

# Life and health conditions among elderly: results of the EpiFloripa Idoso cohort study

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## Abstract

**Objective:** to identify sociodemographic, behavioral and health changes in a follow-up of participants in the health survey EpiFloripa Idoso. **Methods:** this is a population-based longitudinal study with elderly individuals in Florianópolis-SC, Brazil. **Results:** 1,702 elderly individuals were interviewed in 2009-2010 and 1,197 in 2013-2014 (response rate: 89.1% and 70.2%, respectively); among followed-up individuals, most of them remained with a partner (53.4%), living with other people (76.0%), not working (78.0%), with positive health perception (44.0%), not using the Internet (67.5%), not smoking (57.5%), not consuming alcohol (53.3%), not physically active (56.3%), consuming <5 servings of fruits/vegetables (57.3%), independent (60.5%), overweight (47.0%), with negative screening for cognitive impairment (69.4%), with no depressive symptoms (72.0%) and not having suffered falls (60.6%). **Conclusion:** most elderly did not show significant changes in their sociodemographic, behavioral and health characteristics; the need to rethink more effective actions to improve the elderly health stands out.

**Keywords:** Health of the Elderly; Aged; Aging; Longitudinal Studies.

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## Introduction

The accelerated process of population ageing observed in Brazil from the 1960s<sup>1</sup> brought an important impact on society. Especially on health care, this impact is not restricted to increased morbidity among the elderly, it also implicates a reduction in physical function and independence of these people in the development of their daily activities.<sup>2</sup>

Identification and understanding of the determinants and etiological factors of ageing healthy – whether related to conditions and socioeconomic inequalities, individual characteristics (biological, psychological, genetic) or behavioral, physical environment, access and use of health services including , cultural and gender differences<sup>3</sup> become essential to subsidize the planning of health care policies for the elderly population.

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The extension of existence can only be considered a human achievement as far as it adds quality to the additional years of life, even for individuals who have some degree of weakness or disability, or that require some kind of special care.<sup>3</sup> As the political framework "Active Aging" highlights, actions aimed at elderly population should enhance health, personal safety and continuous participation of the elderly in social, economic, cultural, and civil issues as a whole.<sup>3</sup>

Under this principle, it is important to undertake longitudinal research with the elderly, outlined in order to enable causal inference, in addition to checking the individual changes, and follow the evolution of ageing.<sup>4</sup> The results of such studies can assist the development of health policies for the elderly.<sup>3</sup> In such a context, it was proposed a research project to evaluate, and monitor the health conditions of the urban elderly population of Florianópolis city.

The objective of the present study was to identify sociodemographic, behavioral and health changes in a follow-up period of participants in the health survey EpiFloripa Idoso.

## Methods

Data from this study are related to the project "Health Conditions of the Elderly in Florianópolis", named EpiFloripa Idoso ([www.epifloripa.ufsc.br](http://www.epifloripa.ufsc.br)). This is a longitudinal, population-based and household study, conducted with elderly (60 years or more) residents in the urban area of Florianópolis city, Santa Catarina state, Brazil. The baseline data collection of the study took place from September 2009 to June 2010; and the follow-up, from November 2013 to November 2014.

Florianópolis is the capital of the State of Santa Catarina and lies on the coast. According to the Census of 2010, the city's population was of 421,239 inhabitants, 11.4% of them were 60 years old or older.<sup>5</sup> With a local human development index (IDHM) of 0.847 in 2010.<sup>6</sup> Florianópolis is in third position amongst the Brazilian cities, and the first amongst the capitals, at a high level of human development.

The estimate size of the sample was carried out with Epi Info version 6.04, based on the calculation of prevalence, according to population size parameters (44,460), confidence level of 95%, unknown prevalence of the phenomenon (50%), sampling error (4 percentage points), effect of sample design (estimated at 2), plus 20% for estimated losses and 15% for association studies. This resulted in a minimum sample of 1,599 individuals. As a result of the effect of design and financial availability, the sample was expanded to 1,911 elderly people.

The selection of the baseline sample was performed by clusters, in two stages: first, the census tracts, and second, the households. In the first stage of selection, from 420 urban census tracts of Florianópolis, 80 were drawn systematically, which corresponded to 8 tracts from each decile of average monthly income of the head of the family according to data from the Brazilian Institute of Geography and Statistics (IBGE), (R\$192.80 - R\$13,209.50). In the second stage, the households were drawn. To this end, the amount of households, and the record of permanently occupied residential addresses (excluding business addresses, abandoned buildings etc.) were updated. The number of households ranged from 61 to 725. In order to reduce the coefficient of variation from 52.7% (n = 80 tracts) to 35.2% (n = 83 tracts), we performed the grouping of small tracts, according to geographical location, related income decile, and the subdivision of very large sectors. According to the 2000 Census, the average number of

residents per household in Florianópolis amounted to 3.1; and the age group of interest, approximately 11% of the population, leading to one elderly in every three households, per census tract, on average. Thus, we estimated a visit to 60 households per tract, which were drawn systematically from the list of generated addresses after updating the households per sector, to find 20 elderly people.

Institutionalized elderly (residing in nursing homes, hospitals, prisons) were excluded from the baseline; and from the follow-up, those identified by the study as duplicated (erroneously registered twice in the database), and those with incompatible age participating in the study (an individual with less than 60 years old, interviewed in the baseline by mistake).

In these two parts of the study, the losses corresponded to the elderly not located after four visits in different periods; and the refusals when expressed in person, after a visit to the household and an attempt to interview. During the follow-up, the elderly who had moved out from town or were admitted to hospitals were also considered losses.

