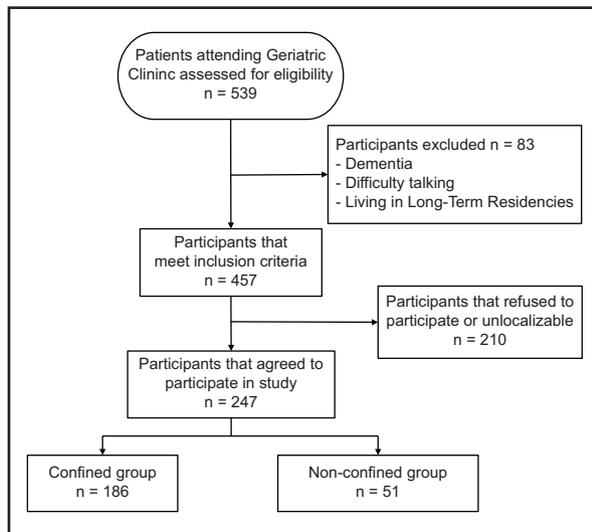
We classified the study participants into two groups depending on their adherence to the instructions that outlined the National Program of Social Distancing in Mexico: the non-confined group included participants involved in normal everyday activities outside the house. The confined group included participants who accomplished complete mandatory COVID-19 National Confinement and those who went outside just for essential activities (to buy food, go to the pharmacy, and have medical appointments).

#### *COVID-19 experiences*

To assess previous experience with COVID-19: including COVID-19 diagnosis, close relatives diagnosed with COVID-19, or deceased because of COVID-19. Fear of contagion and the perception of confinement as an adequate public health policy were inquired about. These last two variables are subjective questions.

#### *Social and emotional impact*

Diaz-Veiga Social Resources Inventory was used to measure social impact. It is a 16-item instrument that inquires about contact frequency, type of social support (economical/instrumental), and degree of satisfaction with spouse, family, and friends<sup>7</sup>. In the CGA, the



**Figure 1.** Participant flow diagram.

emotional aspect includes assessment of depression, anxiety, and apathy. However, we chose to delimitate this variable to depression assessment because is the most frequent of all. The Patient Health Questionnaire-9 (PHQ-9)<sup>8-10</sup> was used to assess the emotional impact focusing on depressive symptoms and severity.

### Medical

The objective of this section was to evaluate the self-report of each participant regarding their physical activity and adherence to their control and medical treatment, this was through the Physical Activity Scale for the Elderly (PASE)<sup>11</sup>, and questions related to their non-communicable diseases and access to their medical services were used to evaluate the medical impact of confinement. Other questions regarding the self-report of medical aspects include changes in body weight, control of non-communicable diseases, number of laboratory studies, and medical consultations, drug use, how they filled their prescriptions, type of medical consult. If participants had telehealth consultations (TCs), a question was designed to measure satisfaction with this consult on a Likert scale. Furthermore, participants were asked if they felt confident about utilizing telehealth.

### Spiritual

The Duke University Religion Index (DUREL)<sup>12,13</sup> and 8 items based on the Spiritual Needs Model<sup>14</sup> were used to assess the spiritual impact. The DUREL items

measure the frequency of organizational religious activity (ORA) and non-organizational religious activity (NORA). ORA involves community activities such as attending religious services (including those on TV) and participating in other group-related religious activities (prayer groups, scripture study groups, etc.). NORA consists of religious activities performed in private such as prayer, meditation, and scripture study. In addition, the research team formulated eight questions to identify met spiritual needs during confinement. These were based on the Spiritual Needs Model.

### Statistical analysis

All data were analyzed using SPSS statistical software (SPSS version 23.0; IBM Corp., Armonk, NY). Descriptive statistics of the quantitative variables were performed with measures of central tendency, with dispersion measures depending on the distribution. Categorical variables were assessed using the Chi-square test, and continuous variables were assessed using Student's t-test or the Mann-Whitney U-test, where appropriate. Data in each aspect were analyzed according to the status of confinement. Logistic regression analysis was performed to determine the impact of confinement in the aspects that resulted with statistical significance between the confined and the non-confined group.  $p < 0.05$  was considered statistically significant.

## RESULTS

### Demographic and fear of contagion by COVID-19

The baseline characteristics are presented in table 1. About 20.6% were classified in the non-confined group and 79.0% in the confined group. The mean age was 71.9 ( $\pm 8.2$  years) and 59.1% were women. We found a higher proportion of women in the confined group (63.3%) compared to the non-confined group (43.1%) ( $p = 0.01$ ). Notably, more subjects in the non-confined group lived alone compared to those in the confined group ( $p = 0.001$ ). Concerning COVID-19 of fear of contagion, 65.2% were afraid of contagion. Of these, 69.4% were in the confined group and 49.0% in the non-confined group, with a significant difference between both groups ( $p = 0.01$ ).

### Social and emotional

Table 2 shows the differences in social and emotional aspects due to the status of confinement for

**Table 1.** Demographic characteristics of the study population

Demographic characteristics	Total (n = 247)	Non-confined group (n = 51)	Confined group (n = 196)	p value
Age – year, mean ± SD	71.9 ± 8.2	70.3 ± 7.9	72.3 ± 8.3	0.11
Female, n (%)	146 (59)	22 (43)	124 (63)	0.01*
Married, n (%)	173 (70)	34 (66.7)	139 (70.9)	0.65
Education level				0.28
None, n (%)	4 (1.6)	1 (2)	3 (1.5)	
Elementary, n (%)	39 (15.8)	8 (15.7)	31 (15.8)	
Secondary, n (%)	24 (9.7)	4 (7.8)	20 (10.2)	
High school, n (%)	77 (31.2)	10 (19.6)	67 (34.2)	
Bachelor degree, n (%)	95 (38.5)	25 (49)	70 (35.7)	
Master's degree, n (%)	8 (3.2)	3 (5.9)	5 (2.6)	
Living arrangements				
Living alone, n (%)	26 (10.5)	12 (23.5)	14 (7.1)	0.001*
Partner, n (%)	105 (42.5)	21 (41.2)	84 (42.9)	0.83
More than 2 relatives, n (%)	116 (47)	18 (35.3)	98 (50)	0.06
Perception of confinement as a public health policy, n (% adequate)	228 (92.3)	45 (88.2)	183 (93.4)	0.46
Knowing someone with COVID-19 diagnosis, n (%)	71 (28.7)	19 (37.3)	52 (26.5)	0.13
Knowing someone with COVID-19-related death, n (%)	30 (12.1)	8 (15.7)	22 (11.2)	0.39
Fear of contagion, n (%)	161 (65.2)	25 (49)	136 (69.4)	0.01*

SD: Standard deviation; \*: p < 0.05.

**Table 2.** Variables to evaluate social and emotional impact

Variables	Total (n = 247) No. (%)	Non- confined group (n = 51) No. (%)	Confined group (n = 196) No. (%)	p value
<b>Social</b>				
With partner, n (%)	175 (70.0)	35 (20.0)	140 (80.0)	0.69
Frequency of contact with partner, n (% at least once a week)	149 (80)	29 (82.9)	120 (85.7)	0.73
Emotional support of partner, n (%)	160 (91.4)	33 (94.3)	127 (90.7)	0.05
Satisfaction of relationship of partner, n (% very satisfied)	169 (96.6)	33 (94.3)	136 (97.1)	0.70
With offspring, n (%)	230 (93.0)	47 (20.0)	183 (80.0)	0.76
Frequency of contact with offspring, n (% at least once a week)	162 (70.4)	33 (70.2)	129 (70.5)	0.88
Emotional support of offspring, n (%)	197 (85.7)	44 (93.6)	153 (83.6)	0.23
Satisfaction of relationship of offspring, n (% very satisfied)	223 (97)	44 (93.6)	179 (97.9)	0.24
With other relatives, n (%)	230 (93.0)	47 (20.0)	183 (80.0)	0.76
Frequency of contact with other relatives, n (% at least once a week)	90 (39)	14 (29.8)	76 (41.5)	0.33
Emotional support of other relatives, n (%)	196 (85.2)	40 (85.1)	156 (85.2)	0.69
Satisfaction of relationship of other relatives, n (% very satisfied)	156 (67.8)	29 (61.7)	127 (69.4)	0.58
With friends, n (%)	158 (64)	30 (19)	128 (81)	0.39
Frequency of contact with friends, n (% at least once a week)	54 (34.2)	13 (43.3)	41 (32)	0.91
Emotional support of friends, n (%)	135 (85.4)	27 (90)	108 (84.4)	0.63
Satisfaction of relationship of friends, n (% very satisfied)	114 (72.2)	23 (76.7)	91 (71.1)	0.97
<b>Emotional</b>				
<sup>a</sup> PHQ-9, n (% minimum depression)	193 (78.1)	41 (80.4)	152 (77.6)	0.83

<sup>a</sup>PHQ-9: Patient Health Questionnaire-9. PHQ-9 Depression severity score: Minimal (1-4), mild (5-9), moderate (10-14), moderately-severe (15-19), and severe (20-27).

**Table 3.** Variables to evaluate medical impact

Variables	Total (n = 247) Mean ± SD or No. (%)	Non-confined group (n = 51) Mean ± SD or No. (%)	Confined group (n = 196) Mean ± SD or No. (%)	p value
<b>Medical</b>				
Maintained weight, n (%)	138 (55.9)	33 (64.7)	105 (53.6)	0.18
Perception of metabolic control, n (% excellent)	247 (100.0)	51 (100.0)	196 (100.0)	1
Less study tests, n (%)	165 (66.8)	39 (76.5)	126 (64.3)	0.26
Less medical visits, n (%)	142 (57.5)	41 (80.4)	101 (51.5)	< 0.001*
Maintained same treatment, n (%)	237 (96.0)	49 (96.0)	188 (95.9)	0.79
Fill-in prescription, n (% non-presential)	134 (54.2)	13 (25.4)	121 (61.5)	< 0.001*
TCa, n (%)	202 (81.8)	31 (60.8)	171 (87.2)	< 0.001*
Type of medical consult, n (% telephone)	184 (74.5)	26 (51.0)	158 (80.6)	< 0.001*
Satisfaction of those who had TC, (n, % very satisfied)	106 (52.5)	8 (25.8)	98 (57.3)	0.01*
<b>PASE<sup>b</sup> women (mean ± SD)</b>				
60-64 years	104.33 ± 45.03	81.64 ± 42.49	108.70 ± 44.96	0.71
65-69 years	96.23 ± 42.35	67.73 ± 65.46	99.79 ± 39.19	
70-75 years	96.17 ± 39.18	88.14 ± 25.28	98.31 ± 42.22	
76-100 years	78.39 ± 42.83	74.40 ± 47.42	78.93 ± 42.74	
<b>PASE men (mean ± SD)</b>				
60-64 years	134.90 ± 62.95	160.75 ± 66.29	110.78 ± 50.53	0.47
65-69 years	105.83 ± 48.58	89.63 ± 84.32	107.86 ± 46.49	
70-75 years	104.30 ± 54.76	114.06 ± 57.71	101.30 ± 55.90	
76-100 years	85.42 ± 68.58	93.99 ± 82.17	82.67 ± 65.10	

<sup>a</sup>TC: Telehealth consultation, <sup>b</sup>PASE: Physical Activity Scale for the Elderly; \*: p < 0.05.

COVID-19 in older people. The degree of satisfaction with their relationship was high with their partner and their offspring; however, we found lower rates with their other relatives and friends. There was no significant difference between groups. A minimal degree of depression was found in 193 participants (78.1%). There was no significant difference between the groups.

