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Multidimensional Frailty among Community-Dwelling Older Adults: Prevalence, Risk Factors, and Protective Factors

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Abstract

Introduction: Most studies on frailty among older adults have been approached from a physiological perspective, although a multidimensional frailty approach that integrates physical, psychological, and social domains has recently gained attention. **Objective:** To identify the risk and protective factors associated with multidimensional frailty and to estimate the prevalence of frailty from a multidimensional perspective among community-dwelling older adults. **Methods**: An analytical observational study was conducted with 219 community-dwelling older adults. The Odds ratio test and risk calculations were applied. Frailty was measured using the Tilburg Frailty Indicator (TFI). **Results**: The prevalence of frailty was 49.8% overall, 54.2% among women, and 44.6% among men. The following risk factors were identified: balance problems, vision problems, hearing problems, recent onset of chronic illness, multiple pathologies, polypharmacy, recent falls, history of abuse, depressed mood, memory problems, anxiety symptoms, low income, spousal illness, and living alone. In contrast, regular physical activity, positive lifestyle perception, effective coping ability, life satisfaction, and a strong social support network were identified as protective factors. **Conclusion**: Frailty is associated with a combination of physiological, psychological, and social factors, rather than exclusively physical conditions.

Keywords

Older adult; frailty; risk factors; protective factors; community; aging.

Registration

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Fragilidad multidimensional en personas mayores en la comunidad: prevalencia, factores de riesgo y factores protectores

Resumen

Introducción: La mayoría de los estudios sobre fragilidad en personas mayores se han abordado desde una perspectiva fisiológica, aunque recientemente ha cobrado fuerza un enfoque de fragilidad Multidimensional que integra dominios físicos, psicológicos y sociales. **Objetivo**: Determinar factores de riesgo y protectores asociados a fragilidad multidimensional y estimar su prevalencia desde una perspectiva multidimensional en personas mayores que viven en comunidad. **Método**: Estudio observacional analítico con 219 personas mayores de la comunidad, se aplicó prueba de momios y cálculo de riesgo. La fragilidad se midió mediante el Indicador de Fragilidad de Tilburg (IFT). **Resultados**: La prevalencia puntual de fragilidad fue de 49,8%; 54,2% en mujeres y 44,6% en hombres. Se identificaron como factores de riesgo: problemas de equilibrio, problemas de visión y audición, enfermedad crónica reciente, pluripatologías, polifarmacia, caídas recientes, antecedentes de abuso y maltrato, afecto deprimido, problemas de memoria; síntomas de ansiedad, bajos ingresos, enfermedad de la pareja y vivir solo. La actividad física regular; buena autopercepción del estilo de vida, capacidad de afrontamiento, satisfacción con la vida y apoyo social, actuaron como factores protectores. **Conclusión**: la fragilidad está asociada con factores fisiológicos, psicológicos y sociales y no exclusivamente con los físicos.

Palabras clave

Persona mayor; fragilidad; factores de riesgo; factores protectores; comunidad; envejecimiento.

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1. Introduction

The process of individual aging, viewed from a holistic and multidimensional perspective, is one that individuals experience throughout the life course. It is an inherent process of human life -universal, heterogeneous, and irreversible- and is understood as a multidimensional phenomenon involving all dimensions of human existence. Castanedo, as cited in Alvarado and Salazar (2014), defines aging as the set of transformations and/or changes (biochemical, physiological, morphological, social, psychological, and functional in nature) that occur in the individual throughout life; it is the result of the passage of time acting upon living beings.

Functional capacity is a central concept, as the World Health Organization defines healthy aging in a broad sense, grounded in both the life-course and functional perspectives. It is understood as the process of fostering and maintaining the functional ability that enables well-being in older age. Functional capacity encompasses health-related attributes that allow a person to pursue and engage in what they value. It comprises an individual's intrinsic capacity, the environmental characteristics that affect that capacity, and the interactions between the individual and those characteristics (World Health Organization, 2015).

