Description of elderly people with frailty in the city of Pereira, 2021

Descripción de las personas mayores con fragilidad en la ciudad de Pereira, 2021

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Abstract

Across the world, aging in the elderly is accompanied by an increase in pathologies, caused by mobility restrictions, physical and psychological problems that characterize the fragile state. The aim of this study was to analyze the spatial distribution of frail people aged ≥60 years in Pereira, a Colombian city. This was a cross-sectional study including 505 participants. Regarding geolocation, Google Earth and Qgis 2.16 software were used to create maps by neighborhoods and blocks and maps according to frailty. In total, 4.4% of the people aged ≥60 years were classified as at risk of frailty, of which a significant relationship was found with disability, nutritional status and falls with a mean age of 71 years. Frailty distribution was shown to be unequal in the city's neighborhoods, with women being more frequently affected. The information will favor public health decision makers to plan and manage strategies to meet the needs of the population, whose geolocation will allow to provide better living conditions in old age.

Keywords: Spatial analysis; Elderly; Frailty; Medical geography.

Resumen

En el mundo, el envejecimiento de las personas mayores va acompañado de un aumento de patologías, provocadas por restricciones de movilidad, problemas físicos y psicológicos que caracterizan el estado frágil. El objetivo de este estudio fue analizar la distribución espacial de las personas mayores con fragilidad en la ciudad de Pereira. Se trata de un estudio transversal con una muestra de (n=505) participantes, en cuanto a la geolocalización, se utilizó el software Google Earth y Qgis 2.16, para elaborar los mapas por barrios y manzanas y según la fragilidad. En

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total, el 4,4 % de las personas de 60 o más años fueron clasificados en riesgo de fragilidad, de los cuales se encontró una relación significativa con la discapacidad, estado nutricional y caídas, con una edad media de 71 años de los participantes. La organización de la fragilidad mostró una distribución desigual en los barrios en el territorio, con mayor compromiso de las mujeres. La información favorecerá a los tomadores de decisiones en salud pública para planificar y gestionar estrategias de atención a las necesidades de la población que al ser georrefenciada permitirá poder brindar mejores condiciones de vida en la vejez.

Palabras clave: Análisis espacial; Adulto mayor; Fragilidad; Geografía médica.

Introduction

In the world, old age has gained attention because of both physiological and pathological effects leading to an impaired health condition[1]. The concept applies to people ≥60 years of age[2]. It is estimated that by 2050 such population will virtually double from 12% to 22%, reaching approximately 2 billion people[3–5]. Aging may be associated with an increase in pathologies resulting from mobility restrictions, physical and psychological problems characterizing the frail state[6]. Thus, frailty is a clinical syndrome affecting >10% of the elderly in the world and its prevalence increases at advanced ages. It is related to a dynamic process based on the downward path of physical function during aging, which may lead to functional loss and is associated with adverse outcomes ranging including falls[7], from disability and hospitalization requirement to death[8,9] and multimorbidity[10].

As a result of the different approaches and measurement methods, there is no standard definition for frailty. Prevalence of the frail condition in older people in the community varies greatly (between 4% and 59%)[11], which makes it difficult to adopt preventive measures to minimize its occurrence and adverse outcomes[12]. This situation is more evident in developing countries such as Colombia, due to the large inequality gap in the provision of health services in preventive care[13], which adds to various socioeconomic components, barriers to access and mobilization, and the difficulties for a timely diagnosis[14,15]. According to the National Study on Health, Wellbeing and Aging (SABE), frailty reaches up to 17.9%[16], with pre-frail state ranging between 18.7% and 53.1%[17].

On the other hand, geographic information systems are an important tool for epidemiological investigation and surveillance as they integrate medical information with geographic data, environmental and socioeconomic variables, among other data[18]. The process requires knowing information needs, information sources, their organization and storage, use and distribution, all of which is the basis for knowledge creation[19]. This technique allows both early detection and decision-making in any geographical context[18], and distributes health-related states or disease determinants for their control[19]. Consequently, improved access implies the absence of physical or geographical barriers preventing people from using health services[20]. This study was aimed to analyze the spatial distribution of frailty in people aged ≥60 years in Pereira, Colombia in 2021.