The fatalities were identified by the database of the Mortality Information System of Santa Catarina state. We included all death that occurred notified from 2009 to 2013, at the beginning and at the end of the cycle of interviews of the follow-up, with 2014 updated data preview through probabilistic linkage of records<sup>7</sup> by the OpenRecLink® (<http://reclink.sourceforge.net/>). After excluding deaths, we sent letters to elderly citizens, informing them about the new interview, and conduct the telephone contact to update the registration data; and when this communication was not possible, the team sought to update the register via InfoSaúde System (health system of the municipality), social networks, phone book, contact with neighbors, relatives and/or friends.

Data were collected through face-to-face interview applied by previously trained interviewers, with the aid of Personal Digital Assistants (baseline) and netbook (follow-up). In standardized questionnaires we used, preferably, validated instruments, and tested in pilot studies applied along the 99 individuals in the baseline, and 76 individuals on the follow-up. Data consistency was checked weekly; and quality control, conducted by the application, by telephone, of a questionnaire reduced to approximately 10% of respondents, randomly selected. The reproducibility of the questions presented satisfactory to good concordance (at baseline, Kappa index between 0.6 and 0.9; and at follow-up, between 0.5 and 0.9).

The variables described below refer to data collected at baseline and at follow-up. The sociodemographic characteristics considered were the following:

- sex (female; male);
- age (in years: 60 to 69; 70 to 79; 80 or more);
- family income per capita in minimum wages (MW) at the time of the interview<sup>8</sup> ( $\leq 1$  MW; 1 to 3 MW;  $>3$  to 5 MW;  $>5$  to 10 MW;  $>10$  MW);
- education level (without formal education level; 1 to 4 years; 5 to 8 years; 9 to 11 years; 12 or more years);
- family arrangement (living accompanied; living alone);
- marital status (married; single; divorced; widowed);
- respondent (elderly; informant);
- existence of caregiver (no; yes);
- paid work, at the time of the interview (no; yes); and
- self-rated health (very good; good; average; poor; very poor).

The behavioral characteristics considered were:

- Internet use (no; yes);
- smoking (never smoked; former smoker but stopped; smoker);
- frequency of alcohol intake, defined by the first three questions of the Alcohol Use Disorders Identification Test (AUDIT)<sup>9</sup> (never [never consumes alcoholic beverages]; moderate [consumes up to a dose of alcohol in an ordinary day and never consumes 5 or more drinks on a single occasion]; high [consumes more than 2 doses in a normal day or 5 or more drinks on a single occasion]);
- leisure-time physical activity (International Physical Activity Questionnaire)<sup>10</sup> (0 to 149 minutes/week [physically inactive];  $\geq 150$  minutes/week [physically active]); and
- daily consumption of fruits and vegetables<sup>11</sup> ( $<5$  servings;  $\geq 5$  servings)

Concerning health conditions, we measured the following:

- weight and stature of the participants;
- nutritional status, by body mass index (BMI)<sup>12</sup> (normal; low weight; overweight);
- cardiovascular risk, estimated by the waist circumference<sup>13</sup> (normal; increased; increased substantially);
- dependence in daily activities of life<sup>14</sup> (none; 1 to 3; 4 or more);
- screening for cognitive deficit, investigated by the mini-mental state examination of Folstein<sup>15</sup> (negative; positive);
- depressive symptoms, investigated by the Geriatric Depression Scale (GDS-15)<sup>16</sup> (normal; suspicion of depression);

- falls in the last year (no; yes); and
- morbidities (none; 1 to 2; 3 or more)

The following self-reported diseases were also investigated, independently:

- back pain (no; yes);
- arthritis or rheumatism (no; yes);
- diabetes (no; yes);
- cancer (no; yes);
- bronchitis or asthma (no; yes);
- hypertension (no; yes);
- cardiovascular disease (no; yes);
- stroke or cerebral infarction (no; yes); and
- kidney disease (no; yes)

We evaluated the changes between the two parts of the study (2009-2010 and 2013-2014) concerning sociodemographic, health behaviors, and health conditions variables, checking how many elderly people had remained in the same category of the baseline, and when they had moved – and to which category they had moved.

In the analysis, we considered the design effect and the sample weights. Data were presented in absolute and relative frequencies (%) and confidence intervals of 95% (CI95%). We used Pearson's chi-square test for comparison between the losses/refusals, interviews, and deaths, and established the value of statistical significance in 5%. All analyses were conducted by the software Stata/SE 13 for Windows (Stata Corp., College Station, United States of America).

EpiFloripa Idoso has been approved by the Ethics Research Committee with Human Beings (CEPSH) at the Federal University of Santa Catarina (UFSC): the baseline, under the Protocol no. 352/2008, on December 2008; and the follow-up, under the CAAE 16731313.0.0000.0121, on July 8th, 2013. All respondents were given the necessary explanations on the research procedures, before they were asked and decided to participate in the study, by signing the Free Informed Term of Consent.

## Results

We interviewed 1,705 elderly people in the baseline (response rate of 89.1%). In the follow-up, 1,197 were interviewed (response rate: 70.2%), 217 died, 162 represented losses, and there were 129 refusals, 3 were excluded, 2 due to duplicity and 1 due to age incompatible on the baseline. The median age of the baseline respondents was 70 years old (age range: from 60 to 104); and the median age of the follow-up, 73 years old (age range: from 63 to 107).

Table 1 presents sociodemographic characteristics and self-rated health samples of the baseline and follow-up. The two assessments involved, predominantly, female, age up to 69 years, income from 1 to 3 minimum wages, 1 to 4 years of study at school, living accompanied, married, no caregiver, not working, and evaluating their health as very good/good.