A process of physiological aging, combined with suboptimal interactions with the environment, leads to a reduction in the reserve capacity to adapt to external stressors and further undermines the individual's ability to cope with risks and contingencies arising from stressful factors. This condition is commonly referred to as frailty.

Frailty is a key concept in the literature on aging, closely linked to chronological age, functional capacity, and dependency. Researchers and clinicians today are aware of the relationship between the development of frailty, living conditions, and the events and trajectories experienced throughout the life course. They have also reached, within the academic field, a broad consensus on the need to continue advancing on the conceptualization and measurement of frailty from a more eclectic perspective, rather than restricting it solely to the clinical domain or the physiological dimension. For this reason, population-based and epidemiological studies are needed, adopting a multidimensional view of the phenomenon that may lead to a better understanding.

In this context, Gobbens, Luijkx, Wijnen-Sponselee, & Schols (2010) formulated a comprehensive definition of frailty that incorporated the essential components of existing conceptual definitions. According to them, frailty is a dynamic state that affects an individual experiencing losses in one or more domains of human functioning (physical, psychological, social), resulting from the influence of a range of variables and leading to an increased risk of adverse outcomes. This model advocates an integrative approach, describing the pathway from frailty to adverse outcomes and differentiating between the concepts of physical frailty, psychological frailty, social frailty, disability, and comorbidity.

The Tilburg Frailty Indicator (TFI), derived from this theoretical model, was selected for the present study because it operationalizes frailty as a multidimensional construct and has demonstrated adequate psychometric properties across diverse cultural contexts and community-based populations. Recent systematic reviews and validation studies continue to support the TFI as one of the most widely used instruments for assessing multidimensional frailty in community-dwelling older adults due to its conceptual coherence, feasibility, and ability to simultaneously capture physical, psychological, and social vulnerabilities (Vrotsou et al., 2018; Gobbens, 2023). Furthermore, its multidimensional structure aligns with contemporary healthy aging frameworks proposed by the World Health Organization, which emphasize the interaction between individual capacities and contextual factors. Consequently, the TFI was considered particularly suitable for identifying both risk and protective factors associated with frailty beyond the traditional biomedical perspective.

Based on the foregoing, the study aimed to identify risk and protective factors for multidimensional frailty, as well as to determine its prevalence.

2. Theoretical framework

2.1. Frailty

During the aging process, physiological age-related changes occur, leading to a progressive increase in the risk of losing functional independence. The confluence of at least three conditions in older adults contributes to the development of disability: age-related physiological changes, the individual's adopted lifestyle, and underlying health conditions.

Human aging is a process characterized by the gradual decline of multiple physical and cognitive capacities, which contributes to greater morbidity and mortality. Given the challenges and complexity of caring for older adults, maintaining functional independence throughout the lifespan constitutes one of the most important and ambitious goals in contemporary gerontology.

Frailty is a condition that differs from aging, comorbidity, and disability. However, it must be acknowledged that it is linked to an increased risk of adverse health outcomes in older adults (Bergman et al., 2007). In its early conceptualization, frailty was used to describe a predominantly physiological or biological syndrome, resulting from a reduced capacity of the organism to maintain homeostasis. This entails loss of resistance to stress, thereby increasing older adults' vulnerability to multiple adverse outcomes, including greater utilization of health services, a higher risk of immobility, disability, and mortality (Bergman et al., 2004).

At present, there are several models used to study frailty. Among the numerous available assessment tools, the most widely used is the physical frailty phenotype, as operationalized by Fried et al. (2001). According to these authors, frailty corresponds to "a syndrome of decreased reserves and resistance to stressors, resulting from cumulative declines across multiple physiological systems, leading to vulnerability to adverse health outcomes, including falls, hospitalization, and mortality." This is one of the most widely accepted definitions in both academic and clinical contexts, although it has been criticized for focusing only the physical aspects of frailty.