## Medical

Table 3 reveals the differences in the medical aspect due to the self-report of the status of confinement. About 55.9% reported no weight changes. The self-report of adequate metabolic control was present in all the participants. About 66.8% of patients decreased the frequency of laboratory tests and 57.5% decreased the frequency of medical visits, and the latter was more frequent in the non-confined group (p < 0.001). About 81% had at least one TC and this was most common in the confined group (p < 0.001). The telephone call was the most frequent type of medical visit (74.5%). A higher degree of satisfaction with TC was prevalent in the confined group (p = 0.01). The satisfaction with TC was

related to the feeling of safety of staying home (97%) and the perception of having the same attention as an in-person consultation (84%). Most participants (54.2%) had someone else to supply their treatment, with this being more common in the confined group (p < 0.001).

## Spiritual

When assessing the spiritual aspect, 85.8% practiced spiritual activities and 92% practiced them to cope with confinement, the latter more frequent in the confined group (p = 0.05). Only 18.9% increased their spiritual activities due to COVID-19. About 84.0% practiced NORA at least once daily, being most frequent in the confined group (p = 0.04). Furthermore, the practice of ORA was most frequent at least once a week (52.9%) and was similar regardless of the level of confinement (Table 4).

## Impact of confinement

Table 5 shows the impact of confinement in the areas where statistically significant differences were identified, mainly in the medical and

**Table 4.** Variables to evaluate spiritual impact

Variables	Total (n = 212) No. (%)	Non-confined group (n = 40) No. (%)	Confined group, (n = 172) No. (%)	p value
Spiritual				
Frequency of spiritual activities, n (% same frequency)	131 (61.8)	21 (52.5)	110 (64.0)	0.20
NORA <sup>a</sup> , n (% daily)	142 (67.0)	27 (67.5)	115 (66.9)	0.04*
ORA <sup>b</sup> , n (% once a week)	109 (51.4)	18 (45.0)	91 (52.9)	0.24
Spiritual activities to cope with confinement, n (%)	195 (92.0)	34 (85.0)	161 (93.6)	0.05
Feeling loved, n (%)	195 (92.0)	34 (85.0)	161 (93.6)	0.05
Feeling listened, n (%)	192 (90.6)	33 (82.5)	159 (92.4)	0.04*
Positive self-image, n (%)	192 (90.6)	33 (82.5)	159 (92.4)	0.04*
Balance in life, n (%)	196 (92.5)	33 (82.5)	163 (94.8)	0.01*

<sup>a</sup>NORA: Non-Organizational Religious Activity, <sup>b</sup>ORA: Organizational Religious Activity; \*: p < 0.05.

**Table 5.** Impact of confinement in medical and spiritual aspects

Variables	OR	IC 95%	p value
Less medical visits	0.26	0.12-0.55	< 0.001*
Non contact supply of prescription	4.72	2.36-9.43	< 0.001*
Telehealth consultation	4.41	2.19-8.90	< 0.001*
Medical consult by telephone	4.00	2.08-7.69	< 0.001*
Very satisfied with TC <sup>a</sup>	3.86	1.63-9.12	0.002*
Increased spiritual activities to cope with confinement	2.58	0.89-7.47	0.08
Increased spiritual activities to feel loved	2.58	0.89-7.47	0.08
Increased spiritual activities to feel listened	2.59	0.97-6.99	0.06
Increased spiritual activities to have a positive self-image	2.59	0.97-6.99	0.06
Increased spiritual activities to have a balance in life	3.84	1.34-11.05	0.01

<sup>a</sup>TC: Telehealth consultation; \*: p < 0.05.

spiritual aspects. In the medical aspect, confinement was associated with a decrease in medical visits (OR = 0.26, 95% CI = 0.12-0.55, p < 0.001) as well as an increase in non contact supply of prescription (OR = 4.72, 95% CI = 2.36-9.43, p < 0.001), telehealth consultation (OR = 4.41, 95% CI = 2.19-8.90, p < 0.001), including those by telephone (OR = 4.00, 95% CI = 2.08-7.69, p < 0.001), with a feeling of satisfaction with TC (OR = 3.86, 95% CI = 1.63-9.12, p = 0.002). On the other hand, confined only reached statistical significance in the option to have a balance in life with the increment of spiritual activities (OR = 3.84, CI 95% = 1.34-11.05, p = 0.01). No logistic regression analysis to determine OR was performed in the social or emotional aspects since no significant differences were found between the aspects

evaluated when comparing patients with and without confinement.

## DISCUSSION

In the present study, we described the impact of the status of confinement due to COVID-19 on social, medical, emotional, and spiritual aspects in older people. This is the first study designed to assess these four aspects during the COVID-19 pandemic in Mexico. Our results are consistent with the previous studies in which gender was an important predictor of the level of fear of COVID-19, indicating a greater psychological vulnerability in women (2020)<sup>15</sup>. We found that sex, living arrangements, and fear of contagion impacted the status of confinement. Furthermore, the

proportion of participants living alone was greater in the non-confined group.

Several studies showed that during the COVID-19 pandemic, there were unhealthy eating behaviors, weight variability, and inadequate metabolic control<sup>16,17</sup>. Both groups had lower PASE scores than the ones reported in the literature, even though a significant difference between groups was not found. Despite these results, the majority of our participants reported no weight changes according to their self-report (only 16.6% increased weight), and all of them reported the perception of adequate metabolic control. This explores how participants perceive their health in spite of fewer consultations and fewer study tests. This explores how participants perceive their health in spite of fewer consultations and fewer study tests and it is observed that the majority of patients decreased the frequency of medical visits, and this was more common in the non-confined group.

During the COVID-19 pandemic, TC became an essential need for the isolated population<sup>18-21</sup>. In our study, confined participants reported more consultations and a higher degree of satisfaction in their TC compared with non-confined patients. We found that non-confined participants chose to fill their prescriptions in person. In this way, confinement allowed older people to learn new methods to attend their consultations and to remain autonomous and independent in this process.

In the emotional aspect, although several studies have described mental health deterioration with depression and anxiety during the COVID-19 pandemic<sup>10,22</sup>, our studied population did not show a significant difference in depression scores. These results were similar to the study by Losada-Baltar et al. where an inverse association was found between chronological age and loneliness and distress<sup>23</sup>. Moreover, their self-report of emotional support was high and they were satisfied with their relationships, regardless of the level of confinement. These factors could demonstrate why our population had less depression than other populations, even with confinement.

Several studies have found an association between religious and spiritual beliefs during the COVID-19 pandemic and better health outcomes. This may explain the higher levels of hopefulness and lower levels of fear<sup>24,25</sup>. Lucchetti et al. found that most participants (73.4%) reported that religiousness and spirituality helped them cope with social isolation and that 33.8% believed that social isolation improved their religious activities (2020). Our results were similar to the previous studies, where most participants used

daily NORA to cope with confinement. The Spiritual Needs Model includes the need for life balance and the need to maintain identity. These needs were significantly satisfied with spiritual activities in the confined group. In this way, our population practiced more spiritual activities to fulfill these needs despite the National Program of Social Distancing<sup>13</sup>.

Finally, the limitations of our study are that clinical scales used were screening tools. This could be an unintentional bias of diagnosis. Furthermore, all data were recorded by self-reporting and we did not register biochemical variables; thus, information related to metabolic control cannot be confirmed. Our strengths are that we conducted a descriptive cross-sectional study that assessed many variables of a CGA. Another strength is that we excluded patients with cognitive impairment because they cannot self-report and to study a more homogeneous group.

## CONCLUSIONS

Our study showed how community-dwelling older people adapted to new health-care access, remained resilient, autonomous, and independent, and fulfilled spiritual needs in spite of confinement. Further research is planned to assess other consequences of the National Program of Social Distancing as a public health policy, including those with cognitive decline, caregivers, centenarians, and hospitalized patients. In our study, confinement for COVID-19 had its main impact on the medical aspect by increasing the number of remote consultations, medical prescription by third parties, with an increased degree of satisfaction with the use of TC, while little impact was identified on the social, emotional, and spiritual aspects.

## ACKNOWLEDGMENTS

The authors acknowledge to Dr. Paulina Asiain-Loya, Dr. Arturo López-Andrade, Dr. Melissa Burnes-Lucio, Dr. Hazel Badillo-Rodríguez, and Dr. Sergio Lozano.

## FUNDING

This research has not received any specific grant from public, commercial, or non-profit sector agencies.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

## ETHICAL DISCLOSURES

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** Right to privacy and informed consent. The authors have obtained approval from the ethics committee for analysis and publication of routinely acquired clinical data and informed consent was not required for this retrospective observational study.

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## Body composition and nutritional status in older patients with mild cognitive impairment

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### Abstract

**Objectives:** The objectives of the study were to assess the body composition, functionality, and dietary intake of older people with mild cognitive impairment (MCI). **Methods:** Outpatients older than 65 years, without previous diagnoses of dementia, with cognitive impairment, were included in the study. We performed anthropometric measurements, electrical bioimpedance analysis, and grip strength, and assessed dietary intake. **Results:** Thirty-three patients were evaluated; those with normal cognition presented better body composition and grip strength. Dietary intake was similar in both groups; we identified a slightly increased dietary intake in the group with MCI and determined that for each increase in the body mass index (BMI), the possibility of presenting MCI was 2.58 times higher ( $p < 0.05$ ). While a trend to protect, it was observed for each increase in one unit in handgrip strength ( $p = 0.087$ ). Both groups presented loss of muscle tissue, with MCI patients showing a relatively higher loss. **Conclusions:** Those with an MCI have a higher adipose tissue and a higher dietary intake of energy. An increased BMI was associated with the possibility of presenting MCI, while a greater hand grip strength tends to protect it.

**Keywords:** Geriatric nutrition. Body composition. Mild cognitive impairment. Older adults. Nutritional assessment.

### Composición corporal y estado nutricional en personas mayores con deterioro cognitivo leve

#### Resumen

**Objetivos:** Evaluar la composición corporal, funcionalidad e ingestión dietética de personas mayores con deterioro cognitivo leve (DCL). **Material y métodos:** Se incluyeron pacientes ambulatorios mayores de 65 años, sin diagnósticos previos de demencia, con deterioro cognitivo. Se realizaron mediciones antropométricas, análisis de bioimpedancia eléctrica, fuerza de prensión de mano e ingestión dietética. **Resultados:** Treinta y tres pacientes fueron evaluados, aquellos con cognición normal presentaron mejores parámetros de composición corporal y fuerza de prensión de mano. Se identificó una ingestión ligeramente incrementada en el grupo con DCL. Se determinó que por cada incremento en el índice de masa corporal (IMC) la posibilidad de presentar DCL fue de 2,58 veces ( $p < 0,05$ ), mientras que se observó una tendencia a la protección de este por cada incremento en una unidad en la fuerza de prensión de mano ( $p = 0,087$ ). Ambos grupos presentaron pérdida de masa muscular, siendo los pacientes con DCL quienes presentaron mayor pérdida. **Conclusiones:** Los pacientes con DCL tienen una mayor reserva de tejido adiposo y una mayor ingestión dietética de energía. Un IMC incrementado se asoció con la posibilidad de presentar DCL, mientras que una mayor fuerza de prensión de mano tiene una tendencia a la protección para este.

**Palabras clave:** Nutrición geriátrica. Composición corporal. Deterioro cognitivo leve. Envejecimiento. Evaluación nutricional.