Still on Table 1, the distribution of the elderly people interviewed, loss/refusals and deaths during the follow-up can be observed. It was not observed statistically significant differences regarding the status of the follow-up according to sex, family income in minimum wages, family arrangement, smoking, cardiovascular risk, column or back disease, arthritis or rheumatism, cancer and hypertension. The proportion of respondents was significantly lower (and the proportion of deaths was significantly higher) for elderly with higher age, less educated, widowed, whose interviews were answered by informants, having a caregiver, who did not work anymore, with poor self-rated health, which did not use the Internet, who did not consume alcohol, inactive, consuming less than 5 servings of fruits and vegetables per day, with low weight, depending on others for 4 or more activities of daily life, with positive screening for cognitive deficit, with depressive symptoms, who had suffered a fall in the previous year, with the highest number of morbidities, who reported diabetes, bronchitis or asthma, cardiovascular disease, stroke or cerebrovascular accident, or kidney disease.

Regarding the conditions observed between baseline and follow-up, presented in Table 2, most remained with companion (53.4%), remained living accompanied (76.0%), remained not working (78.0%), with positive self-rated (45.0%), not using the Internet (67.5%), not smoking (57.5%), not consuming alcoholic beverage (53.3%), physically inactive (56.3%), with fruits and vegetables consumption of <5 servings per day (57.3%), overweight (47.0%), without dependency (60.8%), with negative screening for cognitive deficit (69.4%), without depressive symptoms (72.0%), and without falls in the previous year (60.6%).

We observed changes in some of the variables, especially the morbidities: 40.0% of the elderly developed one or more diseases. About 14.6% of the elderly have changed their work status and 15.2% began to have positive health self-perception, 16.8% became physically inactive, 17.2% began to consume >5 servings of fruits and vegetables per day, 8.2% began to use the internet, 10.2% began to have positive screening for cognitive

**Table 1 – Descriptive analysis of the sample according to the status of EpiFloripa Idoso health survey, in the city of Florianópolis, SC state, 2009-10 and 2013-14**

| Variables                                       | Total (baseline)<br>no. (%) | Total (follow-up)<br>no. (%) | Monitoring             |                            |                   | P-value <sup>a</sup> |
|---|-----------------------------|------------------------------|------------------------|----------------------------|-------------------|----------------------|
|   |                             |                              | Respondents<br>no. (%) | Losses/refusals<br>no. (%) | Deaths<br>no. (%) |                      |
| <b>Sex</b>                                      |                             |                              |                        |                            |                   | 0.055                |
| Female  | 1,088 (62.5)                | 778 (63.1)                   | 778 (73.2)             | 189 (16.2)                 | 121 (10.6)        |                      |
| Male  | 614 (37.5)                  | 419 (36.9)                   | 419 (71.3)             | 99 (14.6)                  | 96 (14.1)         |                      |
| <b>Age (in years)</b>                           |                             |                              |                        |                            |                   | ≤0.001               |
| 60 to 69  | 847 (50.6)                  | 412 (34.0)                   | 642 (77.0)             | 160 (17.3)                 | 45 (5.7)          |                      |
| 70 to 79  | 616 (35.6)                  | 509 (42.8)                   | 436 (74.0)             | 103 (15.7)                 | 77 (10.3)         |                      |
| ≥80   | 236 (13.7)                  | 276 (23.2)                   | 119 (52.2)             | 24 (9.2)                   | 93 (38.6)         |                      |
| <b>Family income (in monthly minimum wages)</b> |                             |                              |                        |                            |                   | 0.434                |
| ≤1  | 196 (10.7)                  | 92 (6.9)                     | 127 (65.8)             | 44 (22.2)                  | 25 (12.0)         |                      |
| >1 to 3   | 435 (26.2)                  | 327 (28.6)                   | 301 (70.7)             | 75 (16.2)                  | 59 (13.1)         |                      |
| >3 to 5   | 314 (18.4)                  | 227 (19.4)                   | 224 (74.0)             | 47 (12.2)                  | 43 (13.8)         |                      |
| >5 to 10  | 381 (23.7)                  | 274 (23.9)                   | 269 (74.0)             | 70 (16.2)                  | 42 (9.8)          |                      |
| >10   | 326 (21.1)                  | 221 (21.2)                   | 241 (75.0)             | 45 (14.3)                  | 40 (10.7)         |                      |