On the other hand, the literature also identifies other, more integrative models, such as the deficit accumulation model proposed by Rockwood and Mitnitski (2011), which posits that as individuals age, they accumulate deficits that ultimately manifest as frailty. According to this model, the accumulation of subcellular deficits gives rise to clinically observable deficits, either through clinical manifestations or diagnostic testing. As damage progresses -from the molecular to the cellular level, and from tissues to organs- almost all diseases that appear in adulthood become more common with age, although the role of age itself as the cause of disease remains a matter of debate. Finally, the multidimensional model -which, in addition to the physical dimension, also incorporates the psychological and social dimensions of frailty- defines it as "a dynamic state affecting an individual who experiences losses in one or more domains of human functioning (physical, psychological, social), resulting from the influence of multiple variables and leading to an increased risk of adverse outcomes" (Gobbens, et al., 2010). There is no consensus among these approaches as to whether frailty should be understood as a syndrome limited exclusively to the physical dimension or as a truly multidimensional construct.

Lately, multidimensional approaches have become much more relevant because they recognize that vulnerability in old age goes beyond simple biological decline. Factors like psychological well-being, social connections, living environments, and life experiences are now seen as key drivers of frailty, particularly among community-dwelling older adults. Because of this, looking at the whole picture offers a far deeper understanding of frailty than just focusing on physical deficits.

At this point, although the existence of frailty is recognized, there is still no universally accepted definition or set of criteria to describe and identify it. The various definitions and conceptualizations of frailty encompass multiple components, including physical capacity, cognitive function, psychological characteristics, and social factors (Rockwood, 2005; Gobbens et al., 2010; Morley, 2015; Bunt et al., 2017). As a contribution

to the ongoing debate supporting a multidimensional approach to the phenomenon, this study adopts the concept of frailty proposed by Gobbens, et al. (2010).

This study specifically adopted the multidimensional model proposed by Gobbens et al. (2010) because it conceptualizes frailty as the interaction of physical, psychological, and social vulnerabilities. This perspective was considered particularly appropriate given the community-based nature of the study. Unlike models focused predominantly on biological deficits, this framework allows the inclusion of psychosocial and contextual determinants that may influence health trajectories in later life.

Frailty was evaluated through the Tilburg Frailty Indicator (TFI), which has been widely used internationally among community-dwelling older adults and is one of the most frequently employed instruments for measuring multidimensional frailty. Its key strength lies in its ability to simultaneously evaluate physical, psychological, and social domains through a brief assessment procedure. Recent studies continue to support its psychometric robustness, construct validity, and predictive capacity for adverse outcomes such as disability, reduced quality of life, healthcare utilization, and mortality (Gobbens, Boersma, Uchmanowicz, Santiago, 2020; Zamora-Sánchez et al., 2022; Balasch-Bernat et al., 2023).

The literature review conducted for this study did not identify published investigations employing the TFI among Colombian community-dwelling older adults, highlighting the relevance of generating evidence in this context.

2.2. Prevalence of Multidimensional Frailty

In the available literature, numerous studies have examined the prevalence of frailty in different contexts, such as among community-dwelling older adults (Collard et al., 2012) and hospitalized populations (Cunha et al., 2019). However, these assessments have primarily relied on the physical frailty phenotype proposed by Fried et al. (2001), despite the robust evidence highlighting the importance of a multidimensional approach to frailty (Pilotto et al., 2020; Rodríguez-Mañas et al., 2013; Turner & Clegg, 2014). According to Veronese et al. (2021), adopting a multidimensional approach to frailty could help design more targeted interventions for its earliest stages, which require more intensive support. This, in turn, could prevent the progression of functional decline and, eventually, disability.