Methods

Study design

This was a descriptive study, with a cross-sectional, probabilistic and two-stage design. In the first stage, 51 neighborhoods were selected by the residents in the urban area of the surveyed city of Pereira, Colombia. The city was taken as a secondary unit of the sample by means of systematic random sampling; within each neighborhood, two blocks were selected as the primary unit of the sample, by simple random sampling.

Study population

According to the National Administrative Department of Statistics (DANE), 78,127 people aged ≥60 years. were estimated in 2020[21] in the urban area of Pereira.

Data source

The information was collected between April and June 2021, within the framework of the cross-sectional project "Health and mental well-being of older adults in five cities in Colombia, 2020 (SABAM)"[22]. Pereira is made up of 19 communes with 360 neighborhoods of which, 50 related neighborhoods were considered as a primary unit. by simple random sampling, from which all the elderly people residing in selected neighborhood houses were included.

For frailty screening, coordinates were determined by address and located on a base map from the Google Maps program. The base of the communes and neighborhoods was used and a designation was made

for each point of reference according to gender and frail state classification, to create the geodatabase with the corresponding information. In addition, the highest (red) and the lowest (yellow) frailty prevalence ranges were respectively designated by neighborhoods and blocks using the QGis 2.16 program.

Following frailty classification, the coordinates were manually placed with the data of the elderly in remote areas in the Google Maps program, locating the points of interest on the base map. For projections, information from the Agustín Codazzi Geographic Institute (IGAC) and National Administrative Department of Statistics (DANE) was used in the QGis 2.16 software. Polygons of the census tracts were associated with individualized tables by census tract code and frailty classification, favoring spatial consultation. Based on this information, a map of surveyed neighborhoods was created including frailty proportion by neighborhoods and blocks (**Figure 2**).

Variables

Descriptive variables

Sociodemographic variables included city, age, gender, and household socioeconomic status (SES) of the home classified as low (1-2), medium (3-4) and high (5-6) stratum.

Outcome variable

Frailty was assessed using the FRAIL scale (fatigue, resistance, ambulation, illness, weight loss)[23], this instrument combines elements proposed by Fried and Rockwood in relation to deficits, and allows self-diligence[24,25], an instrument that may be self-completed in less than 5 minutes[25]. The score ranges between 0 and 5 points depending on the evaluated items, with >3 reflecting a frail condition[24]. This outcome variable was related to the sociodemographic variables (city, age, gender, household SES), health status (poor, fair, very good, excellent)[26], comorbidities (yes/no), polypharmacy (≥3 drugs), nutritional status (DETERMINE scale)[27], depressive symptoms (Center for Epidemiological Studies Depression Scale, CES-D)[28], functional status (yes/not physically active), falls (yes/no), disability (yes/no), and basic activities of daily living (ADLs) (Barthel index)[29].

Statistical methods

The categorical variables were described using absolute frequencies and percentages. The population characterization data and frailty components studied are presented as means and percentages with their respective 95% confidence intervals (CI), comparing the groups (frail, pre-frail, non-frail). The free version of the Jamovi 2.3.18 statistical program was used.

To calculate the sample size, the Fleiss finite population formula was used, with a 95% CI for a sample of 381 older people, with a 15% expansion that reached a total of 506 older adults who signed the informed consent.

Results

There were 505 elderly people from the city of Pereira surveyed. Mean age was 69.6 (SD ±7.8) years (range 60-98 years). Approximately 52% were males and more than 45% of both men and women were pre-frail and frail (**Table 1**). Three quarters of the elderly were 60 to 74 years old, of whom 69.3% were pre-frail vs 4.7% who were frail. Regarding educational level, >50% had attended primary school (55.4% pre-frail vs. 5.0% frail). As about household SES, more than three quarters were from low SES (67.2% pre-frail vs 5.0 frail), and 20% of the sample were from middle SES (74.0 pre-frail vs 1.9 frail). About 56% were either on poor or fair health condition. In addition, it was found that approximately 37% of the elderly had ≥2 diseases. Over 55% were taking ≥1 medication, were physically inactive, reported having depressive symptoms and having experienced falls. However, according to the ADLs 61.4% were independent.