| <b>Education level (in years)</b>               |                             |                              |                        |                            |                   | ≤0.001               |
| No formal education                             | 158 (8.2)                   | 93 (7.0)                     | 93 (60.0)              | 30 (18.4)                  | 35 (21.6)         |                      |
| 1 to 4  | 595 (33.1)                  | 430 (33.9)                   | 430 (73.5)             | 86 (12.8)                  | 79 (13.6)         |                      |
| 5 to 8  | 307 (17.8)                  | 199 (15.8)                   | 199 (64.1)             | 67 (21.9)                  | 41 (14.0)         |                      |
| 9 to 11   | 241 (16.0)                  | 180 (17.2)                   | 180 (79.9)             | 33 (9.7)                   | 28 (10.4)         |                      |
| 12 or more                                      | 393 (25.0)                  | 292 (26.1)                   | 292 (76.7)             | 72 (17.9)                  | 29 (5.4)          |                      |
| <b>Family arrangement</b>                       |                             |                              |                        |                            |                   | 0.722                |
| Accompanied                                     | 1,430 (83.2)                | 956 (78.7)                   | 1,008 (73.0)           | 238 (15.5)                 | 184 (11.5)        |                      |
| Alone   | 270 (16.8)                  | 241 (21.3)                   | 189 (70.2)             | 48 (16.1)                  | 33 (13.7)         |                      |
| <b>Marital status</b>                           |                             |                              |                        |                            |                   | 0.004                |
| Married   | 990 (58.3)                  | 658 (55.2)                   | 718 (75.5)             | 165 (15.0)                 | 107 (9.5)         |                      |
| Single  | 99 (5.4)                    | 76 (5.8)                     | 72 (73.2)              | 16 (12.8)                  | 11 (14.0)         |                      |
| Divorced  | 132 (8.3)                   | 87 (8.4)                     | 88 (70.7)              | 28 (20.0)                  | 16 (9.3)          |                      |
| Widowed   | 481 (27.9)                  | 376 (30.9)                   | 319 (66.5)             | 79 (16.2)                  | 83 (17.3)         |                      |
| <b>Respondent</b>                               |                             |                              |                        |                            |                   | ≤0.001               |
| Elderly   | 1,653 (97.5)                | 1,140 (95.1)                 | 1,183 (73.5)           | 283 (15.6)                 | 187 (10.9)        |                      |
| Informant                                       | 49 (2.5)                    | 57 (4.9)                     | 14 (31.6)              | 5 (16.0)                   | 30 (52.3)         |                      |
| <b>Caregiver</b>                                |                             |                              |                        |                            |                   | ≤0.001               |
| No  | 1,545 (91.1)                | 1,076 (90.3)                 | 1,131 (75.0)           | 273 (16.1)                 | 141 (8.9)         |                      |
| Yes   | 157 (8.9)                   | 121 (9.7)                    | 66 (46.4)              | 15 (10.8)                  | 76 (42.8)         |                      |
| <b>Paid work</b>                                |                             |                              |                        |                            |                   | ≤0.001               |
| No  | 1,474 (86.6)                | 957 (87.4)                   | 1,008 (70.6)           | 254 (15.9)                 | 212 (13.5)        |                      |
| Yes   | 228 (13.4)                  | 133 (12.6)                   | 189 (84.3)             | 34 (13.9)                  | 5 (1.9)           |                      |
| <b>Self-rated health</b>                        |                             |                              |                        |                            |                   | ≤0.001               |
| Very good                                       | 156 (9.8)                   | 102 (10.4)                   | 121 (79.8)             | 30 (17.7)                  | 5 (2.5)           |                      |
| Good  | 689 (43.5)                  | 541 (49.8)                   | 498 (74.9)             | 143 (18.9)                 | 48 (6.2)          |                      |
| Average   | 642 (37.3)                  | 417 (34.0)                   | 450 (73.0)             | 96 (13.1)                  | 96 (13.9)         |                      |
| Bad   | 125 (7.3)                   | 60 (5.1)                     | 85 (60.9)              | 12 (9.1)                   | 28 (30.0)         |                      |
| Very bad  | 40 (2.1)                    | 20 (1.5)                     | 29 (70.3)              | 2 (4.0)                    | 9 (25.7)          |                      |