Findings from multiple studies reveal substantial differences in the prevalence of frailty, which are believed to result from variations in approaches and, consequently, in the types of measurement applied to identify it. In this regard, Kelly et al. (2017) reported a frailty prevalence of 41.5% among community-dwelling older adults in Dublin, assessed using the Clinical Frailty Scale (CFS). In another study conducted with the same population, however, different prevalence rates were observed: 28% based on the Fried phenotype, 59% using the deficit accumulation model, and 63% according to the multidomain definition. Similarly, Collard et al. (2012) analyzed 21 community-based cohort studies comprising 61,500 older adults and found that operational definitions of frailty and inclusion/exclusion criteria varied considerably across studies. These differences largely explained the substantial variation in reported prevalence rates, which ranged from 4.0% to 59.1%. Once again, the lack of consensus regarding the definition and identification of frailty at the global level becomes evident.

The variability observed across prevalence estimates reflects differences in the conceptualization and measurement of frailty. Studies employing multidimensional instruments such as the TFI frequently report prevalence patterns that differ from those obtained using exclusively physical models, highlighting the importance of explicitly defining the theoretical framework underlying frailty assessment.

2.3. Frailty, Functioning, and Aging

Many of the attributes of frailty also apply to the aging process, to such an extent that it is often difficult to clearly distinguish between the two. The process of aging leads individuals to accumulate deficits across

multiple physiological systems, making them increasingly vulnerable to adverse outcomes. Bergman et al. (2007) noted that vulnerability and decline associated with frailty are inextricably linked to the aging process.

Chronological age is only a proxy measure of an individual's vulnerability to adverse outcomes. Some individuals appear frail at a relatively early age -for example, around 70 years- while others do not exhibit frailty until two decades later. If the concept of frailty allows for a more direct and quantifiable assessment of vulnerability, it could have significant implications in gerontological and geriatric research and practice.

Variable susceptibility to frailty may be attributed to genetic traits as well as to behavioral, environmental, and social determinants. Some studies have reported that a frailty measure incorporating a wide range of deficits -including functional limitations, morbidity, psychosocial status, and cognitive capacity- serve as a stronger predictor of autonomy, institutionalization, and mortality than chronological age alone (Rockwood et al., 2006).

Conversely, findings from several studies suggest that some or all manifestations of frailty arise from an underlying process distinct from aging, but although more likely to develop and progress alongside it. The proposed mechanism leads to multisystem damage that manifests as a constellation of symptoms and disorders identifiable as components of a syndrome. Bergman et al. (2007) argued that the elements of this syndrome are linked in a pathophysiological cascade that generates a downward spiral, and also serve as diagnostic criteria. Identifying the underlying process may offer an opportunity for intervention, and thus alter its course.

The concept of frailty was, for a significant period, used interchangeably with disability. However, it is now recognized as a distinct yet closely related phenomenon.

Disability, on the other hand, is defined as a condition characterized by difficulty or dependency in performing essential activities necessary for independent living, including basic activities of daily living and self -care tasks- such as living independently at home and carrying out personally desired activities that are important for one's quality of life (Fried, Ferrucci, Darer, Williamson, & Anderson, 2004).

The International Classification of Functioning, Disability and Health provides a more precise and updated conceptual framework: the concept of functioning can be considered a broad term referring to all body functions, activities, and participation. Similarly, disability encompasses impairments, activity limitations, and participation restrictions (World Health Organization, 2001).

Frailty is the main risk factor for disability, underscoring the critical importance of studying this condition. Once the threshold of frailty is surpassed, disability emerges; according to some authors, reversing disability once it has been established is unlikely (Ferrucci et al., 2002). Frailty, however, is considered a reversible condition, sometimes even without specific intervention. The effectiveness of certain interventions has been demonstrated, particularly those based on nutritional strategies as well as those involving physical exercise (Pahor et al., 2014).

Factors Associated with Frailty

A wide range of studies has identify factors associated with frailty from physiological, biomedical, and comprehensive multidimensional perspectives.

From a biomedical approach, Liu et al. (2016) demonstrated that slow gait speed was associated with inflammation. This result aligns with broader evidence linking chronic systemic inflammation to frailty and cardiovascular disease (Furman et al., 2019). Similarly, Fernándes et al. (2021) reported that frailty or pre-frailty was associated with cardiovascular risk, independent of sociodemographic and clinical confounders.