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Date of reception: 08-10-2022

Date of acceptance: 17-11-2022

DOI: 10.24875/LAGM.22000009

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## INTRODUCTION

Cognitive impairment attributed to cardiovascular diseases has been called vascular cognitive impairment, which is related to cortical and subcortical infarcts and small vessel diseases, including ischemic and hemorrhagic brain lesions<sup>1,2</sup>. The development of some chronic diseases that present cardiovascular and cognitive risk factors (e.g., hypertension, diabetes mellitus, and dyslipidemia) are associated to modifiable risk factors, among which eating habits stand out<sup>3</sup>.

Healthy lifestyle choices based on eating patterns, specific foods, and dietary supplements may be effective in preventing cognitive decline<sup>4</sup>. Evidence reported that certain eating patterns (Mediterranean Diet, Dietary Approaches to Stop Hypertension [DASH], Mediterranean-DASH Diet Intervention for Neurodegenerative Delay [MIND]) reduce the possibility of mild cognitive impairment (MCI)<sup>5,6</sup>, as they are rich in vitamins (A, B6, B12, C, etc.)<sup>7</sup>, antioxidants, minerals, and polyunsaturated fatty acids (PUFA's)<sup>8,9</sup>, which have protective effects on cognitive function<sup>10,11</sup> thereby reducing the processes of methylation reactions in the central nervous system, among others<sup>7,12</sup>.

Poor dietary intake is related to the risk of having a suboptimal nutritional status and the presence of dietary deficiencies; therefore, the balance between the intake of macro<sup>13</sup> and micronutrients can help maintain neuronal integrity and optimal cognitive function in the elderly<sup>14,15</sup>.

Regarding body reserves in this population, it has been reported that poor nutrition is related to decreased cognitive function, increased body mass index (BMI), waist circumference, and adiposity. Furthermore, nutritional deficiencies have been associated with an increased risk of Alzheimer's disease (AD) and vascular dementia<sup>16,17</sup>. In addition, it has been proposed that the increase in adipose tissue may be associated with greater oxidative stress, low-grade systemic inflammation, and neuroinflammation, which are also related to frailty observed in older populations<sup>13,18</sup>.

Malnutrition and unintentional weight loss are common clinical elements in patients with dementia, which can occur in the preclinical stages of the disease that remain for a long time and can aggravate the prognosis of these patients<sup>19</sup>. Some studies showed that a decrease in body reserves of fat-free mass in older women and men was associated with

the presence of MCI at 1.49 and 1.96 times, respectively. Similar results were observed with appendicular muscle mass and muscle mass of the lower limbs<sup>20</sup>. At the same time, after bioimpedance analysis vectorial analysis (BIVA), authors identified that patients with MCI have a lower reserve of muscle and adipose tissue compared to healthy controls<sup>21</sup>.

Until now, the relationship between dietary intake, body components, and functionality in people with cognitive impairment in a Mexican population has not been evaluated, so our objective was to explore body composition, functionality, and dietary intake in ambulatory patients with MCI.

## METHODS

This study is part of a cohort study of cognitive impairment in older people with frailty syndrome in 2014, approved by our institution's ethics and research committees. For this study, the type of sampling was non-probabilistic.

We included people over 65 years or older who attended the geriatric outpatient clinic without previous diagnoses of dementia according to the DSM-IV-TR; those who have obtained a score of  $\leq 0.5$  in the clinical dementia rating and those who gave their written informed consent to participate in the study.

On the other hand, patients with a diagnosis of rapidly progressive dementia, AD, or another type of dementia, Parkinson's disease, cerebral vascular disease, amputations, untreated depression, delirium, Vitamin B12, and folic acid deficiency, poorly substituted hypothyroidism, severe heart failure, recent head trauma, alcoholism, acquired immunodeficiency syndrome, or cancer without treatment, were excluded from the study, in addition to those without a caregiver or informant family member, or who for some reason could not undergo brain magnetic resonance imaging or any neuropsychological tests.

### **Cognitive and functional assessment**

All participants underwent a standardized assessment to detect geriatric syndromes, medical history, drug review, and a complete physical and neurological examination.

A geriatrician applied a neuropsychological battery with instruments validated in the Mexican population; those with a score of 18-23 on the Minimum Mental State Examination (MMSE) tool<sup>22</sup> and 24-26 of the Montreal cognitive assessment (MoCA), as well as

a score < 15 on the Frontal Battery Assessment (FAB)<sup>23</sup>, were used to corroborate low performance in screening tests. They underwent a brief neuropsychological evaluation in Spanish<sup>24</sup> applied by neuropsychologists who classified as MCI those with SD: -1--1.5 for age and schooling in any cognitive domain. Those with no memory complaints and adequate cognitive performance (SD: 0) were included in the normal cognition (NC) group; Petersen's criteria were used for the clinical diagnosis<sup>25,26</sup>. In addition, the semantic (animals) and phonological (letter F) verbal fluency tests were administered and scored with Ostroski normative tables, and the clock drawing test was achieved with the Dubois method.

Within the functionality tests, we evaluated dependency for basic activities of daily living through the Katz index (entirely dependent: 0; independent: 6); the Lawton index for instrumented activities of daily living (0-8)<sup>27,28</sup>; the Rosow-Breslau scale that contains three items to assess mobility.

### **Anthropometric and body composition assessment**

A previously trained nutritionist evaluated the patients to perform anthropometric measurements of weight (SECA 308), height (SECA 214), and waist and calf circumference (SECA 203), subsequently the BMI was calculated considering Quetelet's equation. All measurements were measured in duplicates, and the average of these was estimated for reporting.

For the evaluation of body composition, an electrical bioimpedance analysis (BIA) was performed (Bodystat Quadscan 400), obtaining resistance (R/H), reactance (Xc/H) standardized by height, and phase angle (°AF). This measurement and its vector analysis BIVA were performed as per the manufacturer's instructions and by authors who have used this technique in the Mexican population<sup>29</sup>.

### **Functionality and physical performance assessment**

Physical functionality and performance were assessed by handgrip strength, gait speed test, and the stand-up-and-go test (TUG); these measurements are widely recommended in older populations<sup>30</sup>. For its measurement, the patients were asked to remain standing with the dominant hand, holding the dynamometer, and performing a single intense pressure; this measurement was made in triplicates, reporting

the average of these measures in kilograms. A Takei® dynamometer (SMEDLEY III T-18A, Japan) was used for this test. The gait speed test and TUG were performed by a standardized physician who timed the measurements in duplicate, reporting the average in seconds.

### **Dietary record**

All patients responded, along with a previously trained nutritionist, to a 24-h recall. The patients reported a full day's intake, using food replicates, and household measures (cups, spoons, etc.) during the recall to standardize reported measurements. If a patient had difficulties making the report, the primary caregiver could complete the remainder. A nutritionist analyzed this record with the SCVAN 2006 program developed in our institution; it contains standardized home measures and equivalents from the Mexican System of Equivalent Foods (Sistema Mexicano de Alimentos Equivalentes, SMAE)<sup>31</sup>, displaying the consumption of macro and micronutrients in each reminder.

### **Statistical analysis**

We evaluated the data distribution through skewness and kurtosis, the description of the data was expressed with means and standard deviations (SD) or medians with interquartile ranges according to their distribution. Categorical variables were described as frequencies and percentages.

For the description and analysis of the population, we categorized into two groups according to the cognitive diagnosis (NC and MCI). The comparison between groups was made with the Student's t-test or Mann-Whitney U test according to the distribution, while the comparison of the categorical variables was performed with  $\chi^2$  or Fisher's exact tests. For the BIVA comparison analysis, the Hotelling T<sup>2</sup> test was used with the BIVA confidence program.

Spearman correlations and subsequent logistic regression models were performed to assess the association of MCI with anthropometric parameters such as BMI and dynamometry (stratified according to the cutoff points established in the EWGSOP<sup>230</sup>: men > 26 kg, women > 16 kg), in addition to energy, protein, and carbohydrate intake parameters. We used STATA V.14.1 software to identify statistically significant differences, and a value of  $p < 0.05$  was considered.

<b>Variables</b>	<b>All (n = 33)</b>	<b>NC (n = 16)</b>	<b>MCI (n = 17)</b>	<b>p<sup>‡</sup> value</b>
Age (years)	74.4 ± 6.6	73.1 ± 6.4	75.7 ± 6.7	0.276
Sex (n, %; female)	25 (75.8)	11 (33.3)	14 (42.4)	0.225
Marital status (n, %)				0.093
Married	17 (51.5)	6 (18.8)	11 (34.4)	
Divorced	3 (9.4)	3 (9.4)	0 (0)	
Singleness	2 (6.1)	2 (6.3)	0 (0)	
Widowhood	10 (30.3)	5 (15.6)	5 (15.6)	
Scholarship (years)	10.9 ± 6.5	11.1 ± 5.0	10.9 ± 7.7	<b>0.002</b>
Comorbidities (n, %)				0.122
Diabetes mellitus	5 (41.7)	5 (41.7)	7 (58.3)	
Cardiovascular diseases	16 (48.5)	7 (21.2)	9 (27.3)	
Others	21 (63.6)	10 (30.3)	11 (33.3)	
Smoking (n, %)	15 (45)	9 (28.1)	6 (18.8)	0.288
Alcoholism (n, %)	16 (48.5)	9 (27.3)	7 (21.2)	0.387
Cognitive and functional GDS	2 (1-4)	1 (0-2)	2 (1-4)	<b>0.005</b>
Katz index	5.7 ± 0.9	5.8 ± 0.4	5.7 ± 0.6	0.674
Lawton scale	7.3 ± 0.32	7.9 ± 0.7	6.7 ± 0.5	0.057
Rosow-Breslow scale	2.5 ± 0.1	2.4 ± 0.1	2.5 ± 0.3	0.874
Nagi scale	4.6 ± 0.1	4.9 ± 0.1	4.4 ± 0.2	0.062
Clock drawing	1.2 ± 0.2	0.6 ± 0.1	1.7 ± 0.4	<b>0.018</b>
MMSE	28 (26-30)	28 (27-30)	29 (24-29)	0.478
MoCA	24.4 ± 3.6	25.28 ± 2.05	23.2 ± 5.11	0.139
FAB	13.3 ± 0.9	13 ± 0.1	13.3 ± 1.0	0.255
Semantic fluency (total)	18.5 ± 4.3	18.5 ± 4.4	18.6 ± 4.4	0.948
Standard deviation	0.06 ± 1.2	0.2 ± 0.5	-0.05 ± 1.6	
Phonological fluency (total)	11.37 ± 3.7	12.6 ± 3.2	10.4 ± 3.9	0.087
Standard deviation	0 ± 0.7	0.1 ± 0.6	-0.1 ± 0.8	
Number of medications	4.4 ± 1.9	3.6 ± 1.8	5.2 ± 1.8	<b>0.045</b>

NC: normal cognition; MCI: mild cognitive impairment; GDS: geriatric depression scale; MMSE: mini-mental state examination; MoCA: montreal cognitive assessment; FAB: frontal assessment battery. ‡: Student's-t; Mann-Whitney U; Fisher's exact test. Numbers in bold are values of p < 0.05.