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Table 1 – Continuation

| Variables   | Total<br>(baseline)<br>no. (%) | Total<br>(follow-up)<br>no. (%) | Monitoring  |                     |            | P-value <sup>a</sup> |
|---|--------------------------------|---------------------------------|-------------|---------------------|------------|----------------------|
|   |                                |                                 | Respondents | Losses/<br>refusals | Deaths     |                      |
|   |                                |                                 | no. (%)     | no. (%)             | no. (%)    |                      |
| <b>Internet use</b>                               |                                |                                 |             |                     |            | ≤0.001               |
| No  | 1,358 (77.1)                   | 877 (70.9)                      | 930 (70.6)  | 222 (14.8)          | 206 (14.6) |                      |
| Yes   | 344 (22.9)                     | 318 (29.1)                      | 267 (78.8)  | 66 (18.3)           | 11 (2.9)   |                      |
| <b>Smoking habit</b>                              |                                |                                 |             |                     |            | 0.064                |
| Never smoked                                      | 1,037 (59.6)                   | 731 (59.7)                      | 743 (73.2)  | 180 (16.6)          | 114 (10.2) |                      |
| Former smoker and stopped                         | 522 (32.0)                     | 382 (33.2)                      | 350 (70.5)  | 86 (13.8)           | 86 (15.7)  |                      |
| Currently smoking                                 | 141 (8.4)                      | 83 (7.1)                        | 103 (75.2)  | 22 (15.6)           | 16 (9.2)   |                      |
| <b>Consumption of alcoholic beverage</b>          |                                |                                 |             |                     |            | 0.002                |
| Never   | 1,108 (64.2)                   | 751 (62.2)                      | 766 (71.0)  | 173 (14.4)          | 169 (14.6) |                      |
| Moderated   | 315 (18.8)                     | 268 (22.1)                      | 227 (73.3)  | 63 (18.9)           | 25 (7.8)   |                      |
| High  | 277 (17.0)                     | 177 (15.7)                      | 203 (77.2)  | 52 (16.6)           | 22 (6.2)   |                      |
| <b>Physical activity</b>                          |                                |                                 |             |                     |            | ≤0.001               |
| Inactive (<10 min/week)                           | 929 (53.1)                     | 691 (57.1)                      | 630 (69.7)  | 139 (14.0)          | 160 (16.3) |                      |
| Inadequately active (10-149 min/week)             | 279 (16.0)                     | 187 (15.9)                      | 203 (75.2)  | 51 (18.2)           | 25 (6.6)   |                      |
| Active (≥150 min/week)                            | 494 (30.9)                     | 313 (27.0)                      | 364 (75.8)  | 98 (17.2)           | 32 (7.0)   |                      |
| <b>Daily consumption of fruits and vegetables</b> |                                |                                 |             |                     |            | 0.019                |
| <5 servings                                       | 1,050 (68.7)                   | 661 (62.2)                      | 777 (75.5)  | 150 (13.5)          | 121 (11.0) |                      |
| ≥5 servings                                       | 505 (31.3)                     | 400 (37.8)                      | 319 (66.7)  | 115 (21.1)          | 70 (12.2)  |                      |
| <b>Nutritional status</b>                         |                                |                                 |             |                     |            | ≤0.001               |
| Normal  | 634 (38.9)                     | 418 (35.8)                      | 451 (73.5)  | 117 (16.3)          | 66 (10.2)  |                      |
| Low weight  | 142 (8.4)                      | 105 (9.1)                       | 91 (67.6)   | 18 (8.5)            | 33 (23.9)  |                      |
| Overweight  | 860 (52.7)                     | 622 (55.1)                      | 627 (74.5)  | 147 (16.5)          | 86 (9.0)   |                      |
| <b>Cardiovascular risk</b>                        |                                |                                 |             |                     |            | 0.297                |
| Normal  | 240 (14.1)                     | 169 (13.9)                      | 158 (67.7)  | 46 (16.5)           | 36 (15.8)  |                      |
| Increased   | 556 (33.1)                     | 349 (29.9)                      | 391 (73.9)  | 107 (17.3)          | 58 (8.8)   |                      |
| Substantially increased                           | 847 (52.8)                     | 642 (56.2)                      | 624 (74.7)  | 130 (14.6)          | 93 (10.7)  |                      |
| <b>Dependency on daily life activities</b>        |                                |                                 |             |                     |            | ≤0.001               |
| None  | 457 (25.6)                     | 367 (31.5)                      | 336 (74.0)  | 104 (22.4)          | 17 (3.6)   |                      |
| 1 to 3  | 708 (43.0)                     | 454 (38.3)                      | 531 (77.1)  | 122 (16.2)          | 55 (6.7)   |                      |
| 4 or more   | 537 (31.4)                     | 372 (30.2)                      | 330 (64.8)  | 62 (9.4)            | 145 (25.8) |                      |
| <b>Screening for cognitive deficit</b>            |                                |                                 |             |                     |            | ≤0.001               |
| Negative  | 1,242 (75.7)                   | 876 (75.3)                      | 916 (76.1)  | 209 (15.0)          | 117 (8.9)  |                      |
| Positive  | 453 (24.3)                     | 306 (24.7)                      | 278 (61.7)  | 79 (17.7)           | 96 (20.6)  |                      |
| <b>Depressive symptoms</b>                        |                                |                                 |             |                     |            | ≤0.001               |
| Normal  | 1,233 (76.2)                   | 907 (81.0)                      | 909 (76.1)  | 221 (16.5)          | 103 (7.4)  |                      |
| Suspicion of depression                           | 401 (23.8)                     | 223 (19.0)                      | 248 (62.2)  | 64 (14.6)           | 89 (23.2)  |                      |
| <b>Falls (last year)</b>                          |                                |                                 |             |                     |            | 0.015                |
| No  | 1,380 (81.8)                   | 832 (71.2)                      | 968 (72.4)  | 251 (16.7)          | 161 (10.9) |                      |
| Yes   | 322 (18.2)                     | 365 (28.8)                      | 229 (72.5)  | 37 (10.9)           | 56 (16.5)  |                      |
| <b>Morbidities</b>                                |                                |                                 |             |                     |            | ≤0.001               |
| None  | 120 (7.9)                      | 75 (6.8)                        | 86 (72.0)   | 28 (23.3)           | 6 (4.6)    |                      |
| 1 to 2  | 585 (5.4)                      | 410 (35.2)                      | 398 (72.4)  | 122 (19.0)          | 65 (8.6)   |                      |
| 3 or more   | 997 (56.7)                     | 712 (58.0)                      | 713 (72.6)  | 138 (12.5)          | 146 (15.0) |                      |