Recognizing physical frailty as a major health challenge, recent multidimensional models identify chronic disease, low physical activity, cognitive decline and weak social integration as modifiable predictors and mediators, highlighting the need for comprehensive social and behavioral interventions (Hoogendijk et al., 2019).

Frailty is also strongly associated with cognitive decline. Recent evidence confirms that physical frailty components, such as decreased grip strength and slowed gait speed, correlate with poorer cognitive performance and an increased risk of mild cognitive impairment and dementia (Hoogendijk et al., 2019; Pilotto et al., 2020). These findings consolidate the concept of cognitive frailty as a distinct syndrome encompassing both physical and cognitive dimensions, requiring specific clinical attention.

From a more integrative perspective, multidimensional assessment of frailty confirm that the physical, psychological, and social components of frailty significantly and independently impact overall quality of life, even after controlling for sociodemographic factors and multimorbidity (Gobbens & Van Assen, 2018; Hoogendijk et al., 2019).

Furthermore, socioeconomic inequalities significantly influence the trajectory of frailty. Longitudinal evidence demonstrates that low education and low income are strongly associated with a higher risk of frailty progression, with these inequalities being particularly pronounced among older men (Hoogendijk et al., 2019).

Finally, establishing reference values for multidimensional tools like the Tilburg Frailty Indicator (TFI) across diverse sociodemographic variables is crucial. These reference values enable researchers and policymakers to accurately interpret frailty scores and tailor interventions to mitigate adverse outcomes across different population subgroups (Gobbens & Van Assen, 2018).

3. Methodology

An analytical observational study was conducted with 219 community-dwelling individuals aged 60 and older, residing in the Department of Quindío. To ensure robust representation of the target population, we employed a stratified random sampling design. The sampling frame encompassed 89,696 community-dwelling older adults residing in the urban sectors of the study region. We calculated the required sample size using the finite population formula, establishing a 90% confidence level, a 6% margin of error, and an expected proportion of 50%. This yielded a minimum target of 219 participants. Stratification was geographically anchored across the 12 municipalities within the study area, treating each as a distinct stratum. Allocation was then executed proportionally, reflecting the relative size of the older adult population in each municipality, followed by simple random sampling within these specific geographic boundaries.

We adopted the 50% expected proportion under the assumption of maximum variability, a decision necessitated by the lack of baseline epidemiological data on multidimensional frailty within this specific context. While existing literature offers prevalence estimates for frailty, these figures exhibit marked heterogeneity across different regions and cohorts. This variability largely stems from divergent sociodemographic and cultural landscapes, compounded by the wide array of theoretical models and operational definitions of frailty applied in prior research. Extrapolating prevalence rates from disparate settings risked introducing selection bias by imposing unverified epidemiological patterns onto our target population. Consequently, applying the maximum variability criterion ($p = 0.50$) served as the most conservative methodological safeguard, effectively minimizing the risk of underpowering the study.

Restricting the sample to urban-dwelling older adults was a deliberate methodological choice to ensure contextual homogeneity. Urban and rural environments diverge significantly across multiple dimensions of aging, including sociodemographic profiles, accessibility to healthcare, social services and social support networks. Each of these factors intricately shapes the manifestation and trajectory of multidimensional

frailty. Merging these distinct populations within a single sampling framework would have introduced confounding variability, thereby obscuring the interpretation and comparability of the results. Ultimately, this research aims to establish foundational, locally grounded evidence on multidimensional frailty. Such data is critical for informing future epidemiological surveillance, enabling nuanced comparative research, and guiding the design of transdisciplinary interventions dedicated to fostering healthy aging and mitigating dependency in later life.