## RESULTS

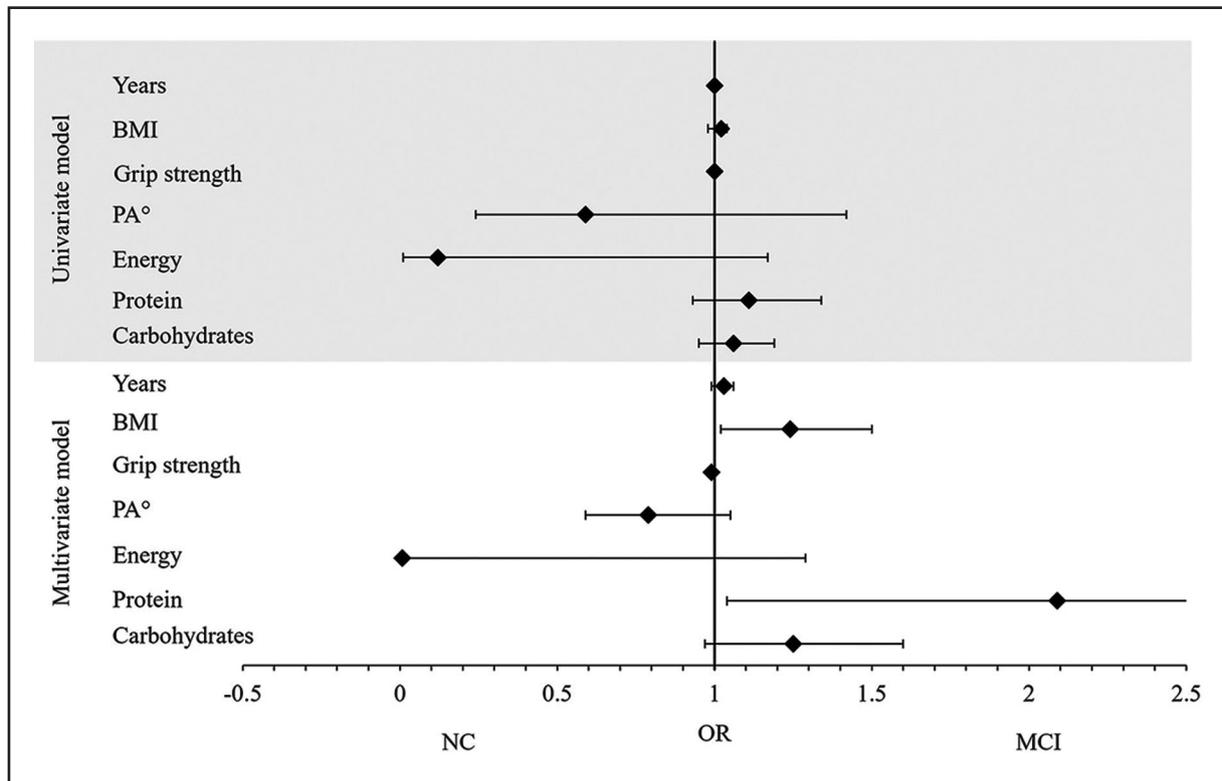
For this study, the results of 33 patients were reported who had complete dietary and anthropometric information. When exploring the general characteristics of the patients, we identified no significant differences in variables such as age and gender between the groups were observed. Participants with MCI had less years of education, a higher frequency of diabetes and other cardiovascular diseases, and a greater number of drugs.

Regarding the cognitive tests, we observed a poorer performance in the MCI group, in MoCA test (25.2 vs. 23.2, p = 0.139), phonological verbal fluency (SD: 0 vs. SD: -1.0, p = 0.08), and drawing of the clock (0.6 vs.

1.7, p < 0.01). Both groups preserved the functionality of the primary activities. However, in the MCI group, dependence was observed for instrumented activities measured by Lawton (7.9 vs. 6.7, p = 0.057) and worse performance in Nagi (4.9 vs. 4.4, p = 0.06), see table 1.

### **Relationship of MCI with anthropometric and functional parameters**

Participants with MCI had higher weight, BMI, and waist circumference, while the NC group had higher handgrip strength and were slightly faster on the TUG test. These patients also obtained a better body composition parameter evaluated by BIA; when assessing



**Figure 1.** Association of MCI and nutritional parameters.

the BIVA, we observed that patients with MCI tend to display decreased muscle mass and adipose tissue, and some patients were even found to have cachexia. However, compared to the group with normal cognition, these results did not present significant differences ( $T^2 = 0.9$ ;  $p = 0.638$ ), see figure 1.

### Relationship of MCI and dietary parameters

Patients in the MCI group had a higher intake of energy (kcal), protein, carbohydrates, lipids, and sodium, with no differences in the NC group. The intake of retinol ( $p \leq 0.05$ ) and vitamin C ( $p = 0.051$ ) was higher in the group of patients with NC, see table 2.

### Association of MCI with anthropometric, functional, and dietary parameters

We performed correlations to identify the direction of the anthropometric, body composition, functionality, and dietary variables on the MCI and observed that all the variables presented weak correlations with MCI.

Subsequently, we included different variables considering the biological plausibility of MCI in the

multivariate analysis (forwards;  $R^2 = 0.48$ ), where it was possible to identify that the increase in one unit of BMI was significantly associated with the possibility of presenting MCI at 2.58 times ( $p \leq 0.05$ ), while age and protein intake showed increasing trend to the presence of MCI, whereas the increase in one unit in hand grip strength presented a trend to protection against MCI ( $p \geq 0.05$ ), see figure 2.

## DISCUSSION

It has been described that lifestyle changes protect from progressive cognitive deterioration; within these, healthy changes in dietary intake are of great importance<sup>7</sup>. Anthropometric and age-related changes in body composition have been recognized as factors associated with decreased physical function, disability, and mortality<sup>32,33</sup>.

### Anthropometry

Some studies have reported body composition characteristics in people with dementia, AD, and MCI. Either through the BMI<sup>17</sup> or more specific methods such as bioelectrical impedance<sup>20,21</sup>. An association between low weight and low BMI with MCI has been

**Table 2.** Anthropometric and dietary characteristics

Variables	All (n = 33)	NC (n = 16)	MCI (n = 17)	p <sup>‡</sup> value
Weight (kg)	65.6 (59.5-70.6)	62.2 (57.0-68.3)	68.3 (63.3-73.0)	0.105
BMI (kg/m <sup>2</sup> )	27.4 ± 4.1	26.5 ± 4.0	28.2 ± 4.1	0.234
Waist circumference (cm)	91.5 ± 10.8	89.9 ± 13.8	92.9 ± 7.0	0.436
Calf circumference (cm)	34.0 ± 2.5	33.3 ± 2.7	34.6 ± 2.3	0.139
R/H (Ω)	350.2 ± 45.8	352.6 ± 48.4	347.8 ± 44.6	0.769
Xc/H (Ω)	31.2 (27.6-38.6)	30.7 (28.8-36.9)	31.5 (25.8-38.6)	0.880
PA°	5.1 (4.5-5.6)	5.4 (4.7-5.8)	4.9 (4.3-5.5)	0.104
Grip strength average (kg)	21.1 (19.0-24.6)	21.1 (19-24.6)	20.7 (18.5-24.3)	0.705
Gait speed (seg.)	5.2 (4.3-5.8)	5.2 (5.0-5.5)	4.9 (4.2-5.9)	0.907
TUG (seg.)	11.5 (10.5-14.3)	10.8 (10.5-11.8)	13.8 (10.8-15.1)	0.071
Energy (total kcal)	1657.7 ± 656.4	1588.4 ± 634.5	1722.8 ± 689.1	0.565
Protein (g)	70.1 ± 27.5	64.1 ± 20.6	75.8 ± 32.3	0.229
Carbohydrates (g)	254.0 ± 109.1	237.3 ± 94.2	269.6 ± 122.3	0.403
Lipids (g)	33.3 (25.6-53.9)	32.8 (24.2-55.6)	39.5 (26.1-53.2)	0.971
Cholesterol (mg)	229.6 ± 164.6	251.2 ± 166.9	209.2 ± 164.9	0.472
Saturated FA (g)	14.7 ± 8.3	13.1 ± 7.8	15.9 ± 8.7	0.349
Polyunsaturated FA (g)	5.7 (3.9-8.4)	5.5 (4.1-9.2)	6.1 (3.9-7.4)	0.828
Fiber (g)	12.1 (10.0-17.4)	12.9 (9.3-17.3)	11.7 (10.7-20.8)	0.471
Calcium (mg)	991.1 ± 497.6	874.5 ± 499.7	1100.9 ± 484.4	0.191
Sodium (mg)	449.9 (249.3-1076.5)	382.1 (187.6-967.3)	491.8 (353.8-1344.6)	0.471
Retinol (µg ER)	704.0 (447.1-1012.7)	959.6 (564.2-1173.7)	516.5 (386.8-804.3)	<b>0.010</b>
Vitamin C (mg)	71.4 (41.7-141.4)	101.7 (58.0-158.3)	52.1 (36.8-81.9)	0.051
Pyridoxine (mg)	0.8 (0.6-1.1)	0.8 (0.5-0.9)	0.9 (0.6-1.6)	0.985
Folic acid (µg EF)	102.4 (77.6-267.4)	87.4 (44.1-107.5)	237.1 (92.0-464.4)	0.121
Cobalamin (µg)	1.18 (0.84-2.28)	1.09 (0.85-2.33)	1.32 (0.68-2.28)	0.985

NC: normal cognition; MCI: mild cognitive impairment; BMI: body mass index; R/H: Resistance normalized by height; Xc/H: reactance normalized by height; PA: phase angle; TUG: time up and go; FA: fatty acids; µg ER: µg retinol equivalents; µg EF: µg dietary folate equivalent  
<sup>‡</sup>: Student's-t; Mann-Whitney U; Fisher's exact test; Numbers in bold are values of p < 0.05.

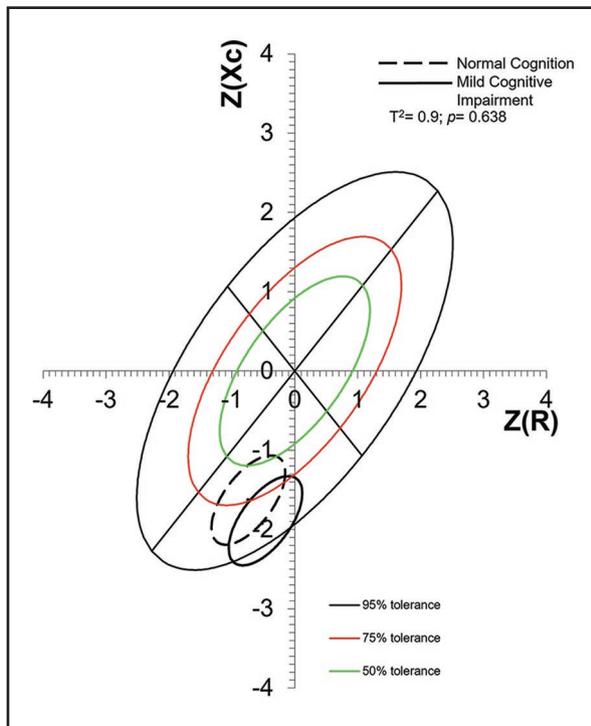
identified, suggesting that low BMI is a potential risk factor for cognitive impairment<sup>34</sup>. In contrast, low body weight increases the risk of incidence of dementia and AD, suggesting that either of these parameters may be risk factors or an early sign of dementia<sup>35</sup>.

In our study, we observed that the group with MCI presented a higher adipose reserve evaluated with weight, BMI, and waist circumference (p ≥ 0.05). These results are like those reported in 2017, where MCI, AD, and healthy controls were assessed and found that male patients with MCI presented a higher waist circumference (p ≤ 0.05). In contrast, decreased scores in the Mini Nutritional Assessment (MNA) were observed in both groups with cognitive alterations compared

to healthy controls (p ≤ 0.001), denoting a worse nutritional status<sup>36</sup>. In this study, it was not possible to obtain the results of the MNA, limiting the identification of potential nutritional risks in our population.