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Table 1 – Conclusion

| Variables                            | Total<br>(baseline)<br>no. (%) | Total<br>(follow-up)<br>no. (%) | Monitoring   |                     |            | P-value <sup>a</sup> |
|--------------------------------------|--------------------------------|---------------------------------|--------------|---------------------|------------|----------------------|
|                                      |                                |                                 | Respondents  | Losses/<br>refusals | Deaths     |                      |
|                                      |                                |                                 | no. (%)      | no. (%)             | no. (%)    |                      |
| <b>Back pain</b>                     |                                |                                 |              |                     |            | 0.107                |
| No                                   | 855 (49.6)                     | 600 (51.8)                      | 567 (69.8)   | 163 (17.8)          | 125 (12.4) |                      |
| Yes                                  | 846 (50.4)                     | 597 (48.2)                      | 629 (75.1)   | 125 (13.4)          | 92 (11.4)  |                      |
| <b>Arthritis or rheumatism</b>       |                                |                                 |              |                     |            | 0.166                |
| No                                   | 1,120 (67.5)                   | 786 (67.7)                      | 764 (71.1)   | 205 (17.0)          | 151 (11.9) |                      |
| Yes                                  | 577 (32.5)                     | 411 (32.3)                      | 430 (75.2)   | 81 (12.7)           | 66 (12.1)  |                      |
| <b>Diabetes</b>                      |                                |                                 |              |                     |            | 0.009                |
| No                                   | 1,327 (78.5)                   | 896 (76.3)                      | 937 (73.0)   | 236 (16.7)          | 154 (10.3) |                      |
| Yes                                  | 375 (21.5)                     | 301 (23.7)                      | 260 (70.3)   | 52 (11.6)           | 63 (18.1)  |                      |
| <b>Cancer</b>                        |                                |                                 |              |                     |            | 0.301                |
| No                                   | 1,546 (91.4)                   | 1,059 (88.5)                    | 1,094 (73.0) | 259 (15.4)          | 193 (11.6) |                      |
| Yes                                  | 156 (8.6)                      | 138 (11.5)                      | 103 (66.6)   | 29 (17.8)           | 24 (15.6)  |                      |
| <b>Bronchitis or asthma</b>          |                                |                                 |              |                     |            | 0.006                |
| No                                   | 1,434 (84.9)                   | 985 (83.0)                      | 1,014 (72.9) | 251 (16.2)          | 169 (10.9) |                      |
| Yes                                  | 268 (15.1)                     | 212 (17.0)                      | 183 (69.7)   | 37 (12.7)           | 48 (17.6)  |                      |
| <b>Arterial hypertension</b>         |                                |                                 |              |                     |            | 0.059                |
| No                                   | 696 (41.9)                     | 416 (34.9)                      | 496 (74.2)   | 122 (16.4)          | 78 (9.4)   |                      |
| Yes                                  | 1,006 (58.1)                   | 781 (65.1)                      | 701 (71.2)   | 166 (15.0)          | 139 (13.8) |                      |
| <b>Cardiovascular disease</b>        |                                |                                 |              |                     |            | ≤0.001               |
| No                                   | 1,224 (71.9)                   | 806 (67.8)                      | 860 (72.6)   | 232 (17.7)          | 132 (9.7)  |                      |
| Yes                                  | 478 (28.1)                     | 391 (32.2)                      | 337 (72.0)   | 56 (10.2)           | 85 (17.8)  |                      |
| <b>Stroke or cerebral infraction</b> |                                |                                 |              |                     |            | ≤0.001               |
| No                                   | 1,550 (91.9)                   | 1,062 (90.2)                    | 1,109 (73.7) | 207 (16.2)          | 171 (10.1) |                      |
| Yes                                  | 151 (8.1)                      | 135 (9.8)                       | 88 (59.6)    | 18 (9.4)            | 45 (31.0)  |                      |
| <b>Kidney disease</b>                |                                |                                 |              |                     |            | ≤0.001               |
| No                                   | 1,624 (95.9)                   | 1,142 (95.4)                    | 1,158 (73.3) | 277 (15.8)          | 189 (10.8) |                      |
| Yes                                  | 77 (4.1)                       | 55 (4.6)                        | 39 (51.9)    | 11 (11.1)           | 27 (37.0)  |                      |

a) Pearson chi-square test.

deficit, 8.1% ran into suspicion of depression, and 21.1% fell. Besides, regarding the first reply recorded in the baseline research, 24.8% of the elderly reported, at the time of follow-up, fewer diseases, 10.6% had come to evaluate their own health as worse, 11.2% had become physically active, 24.3% had reduced the consumption of fruits and vegetables, 9.8% began to consume alcohol, 5.8% no longer presented positive screening for cognitive deficit, and 9.3% no longer reported dependency in activities of daily life.

## Discussion

Based on the results, it was possible to observe that, after four years of follow-up, most of the elderly did

not present major changes in their sociodemographic, behavioral, and health characteristics, with the exception of the number of morbidities. Overall, more than one third of the assessed sample developed one or more chronic diseases between the baseline and the follow-up of the study, whilst 24.8% reported fewer diseases.

In longitudinal studies like this, the design and the conducted analysis show a tendency of increase in the occurrence of diseases, and conditions related to the population aging. Thus, the increase in prevalence of chronic non-communicable diseases (NCD) was expected, since this is a condition inherent to the aging process, related to anatomical, physiological, and functional aging changes (e.g. weight reduction and cerebral blood flow), and with the increase of

physical inactivity, unhealthy diet and overweight.<sup>17</sup> We highlight that, in spite of having found a reduction in the number of self-reported NCD between some of the elderly, the increase in number of those morbidities was over 40.0%.

It was also possible to observe the preservation of the high percentage of elderly with daily fruit and vegetable consumption fall short of the recommendations of the World Health Organization (WHO),<sup>11</sup> in addition to their report of being inadequately active and, most of them, being overweight. As noted by WHO,<sup>11</sup> most cases of chronic diseases would be possible to present through the adoption of some measures, such as a regular combined consumption of fruits and vegetables more than five servings/day, a regular practice of physical activity, and a reduction in weight.

Despite these recommendations and the existence of other measures in Florianópolis, such as the Floripa Ativa Programme,<sup>18</sup> focused on health promotion and prevention of chronic degenerative diseases among residents of the city, the results of this study indicate that such initiatives may still be insufficient for the elderly population. The concern with that scenario is justified: at higher ages, the NCD exert important deleterious impact on health, reducing functional and cognitive capacity.<sup>19</sup>

Regarding the dependency on performing daily life activities, the proportion of elderly people with independency was the highest, from the first to the second evaluation. We believe that a possible explanation for this finding is in survival bias, since the disability was associated with increased risk of mortality and, thus, may have reduced the share of elderly people with dependence due to death.<sup>20</sup> Mortality among elderly people with dependence on 4 or more activities was 25.8%, compared to 3.6% among those without dependency.<sup>20</sup> Moreover, the percentage of elderly people who become dependents (11.2%) was very close to the same percentage of whom were no longer dependents (9.3%), featuring a balance in this status changing.

Though most respondents reported not using the Internet, the proportion of those who make use of this communication tool has risen 8.2%, indicating that this population lives a digital inclusion process. Other inquiries shows that elderly Internet users maintain a healthier lifestyle,<sup>21,22</sup> demonstrating enhanced cognitive<sup>23</sup> and functional<sup>21</sup> capacity.