Table 1. Characteristics of elderly people as per frailty classification, Pereira, Colombia 2021

Characteristics	Total n = 505	Robust n = 138 (27.3%)	Prefrail n = 345 (68.3%)	Frail n = 22 (4.4%)	X^2	p
Gender						
Female	239(47.3)	62 (44.9)	165 (47.8)	12 (54.5)	0.813	0.666
Male	266(52.7)	76 (55.1)	180 (52.2)	10 (45.5)		
Age						
Early elderly (60-74)	381(75.4)	99 (71.7)	264(76.5)	18(81.8)	2.26	0.688
Late elderly (75-89)	119(23.6)	38 (27.5)	77 (22.3)	4 (18.2)		
Nonagenarian (≥90)	5(1.0)	1 (0.7)	4 (1.2)	0 (0.0)		
Education						
Primary school	284(56.1)	82(59.4)	191(55.4)	11(5.0)	4.42	0.817
High school	127(25.1)	31(22.5)	91(26.4)	5(22.7)		
Technical/university degree	40(7.9)	12(8.7)	25(62.5)	3(13.6)		
Posgraduate study	7(1.4)	1(0.7)	5(1.4)	1(4.5)		
No studies	47(9.3)	12(8.7)	33(9.6)	2(9.1)		
Household SES						
Low (1-2)	399(79.0)	111 (80.4)	268 (77.7)	20 (90.9)	8.15	0.086
Middle (3-4)	104(20.6)	25 (18.1)	77 (22.3)	2 (9.1)		
High (5-6)	2(0.4)	2 (1.4)	0 (0)	0 (0)		
Health condition						
Poor	21(4.2)	11 (8.0)	9 (2.6)	1 (4.5)	9.52	0.300
Fair	265(52.5)	69 (50.0)	184 (53.3)	12 (54.5)		
Good	111(22.0)	32 (23.2)	73 (21.2)	6 (27.3)		
Very good	64(12.7)	16 (11.6)	47 (13.6)	1 (4.5)		
Excellent	44(8.7)	10 (7.2)	32 (9.3)	2 (9.1)		
Comorbidities						
No comorbidities	155(30.7)	45 (32.6)	104 (30.1)	6 (27.3)	12.3	0.056
1	157(31.1)	35 (25.4)	112 (32.5)	10 (45.5)		
2	161(31.9)	54 (39.1)	101 (29.3)	6 (27.3)		
≥3	32(6.3)	4 (2.9)	28 (8.1)	0 (0.0)		
Medications taken						
None	156(30.9)	49 (35.5)	102 (29.6)	5 (22.7)	5.87	0.209
1-3 medications	330(65.3)	81(58.7)	232 (67.2)	17 (77.3)		
≥4 medications	19(3.8)	8 (5.8)	11 (3.2)	0 (0.0)		
Physical activity						
Active	209(41.4)	53 (38.4)	145 (42.0)	11 (50.0)	1.24	0.539
Inactive	296(58.6)	85 (61.6)	200 (58.0)	11 (50.0)		
Disability						
No	366(72.5)	117 (84.8)	242 (70.1)	7 (31.8)	29.6	<.001
Yes	139(27.5)	21 (15.2)	103 (29.9)	15 (68.2)		