### Body composition

Few studies have reported differences in body composition in older patients with cognitive impairment, mainly indicating a substantial decrease in muscle tissue, as observed in the case of a study that evaluated changes in body composition analyzed with IBA and BIVA in hospitalized male patients with dementia, compared with a group of apparently



**Figure 2.** Electrical bioimpedance vectors of MCI and NC groups. Solid line reports patients with MCI, while the dotted line reports those with NC.

healthy patients. We observed that those patients with dementia presented diminished values of  $Xc/H$  parameters ( $p \leq 0.001$ ) and in the  $AF^\circ$  ( $p \leq 0.01$ ), denoting a decrease in the reserve of the adipose tissue and the cellular integrity, corroborated by the reduction in fat mass (kg) ( $p \leq 0.001$ ), and in fat-free mass (kg)<sup>21,37,38</sup>. Similarly, an author described that muscle mass is significantly decreased in patients with MCI, evidenced by the parameters of fat-free mass, appendicular muscle mass, and muscle mass in the upper and lower limbs ( $p \leq 0.05$ ) in a group of patients with MCI<sup>20</sup>.

In our study, both groups presented similar results to what has already been described; patients with MCI presented lower  $R/H$  and  $AF^\circ$ , indicating a decrease in muscle and cellular reserves, and the graph indicating the presence of cachexia, while the control group's slightly increased  $Xc/H$  denoting a greater accumulation in adipose tissue. However, these results were not statistically significant, possibly due to the small sample size.

## Diet

Older people have a higher nutritional risk due to the decrease in the intake of macro and micronutrients, which have significant effect on cognition. It has been reported that folate deficiency increases with

age and is closely related to the decrease in vitamin B12 concentrations. Both deficiencies have been associated with the presence of MCI, identifying its low serum concentrations or decreased dietary intake is related to low scores in memory and abstract thinking tests<sup>12</sup>. Although we did not identify significant differences in the proportion of macro and micronutrients, we can observe that the clinical differences in dietary intake are contrary to what various authors have previously reported in this population.

The cross-sectional nature of the study, the sample size, the dietary analysis techniques, and the lack of reporting of screening and nutritional status are some of the limitations of this study. However, it is relevant to point out that this study is one of the first to describe anthropometric characteristics, body composition, functionality, and dietary quality in a Mexican population with MCI.

## CONCLUSIONS

The patients with cognitive impairment present alterations in body composition, mainly in parameters that assess muscle mass reserves such as resistance and phase angle. Further investigations with prolonged observation times are necessary to investigate the possible causal elements in the nutrition deficiencies of health deterioration.

## ACKNOWLEDGMENTS

The authors thank to Drs. Angeles Espinosa-Cuevas and Ailema González-Ortiz for their support in training in the use of electrical bioimpedance equipment and their analysis.

## FUNDING

This research has not received any specific grant from public, commercial, or non-profit sector agencies.

## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

## ETHICAL DISCLOSURES

**Protection of people and animals:** The authors declare that no experiments were performed on humans or animals for this research.

**Data confidentiality:** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent:** The authors have obtained approval from the Ethics Committee for analysis and publication of routinely acquired clinical data and informed consent was not required for this retrospective observational study.

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## Neutrophils/Lymphocytes and MPV/PC index assessed in stroke during elderly, is there a difference?

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### Abstract

**Introduction:** In stroke the inflammatory response depends on the neutrophils and leukocytes, reason why the neutrophil/lymphocyte (N/L) and mean platelet volume/platelet count (MPV/PC) indexes are considered to assess stroke. **Aim:** We aim to determine which index, N/L index or mean platelet volume/platelet count, is better to assess stroke in elderly. **Methods:** We retrospectively review files of patients over 65 years old with the previous stroke during the period of 2019-2022, including 180 patients (72 males 69-78 years and 108 females 67-84 years). All patients had brain imaging, initial and follow-up hematic cytometry to determine indexes and compare it between them. **Results:** Most patients had  $N/L < 3$  ( $p = 0.045$ ) and  $MPV/PC > 0.031$  ( $p = 0.0021$ ) during the first 48 h. The receiver operating characteristic showed area under the curve (AUC) values of  $MPV/PC = 0.872$  (0.816-0.929) ( $p = 0.001$ ) and  $N/L = 0.647$  (0.564-0.730) ( $p = 0.001$ ) with a significant difference between AUC values ( $p = 0.001$ ). **Conclusions:** Mortality rises in 76-80 years group; males had a higher mortality in ischemic events compared to females. The MPV/PC is better to predict severe events and long hospital stay, which could be used as a prognosis during the first 48 h of hospitalization.

**Keywords:** Mean platelet volume. Neutrophils/lymphocytes. Stroke. Mortality.

### Índice de neutrófilos/linfocitos y MPV/PC evaluados en EVC en geriátricos, ¿hay alguna diferencia?

### Resumen

**Introducción:** En los eventos vasculares cerebrales (EVC) la respuesta inflamatoria depende de los neutrófilos y leucocitos, por lo que se consideran los índices neutrófilo/linfocito (N/L) y volumen plaquetario medio/recuento plaquetario (MPV/PC) para valorar el EVC. **Objetivo:** Nuestro objetivo es determinar si el índice N/L o el MPV/PC son mejores para evaluar el EVC en pacientes adultos mayores. **Métodos:** Revisamos retrospectivamente los archivos de pacientes mayores de 65 años con EVC previo durante el periodo de 2019 a 2022, incluyendo a 180 pacientes (72 hombres de 69 a 78 años y 108 mujeres de 67 a 84 años). A todos los pacientes se les realizó tomografía computarizada cerebral, biometría hemática inicial y de seguimiento para determinar los índices y compararlos entre ellos. **Resultados:** La mayoría de los pacientes tuvieron  $N/L < 3$  ( $p = 0.045$ ) y  $MPV/PC > 0,031$  ( $p = 0.0021$ ) durante las primeras 48 horas. La curva receiver operating characteristic (ROC) mostró valores de AUC de  $MPV/PC = 0,872$  (0,816-0,929;  $p = 0,001$ ) y  $N/L 0,647$  (0,564-0,730;  $p = 0.001$ ), con una diferencia significativa entre los valores de AUC ( $p = 0.001$ ). **Conclusiones:** La mortalidad aumenta en el grupo de pacientes de 76 a 80 años; el sexo masculino tuvo una mayor mortalidad en eventos isquémicos en comparación con el sexo femenino. El índice MPV/PC fue mejor predictor de eventos graves, así como de larga estancia hospitalaria, lo que podría considerarse como pronóstico durante las primeras 48 horas del evento y la hospitalización.

**Palabras clave:** Volumen plaquetario medio. Neutrófilos/linfocitos. EVC. Mortalidad.

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Date of reception: 01-08-2022  
Date of acceptance: 28-11-2022  
DOI: 10.24875/LAGM.22000006

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## INTRODUCTION

In Mexico, stroke is the main neurologic disorders related to disability because of neuron death, the principal is ischemic stroke in 85% and hemorrhagic stroke in 15%; however, elderly patients are often excluded from big clinical trials, this is a problem, because there are some conditions as medical comorbidities, changes in medication distribution and clearance, sarcopenia, immunosenescence, frailty which impact in the response to acute and chronic stroke therapies, as well as stroke recovery<sup>1</sup>. Hypertension is the main condition related to stroke; however, during elderly some factors as diabetes and atrial fibrillation which are highly prevalent in stroke patients<sup>2</sup>.

In elderly, the acute stroke can often lead suddenly to physical disability, loss of consciousness, or cognitive disorder, the prevalence of frailty is high, and a major problem in super-aged societies and is considered as a major risk factor for disability and death<sup>3</sup>.

The chronic inflammation led to higher platelet levels and lower lymphocytes levels, increasing the risk of stroke events, but, during elderly, the immune response is reduced, as well as platelet function. This is important, because, there are some indicators proposed to evaluate this process, as mean platelet volume/platelet count (MPV/PC)<sup>4</sup>.

In general population, the MPV/PC index is a better indicator of inflammation and platelet activation compared to MPV or PC alone<sup>5</sup>.

A higher platelet size increases the cardiovascular risk, while neutrophil/lymphocyte (N/L) and platelet/lymphocyte (P/L) express systemic inflammation, this last it is important during stroke, because inflammation predisposes stroke and repeated events; however, inflammation is reduced during elderly<sup>6</sup>. On the other hand, low platelets levels are related to thrombosis events, increasing cardiac events and mortality<sup>7</sup>. The platelet size is directly related to cardiovascular events, increasing the cardiovascular risk in patients with large platelets<sup>6</sup>.

There are some studies which mention the use of these indexes in stroke, and the increase in MPV and neutrophils/lymphocytes/platelets predicts severity of stroke and TIA at admission and after 3 months<sup>8</sup>.

The high platelet levels are increased in stroke, increasing cardiovascular risk and mortality<sup>9</sup>. Some

authors use the MPV as an indicator of platelets activation<sup>10</sup>. This expresses inflammation, which in stroke, produces brain damage and microvascular dysfunction; all these conditions provide a high mortality and a worst prognosis<sup>11</sup>.

## METHODS

We made a retrospective review during the period from 2019 to 2022, we include patients over 65 years old, including ischemic and hemorrhagic stroke, with the previous brain tomography or brain magnetic resonance during the first 48 h of the event establishing diagnosis, with clearly evidence of stroke; the use of this study aimed to differentiate the ischemic from hemorrhagic stroke and intracerebral hemorrhages; to exclude other causes of stroke such as tumors or another structural lesions; to determine the occluded artery in stroke also with at most 48 h previous hematic cytometry. Ischemic events, MPV/PC and N/L were considered in the final analysis. We collect laboratory parameters from all hematic cytometry of WBC, MPV, neutrophils, lymphocytes, platelets; demographic parameters, sex, age; and stroke events, type of stroke, hospital stay days, hospital stay until discharge, and cause of discharge (die or alive), considering all mortality causes as sepsis, pneumonia, acute respiratory syndrome, heart failure, and complications of previous chronic diseases. The N/L index normal (0.78-3.53) was divided into three three groups, low risk < 1.5, intermediate risk 1-5-3, and high risk > 3. The MPV/PC index (< 0.031) was considered normal. Kaplan–Meier survival statistics and the log-rank test were used to compare stroke events according to sex, and sub divided into groups of age (65-70, 75-80, 81-85, 86-90, and >90 years). A plot for comparison of ROC curves among MPV/PC and N/L index was done. All the tests were two-sided and  $p < 0.05$  was considered significant. All analyses were done using SPSS 22.0 (SPSS, Inc.).

## RESULTS

We collected 180 patients including 72 males ( $69 \pm 78$  years) and 108 females ( $67 \pm 84$  years); with 85 hemorrhagic cases, and 95 ischemic cases. Most of patients had previous chronic disease as hypertension and diabetes, which may contribute to stroke, hospital complications and long hospital stay, these diseases were prevalent in all groups of patients according to age (Table 1). Mortality was

**Table 1.** Main demographic features of population studied classified into groups according to age

Features	Groups according to age					
	65-70 years	70-75 years	75-80 years	80-85 years	85-90 years	90-95 years
Females	12	23	14	31	24	16
Males	12	15	12	8	9	4
Hypertension	17	29	13	19	25	14
History of smoking	6	7	5	7	7	7
Chronic kidney disease	1	8	4	3	6	3
Diabetes	19	21	11	21	23	11
Atrial fibrillation	4	3	2	4	6	1
MPV/PC index < 0.031	7	7	12	15	11	5
MPV/PC index > 0.031	17	31	14	24	22	15
High N/L index	19	26	16	28	23	13
Moderate/low N/L index	5	12	10	11	10	7

MPV/PC: mean platelet volume/platelet count; N/L: neutrophil/lymphocyte.

higher in 76-80 and > 90 years old groups during the 5 days of hospitalization, according to our subgroup analysis shown in a Kaplan–Meier plot (Fig. 1).