The positive self-rated health increased by 15.2%, and 44% of the elderly kept this perception, a fact that may have contributed to their higher independence and autonomy.<sup>24</sup> Internet use provides digital inclusion, especially important for the elderly, which may reflect positively on the adoption of healthy habits,<sup>22</sup> higher self-esteem, greater self-confidence and mental health benefits,<sup>25</sup> contributing to health maintenance and/or improvement.

Especially in terms of mental health, most of the respondents remained without cognitive deficit and without suspicion of depression, between both evaluations. Similar results were observed in longitudinal research on the elderly in the city of Juiz de Fora, Minas Gerais state,<sup>26</sup> in which most of them remained free from depressive symptoms after 16 months of follow-up. Nevertheless, it is worth noting that 8.1% of the elderly began to show symptoms of depression, and 10.2% began to present possible cognitive deficit, between the baseline and the follow-up of the study. Such results raise the attention of public managers and health professionals, and the need for clinical investigations aiming early diagnosis of both conditions, seeking to avoid the negative impact of these diseases on the quality of life of the elderly population.

Falling have also been a source of much concern for global public health, as its prevalence tends to increase with age, and its consequences assume greater significance.<sup>27</sup> Although most of the elderly have not mentioned falls during the assessments of this study, 21.1% began to suffer these accidents. Regardless of institutions, such as WHO and the Ministry of Health, have been addressing this issue, the number of falls among the elderly has increased.<sup>27</sup> The design and implementation of more effective action strategies, educational and informative campaigns in different areas of the community, may suit a democratization of prevention, planning and construction or adaptation of accessible environments not only for the elderly but also to the general society. A good example of these actions is the Health Handbook (Caderneta da Saúde),<sup>18</sup> distributed by *Capital Idoso* from Florianópolis, with various instructions on healthy habits, including measures for preventing falls.

Population aging and the development of NCD represent a new challenge to health managers. Being long-term diseases, they raise the demand for care and treatments, further increasing spending on health services, and



**Table 2 – Changes in sociodemographic, behavioral variables and health conditions of the elderly in EpiFloripa Idozo health survey, in the city of Florianópolis, SC, 2009-10 and 2013-14**

| Variables   | no. | % (CI95% <sup>a</sup> ) |
|---|-----|-------------------------|
| <b>Marital status (n = 1,197)</b>                 |     |                         |
| Remained accompanied                              | 637 | 53.4 (49.3;57.4)        |
| Status changed                                    | 102 | 8.3 (6.6;10.4)          |
| Remained not accompanied                          | 458 | 38.3 (34.3;42.4)        |
| <b>Family arrangement (n=1,197)</b>               |     |                         |
| Remained living alone                             | 152 | 13.2 (10.7;16.1)        |
| Remained living accompanied                       | 918 | 76.0 (72.1;79.5)        |
| Began to live alone                               | 90  | 7.7 (6.0;10.0)          |
| Began to live with companion                      | 37  | 3.1 (2.1;4.5)           |
| <b>Work (n=1,090)</b>                             |     |                         |
| Remained working                                  | 78  | 7.4 (5.6;9.6)           |
| Status changed                                    | 156 | 14.6 (12.0;17.7)        |
| Remained without work                             | 856 | 78.0 (74.3;81.2)        |
| <b>Self-rated health (n=1,139)<sup>b</sup></b>    |     |                         |
| Kept negative health self-perception              | 365 | 29.8 (26.6;33.2)        |
| Began to have positive health self-perception     | 174 | 15.2 (12.7;18.1)        |
| Began to have negative health self-perception     | 130 | 10.6 (8.8;12.9)         |
| Kept positive health self-perception              | 468 | 44.0 (39.8;49.0)        |
| <b>Internet use (n=1,195)</b>                     |     |                         |
| Continued to use the Internet                     | 228 | 20.9(16.8-25.7)         |
| Ceased to use the Internet                        | 38  | 3.4(2.2-5.1)            |
| Began to use the Internet                         | 90  | 8.2(6.5-10.2)           |
| Continued not using the Internet                  | 839 | 67.5(62.5-72.2)         |
| <b>Smoking habit (n=1,195)</b>                    |     |                         |
| Remained not smoking                              | 701 | 57.5 (54.0;61.0)        |
| Remained smoking                                  | 422 | 37.3 (33.7;41.90)       |
| Ceased smoking                                    | 30  | 2.1 (1.4;3.3)           |
| Began to smoke                                    | 42  | 3.0 (2.1;4.3)           |
| <b>Consumption of alcohol (n=1,197)</b>           |     |                         |
| Continued without consumption of alcohol          | 652 | 53.3 (48.7;57.7)        |
| Continued consuming alcohol                       | 330 | 27.9 (24.1;32.1)        |
| Ceased to consume alcohol                         | 99  | 9.0 (7.4;10.9)          |
| Began to consume alcohol                          | 114 | 9.8 (8.9;12.1)          |
| <b>Leisure-time physical activities (n=1,197)</b> |     |                         |
| Continued inactive/inadequately active            | 691 | 56.3 (51.0;61.4)        |
| Continued physically active                       | 175 | 15.7 (12.8;19.3)        |
| Became inactive/inadequately active               | 188 | 16.8 (13.2;21.1)        |
| Became physically active                          | 139 | 11.2 (9.1;13.7)         |
| <b>Fruit and vegetable consumption (n=996)</b>    |     |                         |
| Continued to consume <5 daily servings            | 655 | 57.3 (53.0;61.4)        |
| Continued to consume ≥5 daily servings            | 16  | 1.2 (0.07;2.1)          |
| Began to consume <5 daily servings                | 274 | 24.3 (21.0;27.9)        |
| Began to consume ≥ 5 daily servings               | 185 | 17.2 (14.3;20.6)        |