Characteristics	Total n = 505	Robust n = 138 (27.3%)	Prefrail n = 345 (68.3%)	Frail n = 22 (4.4%)	X^2	p
Nutritional status						
Good	179(35.4)	58 (42.0)	116 (33.6)	5 (22.7)	20.8	<.001
Moderate nutritional risk	133(26.3)	47 (34.1)	83 (24.1)	3 (13.6)		
High nutritional risk	193(38.2)	33 (23.9)	146 (42.3)	14 (63.6)		
Depression symptoms						
No depression	177(35.0)	40(29.0)	129(37.9)	8(36.4)	3.08	0.215
Depression present	328(65.0)	98(71.0)	216(62.6)	14(63.6)		
ADLs						
Independent	310(61.4)	85 (61.6)	211 (61.2)	14 (63.6)	0.06	0.972
Dependent	195(38.6)	53 (38.4)	134 (38.8)	8 (36.4)		
Falls						
No	448(88.7)	131 (94.9)	302 (87.5)	15 (68.2)	15.1	<.001
Yes	57(11.3)	7(5.1)	43 (12.5)	7 (31.8)		

SES: household socioeconomic status. ADLs: basic activities of daily living

Frailty prevalence was 4.4% (Table 1); components are presented in Table 2. As assessed by means of the FRAIL scale, about 49% of the population reported fatigue and <15% impairment of endurance, ambulation, and balance. It was found that about 45% were hypertensive and <15% suffered diabetes, cancer, chronic obstructive pulmonary disease (COPD), heart disease/failure, angina, asthma, arthritis, stroke or kidney disease. This reflects approximately half of elderly people are affected by cardiovascular diseases, while respiratory diseases affect 8.7% and metabolic disorders about 29%.

Table 2. Elderly people distribution according to the FRAIL scale by gender 2021.

FRAIL scale	Total n = 505	Males n = 239	Females n = 266	X^2	p
Fatigue					
At all times	17(3.4)	7(2.6)	10(4.2)	7.66	0.105
Most of the time	37(7.3)	13(4.9)	24(10.0)		
Part of the time	195(38.6)	108(40.6)	87(36.4)		
Very little time	101(38.0)	94(39.3)	195(38.6)		
Never	61(12.1)	37(13.9)	24(10.0)		
Endurance					
Yes	79(15.6)	40(15.0)	39(16.3)	0.156	0.692
No	426(84.4)	226(85.0)	200(63.7)		
Ambulation					
Yes	50(9.9)	25(9.4)	25(10.5)	0.159	0.690
No	455(90.1)	241(90.6)	214(89.5)		
Balance					
Yes	33(6.5)	17(6.4)	16(6.7)	0.0190	0.890
No	472(93.5)	249(93.6)	223(93.3)		

FRAIL scale	Total n = 505	Males n = 239	Females n = 266	X^2	p
Comorbidities					
High blood pressure					
Yes	237(46.9)	120(45.1)	117(49.0)	0.746	0.388
No	268(53.1)	146(54.9)	122(51.0)		
Diabetes					
Yes	147(29.1)	70(26.3)	77(32.2)	2.12	0.145
No	358(70.9)	196(73.7)	162(67.8)		
Cancer					
Yes	15(3.0)	7(2.6)	8(3.3)	0.224	0.636
No	490(97.0)	259(97.4)	231(96.7)		
COPD					
Yes	19(3.8)	6(2.3)	13(5.4)	3.52	0.060
No	486(96.2)	260(97.7)	226(94.6)		
Heart disease					
Yes	6(1.2)	1(0.4)	5(2.1)	3.16	0.076
No	499(98.8)	265(99.6)	234(97.9)		
Heart failure					
Yes	20(4.0)	7(2.6)	13(5.4)	2.61	0.106
No	485(96.0)	259(97.4)	226(94.6)		
Angina					
Yes	11(2.2)	1(0.4)	10(4.2)	8.57	0.003
No	494(97.8)	265(99.6)	229(95.8)		
Asthma					
Yes	30(5.9)	15(5.6)	15(6.3)	0.0914	0.762
No	475(94.1)	251(94.4)	224(93.7)		
Arthritis					
Yes	76(15.0)	38(14.3)	38(15.9)	0.256	0.613
No	429(85.0)	228(85.7)	201(84.1)		
Stroke					
Yes	7(1.4)	3(1.1)	4(1.7)	0.274	0.600
No	498(98.6)	263(98.9)	235(98.3)		
Kidney disease					
Yes	12(2.4)	7(2.6)	5(2.1)	0.158	0.691
No	493(97..6)	259(97.4)	234(97.9)		

COPD: Chronic obstructive pulmonary disease

In the study, the prevalence of frailty in both old men and women was similar among pre-frail subjects aged 70-74 years and 75-89 years, while three quarters of those aged ≥90 years were males. On the other hand, its prevalence was lower among the frail, equally affecting both genders (**Figure 1**).