The N/L index lower than 3 ( $p = 0.045$ ) had a 70.3% of sensitivity and 81.4% of specificity, with a PPV of 61% and NPV of 91%; and MPV/PC index higher than 0.031 ( $p = 0.0021$ ) with a 75.3% of sensitivity and 87.6% of specificity, with a PPV of 74% and NPV of 94%. These indexes rise during the first 48 h from the event, increasing hospital stay days.

Considering ischemic and hemorrhagic strokes, we found that 68 patients died (59.6%) because of a hemorrhagic event, and 46 (40.3%) because ischemic event, this mainly related to complications of long hospital stay. Most of the patients died because of hemorrhagic stroke, however, this event contributed to a high mortality in general. Both indexes had a good specificity to predict mortality and long stay days in ischemic events, the ROC curve (Fig. 2) analysis showed that areas under the curve (AUC) values were MPV/PC = 0.872 (0.816-0.929) ( $p = 0.001$ ) and N/L = 0.647 (0.564-0.730) ( $p = 0.001$ ) with a significant difference between AUC values ( $p = 0.001$ ).

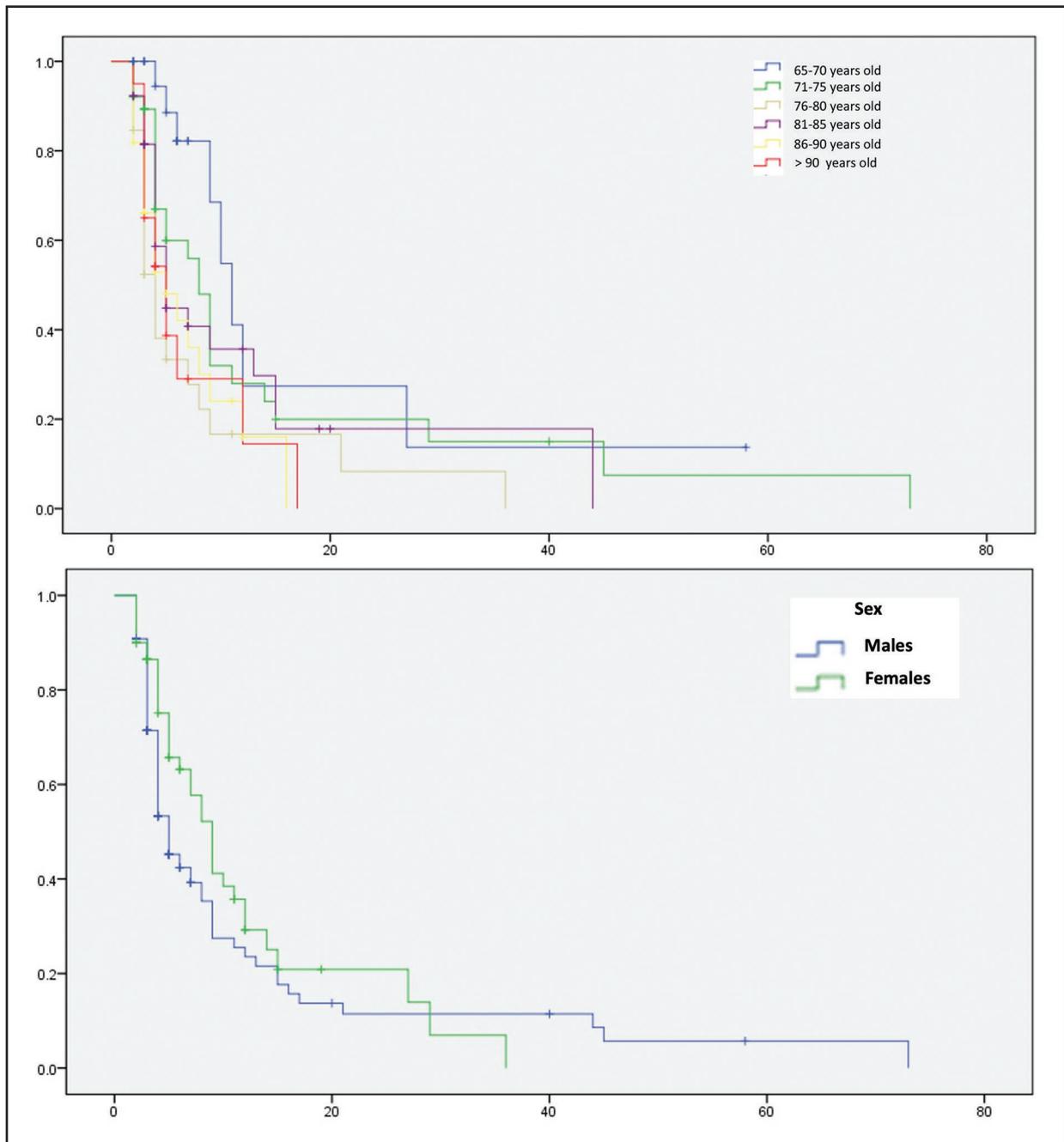
## DISCUSSION

Stroke is the main neurological disease which leads to a disability, however, when this happens

during elderly, the impact of disability is even higher. Despite inflammation, platelets play an important role in stroke events, specially the MPV, which could be used as an inflammatory marker in stroke<sup>12</sup>. Nonetheless inflammation is reduced during elderly, as well as platelet function<sup>13</sup>, and theoretically the N/L and MPV/PC indexes must be reduced, however, both indexes are related to ischemic stroke events.

Elderly with stroke events showed a reduction in the N/L index, and a rise in the MPV/PC index during the first 48 h of stroke; this is useful to distinguish between systemic inflammation and local thrombosis. According to our results, these indexes are relevant in long hospital stay, and mortality in ischemic stroke, however, this is not useful in hemorrhagic events. Even the mortality rises in 76-80 and > 90 years groups, all groups tend to increase mortality, especially during the 5 days after stroke.

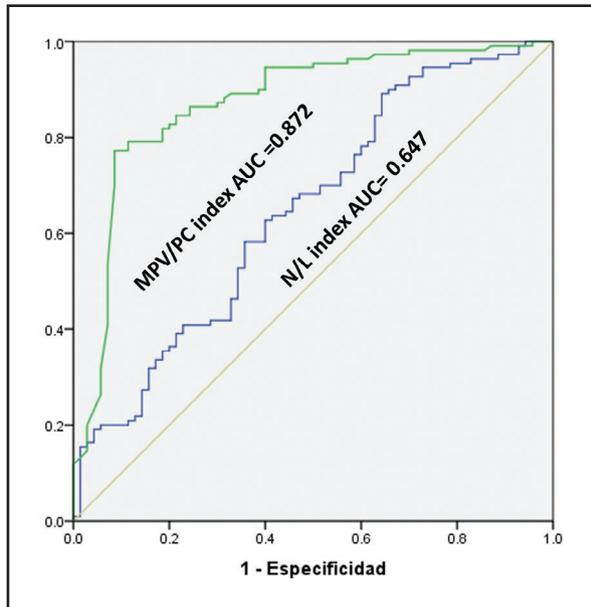
Although stroke events conditioned long hospital stay, these indexes are related to a longer hospital stay as well as increase in mortality. Both indexes are helpful and accessible in stroke during elderly, providing prognosis in this population. More studies are needed in the future, controlling some factors as follow-up, and including a complete assessment of stroke, with Holter, cardiac ultrasound, computed tomography or brain magnetic resonance as follow up, and clinical variables,



**Figure 1.** Kaplan–Meier plots which shows **A:** mortality according to group of age, with a significant increase of mortality during aging; there is an increase in mortality in people over 75-years-old, with slightly reduction in people with 74 years old and below. **B:** mortality according to sex, with an increase of mortality in males during the first days of event, and long hospital stay, on the other hand, females showed a reduction in mortality as well as reduction in hospital stay, with a better prognosis compared to males.

as NIHSS evaluation at first hour from event, and 48 h post event. Our study has several limitations, most of people assessed integrate geriatric syndromes that were not considered in the prognosis

of the disease. The use of scales as NIHSS during the first evaluations was not taken into consideration because only a few of patients were correctly evaluated during the event.



**Figure 2.** Receiver operating characteristic curve which shows the area under curve of mean platelet volume/platelet count (MPV/PC) index and neutrophil/lymphocyte (N/L) index, showing a better sensitivity of MPV/PC index for stroke events, compared to N/L index, which showed worst sensitivity to stroke events. The use of MPV/PC index is better to predict stroke outcomes and complications as mortality.

## ACKNOWLEDGMENT

We appreciate and recognize all the effort that doctors have made and we appreciate the sacrifices they have made during the COVID 19 pandemic.

## FUNDING

This research has not received any specific grant from public, commercial, or non-profit sector agencies.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

## ETHICAL DISCLOSURES

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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## Challenges of aging in Costa Rica

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### Abstract

**Objective:** The purpose of this paper is to describe the different challenges faced by the older population in Costa Rica after the SARS-CoV-2 pandemic, which are similar in most Latin American countries. It discusses the different levels of care, in particular, the "Progressive Care Network for Older Adults," known as the Care Network. **Methods:** Twenty-two challenges for the care of the elderly were analyzed, related to several aspects of the demographic and epidemiological reality, as well as the comprehensive care. **Results:** As a result of the current pandemic, there is a decrease in the life expectancy at birth in Latin America Central America. The analysis of the demographic and epidemiologic situation of the elderly in Costa Rica, as well as the care programs and health services enable to identify the main challenges this country must face to recover from the pandemic years and improve the health and the quality of life of the elderly in the future. **Conclusions:** There is an increase in the morbidity and mortality of the elderly; and, despite the relative well-developed institutional framework of attention, these changes have put pressure on the health and care services, affecting older adults, especially 80 years and over.

**Keywords:** Aging. Demographics. Epidemiology. Care network. Costa Rica.

### Desafíos del envejecimiento en Costa Rica

#### Resumen

**Objetivo:** Describir los desafíos que enfrenta la población adulta mayor en Costa Rica después de la pandemia por COVID-19 que son similares en la mayoría de los países latinoamericanos. Describe los diferentes niveles de atención Texto insertado en el país, particularmente la «Red de Atención Progresiva para el Cuido Integral de las Personas Adultas Mayores», conocido como Red de Cuido. **Métodos:** Se analizaron 22 relacionados con la realidad demográfica y epidemiológica, así como la atención integral. **Resultados:** Producto de la pandemia, se experimenta una disminución de la esperanza de vida al nacer en Latinoamérica y Centroamérica. El análisis de la situación demográfica y epidemiológica, así como de los programas de salud y cuidados, permitió identificar los desafíos que este país debe enfrentar para recuperarse de los efectos de la pandemia y mejorar la salud y la calidad de vida de las personas mayores. **Conclusiones:** Se ha producido un aumento de morbilidad y mortalidad de los adultos mayores en Costa Rica y, a pesar de disponer de un marco de atención relativamente bien desarrollado, esto ha presionado a los servicios de salud en el país, afectando a los adultos mayores, especialmente de 80 años y más.