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Table 2 – Conclusion

| Variables  | no. | % (CI95% <sup>a</sup> ) |
|--|-----|-------------------------|
| <b>Nutritional status (n=1,146)</b>                |     |                         |
| Continued overweight                               | 526 | 47.0 (43.4;50.6)        |
| Moved to low weight/appropriate weight             | 84  | 7.4 (5.8;9.2)           |
| Moved to overweight                                | 92  | 8.4 (5.8;9.2)           |
| Continued with low weight/appropriate weight       | 429 | 37.3 (34.5;40.1)        |
| <b>Dependency on daily life activity (n=1,193)</b> |     |                         |
| Continued without dependency                       | 720 | 60.5 (57.1;63.7)        |
| Continued with dependency                          | 227 | 19.0 (16.6;21.7)        |
| Ceased to have dependency                          | 101 | 9.3 (7.3;11.8)          |
| Began to have dependency                           | 145 | 11.2 (9.2;13.5)         |
| <b>Screening for cognitive deficit (n=1,177)</b>   |     |                         |
| Kept negative tracing                              | 788 | 69.4 (64.7;73.7)        |
| Began to have positive tracing                     | 122 | 10.2 (7.9;13.1)         |
| Began to have negative tracing                     | 85  | 5.8 (4.1;8.1)           |
| Kept positive tracing                              | 184 | 14.5 (11.2;18.7)        |
| <b>Depressive symptoms (n=1,103)</b>               |     |                         |
| Continued normal                                   | 783 | 72.0 (768.6;75.1)       |
| Moved to suspicion of depression                   | 94  | 8.1 (6.5;10.0)          |
| Moved to normal                                    | 102 | 8.9 (7.0;11.4)          |
| Continued with suspicion of depression             | 124 | 11.0 (8.6;13.9)         |
| <b>Fall on previous year (n=1,197)</b>             |     |                         |
| Continued without falls                            | 705 | 60.6 (57.0;64.1)        |
| Began to suffer falls                              | 263 | 21.1 (18.2;24.5)        |
| Ceased to suffer falls                             | 127 | 10.5 (8.5;13.1)         |
| Continued suffering falls                          | 102 | 7.8 (6.4;9.3)           |
| <b>Morbidities: change (n=1,191)</b>               |     |                         |
| Kept same number of diseases                       | 419 | 35.2 (31.7;38.9)        |
| Developed one or more diseases                     | 474 | 40.0 (36.3;43.7)        |
| Decreased number of diseases                       | 300 | 24.8 (21.7;28.1)        |

aa) CI95%: confidence interval of 95%

b) The answer categories of the health self-perception were grouped in positive (very good; good) and negative (average; bad; very bad)

produce a high socioeconomic impact. In Brazil, these diseases constitute one of the major health problems and several actions are being developed,<sup>11,18,28,29</sup> in all spheres of Government, in order to alert about this issue, proposing discussions and eventual changes in the policies of Governments. Measures of NCD prevention and health promotion, in order to avoid or delay the manifestation of these diseases symptoms, may reduce satisfactorily public health spending.<sup>30</sup>

In this sense, intervention measures aimed at identifying preventable and/or treatable causes for non-communicable chronic diseases should be a priority to governmental actions of collective nature, as an effective means to reach the healthy aging of the country's growing elderly population.

Among the positives aspects of this investigation, we highlight the type of study (population-based cohort) and the sampling design (probabilistic sample). Initially, EpiFloripa Idoso Health Survey was designed as a cross-sectional study, but due to its research potential it has been transformed into a cohort with a follow-up of three to four years. Currently, coordinators and members of the involved group plan to continue the follow-up study, maintaining the same time span as default.

A limitation of the study worth highlighting was the possible recall bias in self-reported information, especially when data are collected by means of interviews with elderly people. We also stress the possibility of selection bias, given the non-evaluation of the elderly

hospitalized during the follow-up, who possibly were in worse health conditions. Regarding the losses, less than 10% of the elderly were considered follow-up losses; a rate considered low in studies with this type of design. It is important to remember that the sample calculation considered a 20% increase for losses, in anticipation of its occurrence.

The results found should arouse the attention of public managers and the need to rethink actions aimed at improving the health of elderly people who have maintained and/or negatively altered their conditions (those inadequately active, with unhealthy diet, overweight), as well as the importance of promoting measures for maintenance and/or expansion of the positive conditions (positive self-rated health, no smoking, which do not consume alcohol, no functional dependency, no cognitive deficit, no depressive symptoms, and no falls' reports).

As the demographic, behavioral and health profile of the Brazilian population has been suffering changes over the past 40 years, and that in this scenario the

health care of the elderly is one of the most important challenges for the Brazilian society in the near future, the results of this research can contribute to the scientific basis, development and improvement of governmental actions of health promotion, prevention and treatment of diseases, individual and collective strategies aimed at the main needs of the elderly of Florianópolis and of Brazil.

### Authors' contributions

Confortin SC, Ono LM and Schneider IJC contributed to the conception, planning, analysis and interpretation of data, preparation of the first version, critical revision and approval of the final version of the manuscript. Before DL, Cembranel F, Marques LP, Borges LJ and Krug RR contributed to the design, interpretation of data, preparation of draft, critical revision and final approval of the manuscript. d' Orsi E contributed to the design, critical revision and final approval of the manuscript. All the authors claim to be responsible for all aspects of the study, ensuring its accuracy and completeness.

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