According to the map of Pereira communes, frailty is most common in El Triunfo and La Esperanza neighborhoods (**Figure 2**), where its prevalence exceeds 25%.

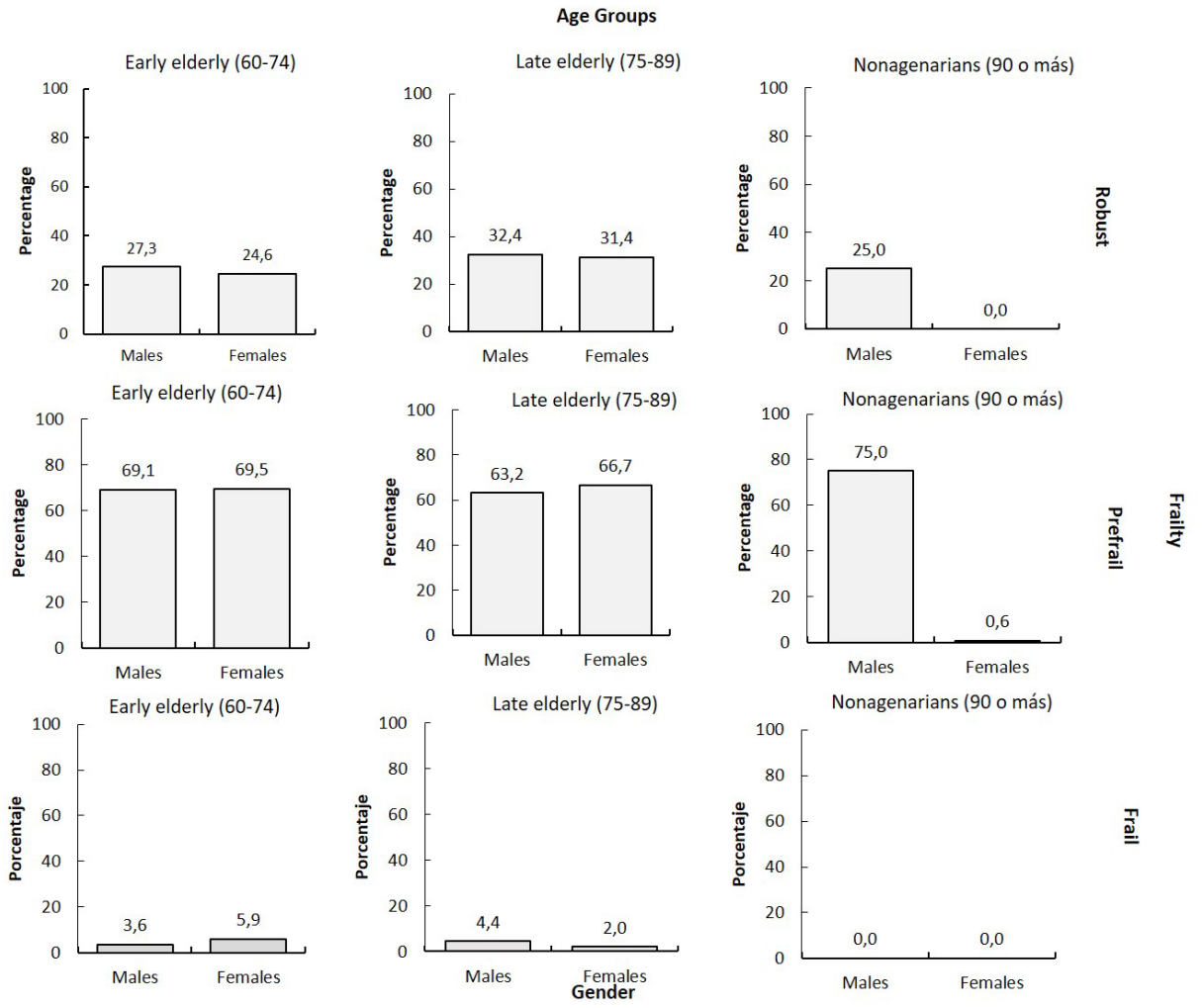