**Palabras clave:** Envejecimiento. Demografía. Epidemiología. Red de Cuido. Costa Rica.

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Date of reception: 04-10-2022

Date of acceptance: 18-11-2022

DOI: 10.24875/LAGM.22000008

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## **COSTA RICA. A COUNTRY ON WAY TO AGING**

Costa Rica is a country located in Central America of 51.179 square kilometers. As of 2022, the total population is estimated at 5.213.362 persons, of which 9.6% represent the elderly, a difference of 3.5% over what was registered in 1973. This marks a major change in the population pyramid of the country as shown in figure 1. In Costa Rica, according to the article two of the Integral Law for the Elderly, “a person is considered a senior citizen being 65 years...”<sup>1</sup>.

According to the National Institute of Statistics and Census (INEC), “this population structure implies that Costa Rica is in the ‘demographic bonus’ which means a significant increase of the active aging population with regard to the economic dependent population”<sup>2</sup>. However, this “demographic bonus” is ending, and the country has entered a process of demographic change that implies the proportional growth of the aged groups of population. A demographic aspect that reflects the aging process of Costa Rican society is the decrease of births and global fertility rates, as well as an increase in the general mortality rate. According to statistics from 2000 to 2020, the gross birth rate passed from 20.19 to 11.38/1000 citizens, while the global fertility rate decreased from 2.42 to 1.41/1000 citizens and the general mortality rate increased from 3.86 to 5.13 deaths/1000 citizens<sup>3</sup>.

The demographic aging process is a world trend, the United Nations Organization has projected that 16% of the world population in 2050 will be 65 years old or older; in 2019, this proportion represented 9%<sup>2</sup>. In Latin America, this process is being more accelerated: in 2050, the proportion of 65 years old or older people could double the 2019 figures<sup>3</sup>.

In this context, Costa Rica has been considered as one of the countries with the most accelerated aging process by the demographic division of the Economic Commission for Latin American and the Caribbean (CELADE), which has outlined the rapid growing of the older proportion of population<sup>4</sup>. In 2050, 23.7% of the Costa Rican population could be elderly people and, in absolute terms, by 2040, the numbers could double the 2020 data<sup>5</sup>.

Costa Rica had a life expectancy after birth of 80.6 years in 2020, where women registered a higher life expectancy than men, 83.2 years, and 78.1 years, respectively (INEC, 2020). This information means that, according to the electoral roll of the Supreme Electoral

Institute (2021), 2.1% of the national population are citizens 80 years of age or older, as observed in table 1.

According to the Economic Commission for Latin America and the Caribbean (ECLAC), the region lost 2.9 years in life expectancy for the older population group in Latin America, and in Central America, this indicator decreased to 3.6 years<sup>6</sup>.

After reviewing the data from table 1, it is important to mention that Costa Rica has one of the five blue zones worldwide, along with Okinawa (Japan), Icaria (Greece), Sardinia (Italy), and Loma Linda (California). The Costa Rican Blue Zone is in the Nicoya Peninsula (province of Guanacaste), distributed in the cantons of Santa Cruz, Nicoya, Hojanca, Nandayure, and Carrillo.

Research conducted by Madrigal et al. identified 43 centenarians with a mean age of 101.93 years, 18 men and 25 women. The study showed low percentages of institutionalized centenarians in the Costa Rican Blue Zone (4.6%) as compared to other worldwide countries and states, for example, Denmark (60%), Georgia, the USA (56%), Portugal (29%), and Japan (32%), but similar to Mexico (4.4%)<sup>7</sup>. In general terms, these people are independent and autonomous, besides the socioeconomic limitations they live by, they are people who tend to remain with their families and communities.

Furthermore, the mentioned research revealed that women obtained less favorable results than men on the dependency evaluation of basic and instrumental daily life activities. The study concluded that the centenarians of the Costa Rican Blue Zone of the Nicoya Peninsula presented low prevalence of diabetes, depression, ischemic cardiopathy, chronic obstructive pulmonary disease, and over medication\*. However, they did present problems related to malnutrition, high blood pressure, low levels of Vitamin D, atrial fibrillation, and visual impairment.

## **AGING AND HEALTH. TOWARD A NEW EPIDEMIOLOGIC PROFILE**

One of the more significant aspects of aging is the health attention that the population 65 years and older must receive, especially the group of octogenarians and older. This population requires specialized, integral, and prompt services because they are people with more physical, mental, emotional, and economic frailty and are highly dependent to do their daily activities.

According to INEC and the National Council of People with Disabilities<sup>8</sup>, the six most frequent morbidities affecting the elderly are high blood pressure

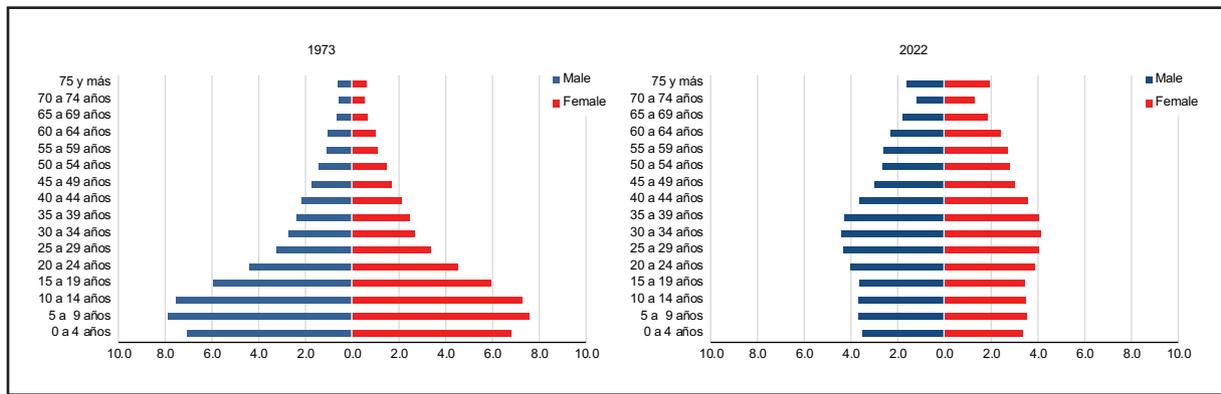


Figure 1. Costa Rica: population pyramid, 1973 and 2022.

**Table 1.** Costa Rica: senior citizens 80 years of age and older on the electoral roll, 2021

Age group	Total	Masculine	Feminine
80-84	55,607	24,997	30,610
85-89	31,825	13,207	18,618
90-94	15,200	5934	9266
95-99	4525	1661	2864
100 y más	884	291	593
Total	108,041	46,090	61,951

(59%), different types of arthritis (38%), chronic back pain (28%), diabetes mellitus (28%), gastric ulcers and gastritis (19%), and heart disease (17%). Furthermore, 35% of people over 65 years of age are in a state of disability or in a loss of functional capabilities, particularly related to mental or psychiatric illness such as Alzheimer’s dementia, chronic anxiety, and depression. All of them must be considered by the health services.

In the Costa Rica Longevity Study on Health and Well-being (CRELES) conducted several years ago but still relevant because of its comprehensive methodology in terms of time and number of subjects, it was found that a high proportion of older people (65%) had high levels of systolic blood pressure, 43% had high triglyceride levels, 50% had a low levels of HDL cholesterol, and about 16% had probable depression<sup>9</sup>.

Furthermore, the II State of Situation of the Costa Rican Elderly Report has found that the life expectancy of 65 years old and older people has increased, the mortality rate has diminished, and the prevalent morbidities are related to chronic conditions<sup>10</sup>.

However, after the COVID pandemic, the life expectancy at birth has decreased in 2.9% in Latin America and 3.6% in Central America, according to ECLAC<sup>11</sup>. In Costa Rica, according to the INEC, the life expectancy has decreased from 79.7 years in 2019 to 78.25 in 2021<sup>11</sup>.

In Costa Rica, the main provider of health services is the Costa Rican Social Security Institute (CCSS), a public institution founded by Law #17 on November 1, 1941, to offer medical services for the country’s labor force. Years later by means of Law #2738 on May 12, 1961, the CCSS began the process of universal coverage of social security nationwide, which now reaches around 95% of the national population<sup>12</sup>.

According to INEC,<sup>13</sup> there are 20.778 elderly that are currently not covered by insurance, of which 59% are men and 41% are women. This situation is described in table 2.

A relevant finding of the first National Survey on Elderly People conducted in 2021 is the confirmation that two out of three elderlies have the CCSS as their health services provider, only one out of two goes to private health services. However, 40% of octogenarians and older people combine public and private health services<sup>10</sup>.

The CCSS provides health facilities throughout the country. It is structured in three levels of attention: On the first level are the Basic Integral Attention Health Teams (EBAIS) widely present over the country but limited to basic attention, on the second level are the Clinics and Integral Health Attention Centers (CAIS) that offer specialized attention and services but without the complexity of a hospital, and the third level is the most complex for health attention, which is formed by all the country’s hospitals organized in

**Table 2.** Costa Rica: uninsured population 65 years of age and older

Population	65 a 69	70 a 74	75 a 79	80 a 84	85 a 89	90 a 94	95 and more
Masculine	31.6	13.7	7.5	3.8	1.1	1.3	0.0
Feminine	23.7	9.5	2.2	1.6	2.0	1.2	0.8
Total	55.3	23.2	9.7	5.4	3.1	2.5	0.8

peripheral, regional, and national hospitals. The latter ones provide the most complex specialized attention as they have the best human and technological resources. Costa Rica has six national hospitals, one of which is the National Geriatrics and Gerontology Hospital, specialized in the elderly population since 1976<sup>12</sup>.

The existence of a specialized hospital for the elderly is relevant due to the current context the country is facing where there is an increase of the elderly population; a reality that is drawing Costa Rica's current epidemiological profile. This situation was exposed in the II State of Situation of the Costa Rican Elderly Report<sup>10</sup>.

Between 2008 and 2018, a decrease of 17% in outpatient consultations of the health facilities in the CCSS has been observed for patients 0 through 14 years of age while an increase of 64% in outpatient consultations for people 65 and older has been observed as well. This increase is also reflected on the number of discharges (48%) and emergency attentions (64%). The rate of laboratory examinations and prescriptions for medicines in this group of age has grown from 12% to 21% and from 11% to 32%, respectively, since 2015 through 2018. From an epidemiological standpoint, the main causes for hospital admittances are chronic obstructive pulmonary disease, injuries, and procedures due to falls, cardiac insufficiency, and kidney infections<sup>12</sup>.

The health attention for the elderly is complex. The morbidities present in this group require specialized attention almost always at the hospital level. However, regarding other needs, there are different forms of attention such as are the community and family support and care.

## INNOVATIVE MODEL FOR AGING ATTENTION: CARE NETWORK

Since 2011, Costa Rica has put in place a model of attention for the elderly named the Progressive Attention for the Integral Care of the Elderly Network,

commonly known as the Care Network<sup>14</sup>. This network is understood as:

“The social structure composed of people, family, community groups, NGOs, and government institutions connected by actions, interests, and programs that guarantee an adequate caring for and satisfaction of the needs of the elderly of the country, providing for them a stage of old age with quality of life”<sup>15</sup>.

This network was created as an option for meeting the needs of attention for the elderly, because by not attending them in an urgent matter more pressure would be generated on the provision of services, especially on health and pensions and the affectation of the quality of life in the elderly. That option helps to overcome a barrier for the incorporation of families, particularly women head of households, to the labor force, being that they have had the caring role traditionally<sup>14</sup>.

The Care Network is implemented by the technical team of the National Council of the Elderly (CONAPAM) which is composed by public institutions employees, representatives of the private sector, different community organizations, and senior citizens, among others. These technical teams facilitate the execution of programs developed by CONAPAM at the community or family levels for the well-being of the elderly<sup>14</sup>.