Figure 1. Prevalence of frailty according to gender and age of elderly people in Pereira Colombia 2021.

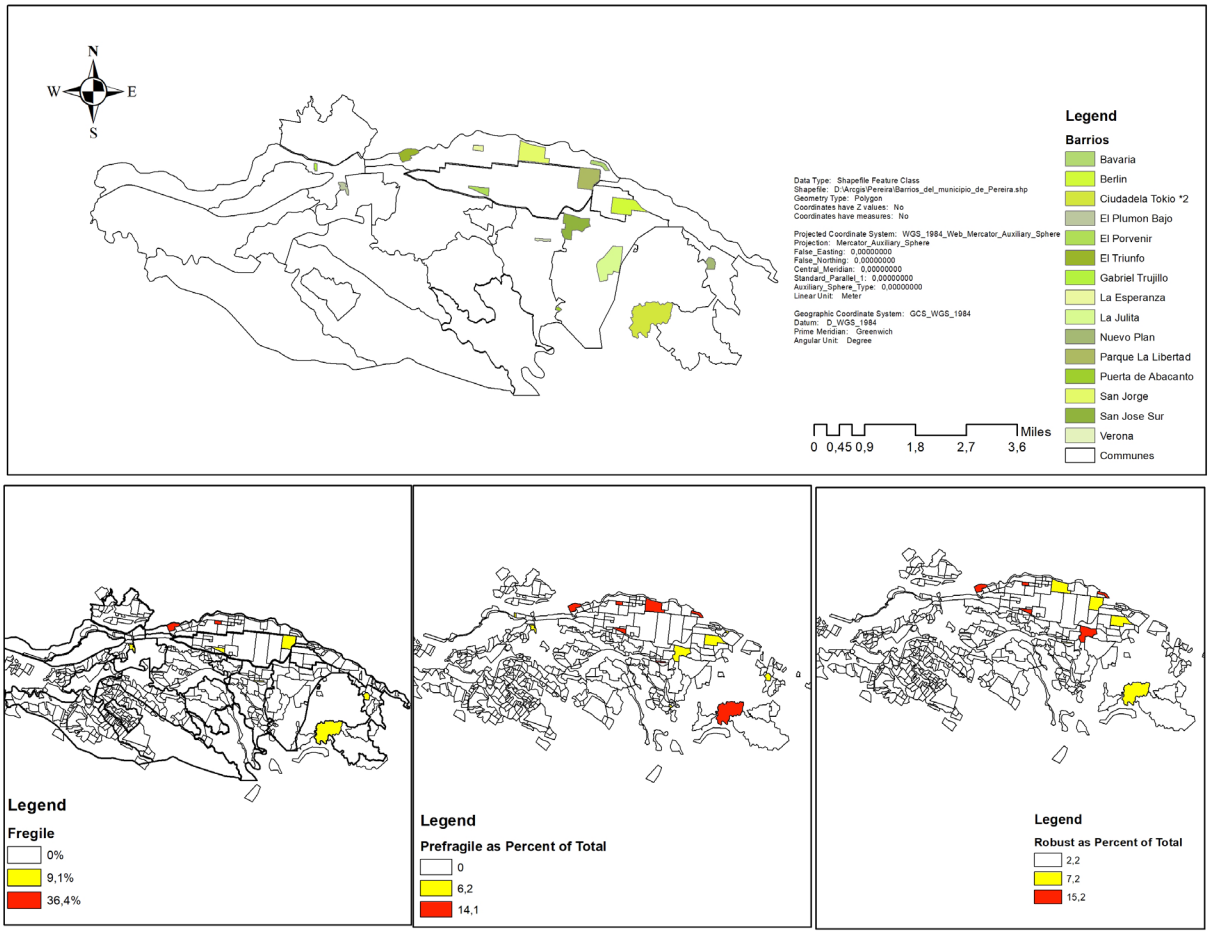

Figure 2. Prevalence of frailty in elderly subjects in Pereira, 2021
Source: the author

Discussion

The prevalence of frailty in elderly people in Pereira is lower than that reported in the SABE for Colombia[16], because this study was carried out in both urban and rural areas and with an instrument for measuring frailty. However, there is similarity to a study reported in Peru, in which it was identified that female gender and low SES are associated risk factors[30], along with the presence of chronic diseases, which add to progressive physical capacity deterioration[10,31]. Therefore, primary health care detection of factors involved in frailty at a community level is important because this may offer an opportunity to identify any changes in elderly people and could also result in delaying progression of the condition.

According to a 2017 Australian geospatial modeling report, the growth of fragile populations in peripheral metropolitan, regional and remote areas can be reduced by targeting health interventions in these areas and improving access to support services[32].

In addition, a relationship with disability is reported, which is similar to what was reported in another study in which it is associated with negative health outcomes[33]. It is associated as it can be marked by loss of independence in a multidimensional process resulting from the interaction between health condition and other individual factors such as age, gender, educational level, social and environmental factors[9,33]. Also, a relationship between fragility and falls was reported, which as mentioned in other research, may be due to weakness in the lower limbs[7]. Likewise, the study identified an association with nutritional status, probably due to inadequate nutrient intake and has also been shown in previous publications[34,35]. As this leads to muscle weakness and physical impairment impacting health condition, timely frailty identification could prevent deficiencies and limitations occurring in the elderly at different times.

Neighborhoods with the highest number of elderly people with frailty (*i.e.*, El Triunfo and La Esperanza) belong to the Rio Otún commune, where the highest concentrations of frail people ≥60 years were seen according to the 2021 DANE report. Frailty was also found among those for whom carrying out any activity was most difficult; consequently, this reflects the need to undertake actions that allow early identification of this pathological condition leading to physical impairment in the elderly[36], and also to implement plans focused on health promotion and disease prevention in the two mentioned neighborhoods. Future implementation of a notification and georeferencing system in the community to establish when a person is at risk of a fragile state in order to facilitate pertaining interventions was proposed.

For frail older people, there are different challenges related to their timely identification, which is why it is recommended to carry out new research on this topic, for the evaluation of the planning and implementation of public policies in this population group. Furthermore, the exploration of frailty is not part of the general medical consultation, and it is important to identify the conditions that are associated in the community, due to their growing interest as part of a continuous accumulation of deficits. The main limitation of the study consists of the type of instrument used to measure frailty, since it presents several phenotypes, which makes comparison between regions difficult.

Conclusions

Georeferencing implementation allows mapping location of vulnerable sectors with older people, which is important for data surveillance and control. It also highlights the need to recognize the changes occurring in the elderly, as in Pereira there is a large number of pre-frail women aged 60-74 years, so that decision makers may make proposals for improving this population health condition.

Authors contribution

VHAC: participated in the macro project, directed the writing of the manuscript. Participated in data analysis and writing of the manuscript, as well as reviewing all versions.
DIMR: participated in the macro project, writing the manuscript, reviewing all versions.
DCA: leader of the macro project, obtaining financing. Manuscript writing, review of all versions.
AMSC: participated in the macro project,design of the statistical component, sampling and analysis. Manuscript writing, review of all versions.
ASC y CRM: participated in the macro project, writing the manuscript, reviewing all versions.
EGG data analysis, writing of the manuscript, review of all versions.

Conflict of interes

The authors do not have any conflicts of interest to disclose.

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The authors report that they did not use Artificial Intelligence, language models, machine learning or similar technologies to create or assist with the elaboration or editing of any of the contents of this document.

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