After 11 years, there are now 56 care networks, 63 day-care centers, and 74 long stance homes working under this model, distributed throughout the seven provinces of the country, mainly concentrated in the greater metropolitan area which is composed of the geographical space at the center of the national territory where 31 cantons of four provinces are located. As of December 2021, 13.347 people were attended through the Care Network, 41.2% were men and 58.8% were women for a ratio of 1.42 times more for women than men<sup>14</sup>.

An analysis of the volunteer provision of long-term care for older people in Thailand and Costa Rica<sup>16</sup> has

pointed that Costa Rica, in addition to its well-developed health-care services, has been also pioneer in several initiatives for older people, including the long-term care, which is part of the referred Care Network. The authors conclude that the approach of this network that promotes the participation of families and communities has allowed this country – as well as Thailand, which has several common points – to rapidly expand long-term care provision for vulnerable elderly.

Even though the positive results shown by this model, the main obstacle it faces to extend to other territories such as the coastal regions, with lower social development indexes due to the high percentage of poverty and extreme poverty<sup>17</sup> is the lack of financial resources. According to CONAPAM<sup>14</sup>, “the institutional budget presents a reduction of 9.50% with regard to 2020, which limits the possibility to continue growing and extend the number of people benefited, as well as the aid they receive from the model.”

One of the great achievements of the Care Network has been the attention of the elderly at their own home, which has made possible for them to stay within their families and communities. It is for this reason that it is so important that this model to continue to work and to encourage the collaborative efforts between public institutions, NGOs, and local governments in every community, to offer an option that satisfies the needs of the elderly through the 14 attention alternatives established by CONAPAM, which are<sup>14</sup>:

- Feeding: attending the feeding needs considering the specific situations of every senior citizen. In cases of special diets, the professional recommendations are necessary.
- Personal and hygienic items: items that satisfy the personal hygienic needs as well as house-keeping and vector control.
- Medications and health implements: including prescriptions that the CCSS does not supply or are non-available. To finance the medications, there must be a prescription by the respective professional and a voucher from the CCSS noting it does not have the medication.
- Social attention and integral health: payment of professional services that guarantee an integral and timely assessment of the situation regarding mental and physical health.
- Technical assistance products: including the purchase of items such as devices, equipment, instruments, and technology that allow for prevention, compensation, and control, to

neutralize deficiencies, activity limitations, and restrictions in the participation of the elderly. To facilitate for this population, activities that improve their mobility, prevent dependency, and improve their general quality of life.

- Housing equipment: this consists of subsidizing basic home items for the caring and attention of the elderly at their homes or in a community home when these are lacking. These items are basic beds, ranges, eating utensils, chairs, tables, and others. The items given to each elderly person benefited are donated.
- Renting homes, municipal and basic services, and immigration procedures: this allows to subsidizing renting housing payments, as well as electricity, water, and basic telephone bills. Funeral expenses and renting of cemetery graves are also covered.
- Solidary family: it consists of the relocation of an elderly person, with or without independence, within a family blood related or not, to provide a shelter to this person, giving him or her protection and required care, and allowing he or she to be part of the family dynamic.
- Basic attention services at home and services of specialized care and attention.
- Community homes: allows a temporal relocation for a maximum of five elderly in poverty conditions and at social risk, with or without functional independence in a home (rented, borrowed, or property of the organization that delivers the service).
- Transportation and Fuel: includes the payment of fuel and transportation fees to facilitate the home delivery of subsidies to the recipients, visitations of the elderly for control, as well as the transferring of the elderly to medical appointments, recreative, cultural, or other activities.
- Prevention and promotion of health: to incentivate individual or group activities bringing forth conglomerates of senior citizens where there are none, or re-enforcing the already existing ones, to facilitate spaces for socializing and promotion of healthy lifestyles by developing educational, occupational, physical, cultural, recreative, and sporting activities.
- Institutionalization: to relocate the elderly in institutions traditionally known as long stance homes, where they permanently reside for up to 2 years. This urgent relocation is meant for elderly with high grades of dependency that is

at social risk and/or has been victims of violence or neglect.

- Home improvement: consists of subsidies for restorations, improvements, or additions to homes where the elderly live, removing architectural barriers to make them habitable and adequate for the person, leading to more autonomy and independence.

As of December 2021, the most frequently required of these alternatives offered by the Care Network is feeding (47.2%), followed by personal and hygienic items (34.98%); the other alternatives provided represented altogether 4.65%<sup>14</sup>.

The main criteria for the selection of the benefited by the different alternatives of the Care Network are based on the concept of social risk, defined as “a situation of high vulnerability of the elderly where risk factors are present that are not being attended to and produce health damage”<sup>14</sup>.

CONAPAM has established a classification of social risk for the elderly population:

- Social Risk #1: poverty conditions, independent for daily and instrumental life activities, presence of other social risk indicators and unsatisfying needs on health, companionship, transportation, recreation, home, hygienic, domestic violence, and neglect, among others.
- Social Risk #2: poverty conditions, mild dependency for daily and instrumental life activities, presence of other social risk indicators and unsatisfying needs on health, companionship, transportation, recreation, home, hygienic, domestic violence, and neglect, among others.
- Social Risk #3: poverty conditions, total dependency for daily and instrumental life activities, presence of other social risk indicators and unsatisfying needs on health, companionship, transportation, recreation, home, hygienic, domestic violence, and neglect, among others.
- Social Risk #4 not associated with poverty: elderly exposed to severe neglect, abandonment and domestic violence conditions or are victims of abuse, disability, or any other condition otherwise proven.

About 58.2% of the beneficiaries of any of the alternatives offered by the Care Network fall under Social Risk #1, 29.3% fall under Social Risk #2, 10.2% fall under Social Risk #3, and 2.3% are classified as Social Risk #4<sup>14</sup>.

At this point it is important to mention that 17% of households in Costa Rica were in poverty in 2020<sup>21</sup>,

but in 2022, poverty reached a 37% of the households. According to the II Report on the Status of the Elderly Person in Costa Rica, the level of poverty in the households with aged people has been similar or even more elevated than the general level between 2010 and 2018<sup>10</sup>.

The Care Network has proved to be a model of attention that has reached population on social risks and has contributed to improve the quality of life of the elderly. However, demographic and epidemiological changes continue to generate all kinds of effects over the vulnerable population, such as 65 years or older people, which impose major challenges to the society to take care of these people.

Therefore, for example, Costa Rica should look forward to the creation of a specialized university hospital on geriatrics and gerontology, with an integral vision and an active and innovative participation of the community that ensure the leadership and the efficient coordination of the entire health attention network of the elderly. It would be the space where all main axes of the public superior education coincide teaching, research, and social action.

## **UNPOSTPONABLE CHALLENGES TO FACE AGING IN COSTA RICA**

Having reviewed various aspects of the demographic and epidemiologic reality as well as the care and attention of the elderly in Costa Rica, diverse challenges for the national society may be defined, specifically for the present decade, that was declared by the General Assembly of the Organization of the United Nations (UN) as “the decade of healthy aging in the Americas: 2021-2030”<sup>18</sup>.

The main challenges in Costa Rica are:

- Response to the demographic and epidemiological changes of the country.
- To establish real political commitments with interinstitutional coherence, guaranteeing its continuity.
- To extend the formation and strengthen the interdisciplinary human resources.
- To stimulate investigation in geriatrics and gerontology.
- To motivate and strengthen voluntary work throughout the country.
- To stimulate auto caring.
- To develop periodic reflection campaigns against abuse (including patrimonial abuse), neglect, and abandonment.

- Strengthen the teaching of geriatrics and gerontology throughout the entire public and private university system.
- Acknowledgement of the Blue Zone in the Nicoya Peninsula.
- Strengthen the geriatric network within the CCSS to become universal.
- To position a culture of respect, dignification, and inclusion of the elderly into society.
- Universalization of the Care Network for the elderly in state of dependency and poverty in the community with an overall genuine support by the government.
- To create a specialized university hospital on geriatrics and gerontology, with an integral vision and extension to the community that allows leadership and coordination in an efficient form of the health attention network of the elderly, and where teaching, investigation, and social action coincide
- To support the WHO “Friendly Cities,” project which is developed in Hatillo (San José) since 2005, as one of the 33 cities worldwide to undergo this initiative. There are now 24 more Age-Friendly Cities in this country, according to the PAHO/WHO<sup>19</sup>.
- To promote the elderly to stay within their family and community nucleus through the execution of programs for the elderly.
- To improve health education including the progressive integral attention and the establishment of committees for elderly abandoned, neglected, or abused,
- To promote an improvement of social services assistance given to the elderly.
- To foment health promotion and prevention.
- To promote innovative programs for preparedness of retirement nationwide.
- To strengthen the organization of local councils for the elderly throughout the country.
- Rigorous surveillance in the compliance of human rights.

## ACADEMIC CONTRIBUTIONS FOR THE INTEGRAL ASSESSMENT OF AGING

The demographic and epidemiological changes examined requires paying much attention to a series of social, health, economic, educational, political, and other factors that affect the way society assumes the process of aging, as well as the manner in which the problems and challenges regarding the care of the population are considered, particularly of people of

advanced age from the perspective of human rights and development opportunities.

Particularly for Costa Rica, the needs and challenges concerning these factors are complex and ever growing. The University of Costa Rica as an institution of public superior education must continue to increase its contributions to society, with a well-established program that articulates and focalizes within the university but also facilitates and strengthens interinstitutional and intersectoral actions that benefit the entire Costa Rican society.

Because of this and to comply with the mandates of the organic status of the university, the Faculty of Medicine proposed to the university authorities the creation of a thematic chair named aging and society, with the purpose to contribute and discuss the current and future challenges that aging in Costa Rica poses. This proposal was approved by the Vice Rector of Teaching through resolution VD-12168-2022.

The Faculty of Medicine of the University of Costa Rica is composed of five schools: nursery, medicine, nutrition, public health, and health technologies. It also includes the Institute of Investigations in Health (INISA) and research centers that make possible to provide answers to the most important health topics, among those centers are the Center for Investigation of Microscopic Structures (CIEMIC), the Center for Investigation in Hematology and Related Illnesses (CIHATA), the Center for Investigation in Neurosciences (CIN), and the Center for Investigation in Nursing Care and Health (CICES).

With the thematic chair of aging and society, the Faculty of Medicine of the University of Costa Rica, its five academic units, the institute, and the four research centers will contribute to the analysis, discussions, and production of new knowledge that may promote the developing of inter, multi, and transdisciplinary joint activities with other academic units from the University of Costa Rica and other public universities, national and international, public institutions, non-profit NGOs, and professional colleges.

The academy in general and particularly the health sciences are called on to develop more inter, multi, and transdisciplinary investigations on the elderly that allow the generation of deeper knowledge and to create innovative approaches for the assessment of the aging process.

## CONCLUSIONS

The aging process is a reality in Costa Rica and in the world, according with all the demographic and

epidemiological data. It is necessary to point out all the described issues to reinforce all different levels of care and services for the growing older population. The caring for older persons network is a good example of implementing assistance for older people in condition of poverty without any social protection. Other actions like the provision of a specialized geriatric attention through a University Hospital in Geriatric Medicine and Gerontology that allow not only geriatric attention, but a strong teaching, research, and social programs would be crucial too. It is very important to mention new programs as the academical set up, for students on different areas related to the aging process to assure the integration of new professionals in this growing field. It is, without a doubt, necessary to make great efforts to catch up the lost years due to the COVID pandemic.

## FUNDING

This research has not received any specific grants from agencies in the public, commercial, or not-for-profit sectors.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

## ETHICAL DISCLOSURES

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that no patient data appear in this article.

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