The study included individuals aged 60 years and older, living in urban areas, who did not present any disability or severe cognitive impairment. Exclusion criteria included individuals unable to complete the Short Physical Performance Battery (SPPB) developed by Guralnik et al., and those who scored above 8 on the Short Portable Mental Status Questionnaire (SPMSQ). The Short Physical Performance Battery (SPPB) was used as an exclusion criterion to identify and exclude individuals with severely impaired functional capacity. By ensuring participants could physically execute the SPPB tasks, the study avoided including those with profound physical decline, mirroring the concurrent exclusion of individuals with advanced cognitive impairment via the SPMSQ. This safeguard guaranteed that the enrolled cohort possessed the minimum physical and cognitive reserves required to reliably complete the comprehensive multidimensional frailty assessments.

Frailty was measured using the Tilburg Frailty Indicator (TFI), which classifies participants as frail when they score positively on five out of fifteen criteria assessing physical, psychological, and social dimensions. Additional instruments included the Short Portable Mental Status Questionnaire (SPMSQ) to determine cognitive functioning; the short-form Geriatric Depression Scale (GDS-SF) to assess affective function; the Short Physical Performance Battery (SPPB) to evaluate functional capacity; and a structured survey designed to identify sociodemographic variables, living conditions, and health-related background information as determinants of frailty. Its purpose was to explore, through self-reporting, adverse living conditions experienced by individuals throughout their lives (early, middle, and late life). Early life: hunger, parental survival, poor health, socioeconomic status, early-age pregnancies; Middle life: socioeconomic status, limited living space, depression, limited physical activity, unhealthy diets, alcohol and tobacco use; Late life: weight/obesity, limited living space, depression, low socioeconomic status (poverty), hunger, lack of education, abuse and maltreatment, comorbidity, self-perceived health, medication use, limited physical activity. This section, as noted, served a descriptive purpose; it did not aim to measure or identify levels of functioning, but rather to identify the perceptions of the individuals in the study.

For data collection, the homes of older adults residing in the various municipalities of the Department of Quindío (Colombia) were visited. These municipalities represented the different population strata. Within each stratum, neighborhoods, blocks, and households with older adults were randomly selected, maintaining proportional representation according to population size. Participation was voluntary: individuals were included if they met the eligibility criteria, agreed to be assessed, and signed an informed consent form.

In defining the variables to be studied, the premise was that frailty is a complex phenomenon involving multiple interrelated factors, and therefore requires a multidimensional approach. Interactions among physiological, psychological, and social dimensions are essential for a comprehensive understanding, enabling the identification of combined risk factors.

The physiological dimension is perhaps the most frequently explored by scholars. It refers to the concept that physical deterioration may compromise an individual's ability to maintain functionality in daily activities. A review of the literature identified variables previously studied that predict decreased functional reserve in older adults. Frailty also has a significant psychological component, as the emotional and cognitive well-being of older adults plays a crucial role in their adaptation and resilience to adverse situations. Thus, depression, anxiety, coping capacity, and cognitive functioning, among others, are critical factors influencing frailty. Finally, the social dimension is fundamental to the analysis of frailty, as the social environment of older adults can shape their ability to face the challenges of aging. Exploring social variables provided insight into how social networks and context influence the frailty process.

Point prevalence of multidimensional frailty was estimated as the proportion of individuals identified as frail at the time of assessment relative to the total evaluated population, applying the standard formula: $P = (a / N) \times 100$, where a represents the number of existing frailty cases and N denotes the total sample size. Prior to inferential testing, the sample was characterized using summary statistics appropriate for each variable's measurement scale; discrete variables were expressed as absolute frequencies and percentages, while continuous variables were described using central tendency metrics according to their distributional properties. To address the study's objectives regarding risk and protective factors, a bivariate analysis was conducted. The Chi-square test (χ^2) determined the statistical significance of associations between the independent variables and frailty status. To quantify the strength and direction of these relationships, crude Odds Ratios (OR) with 95% confidence intervals (95% CIs) were computed. Although Prevalence Ratios (PR) are frequently advocated for cross-sectional designs, the OR was retained and explicitly interpreted as a Prevalence Odds Ratio (POR). This approach maintains consistency with the logistic framework, strictly framing the estimates as measures of prevalent odds-thereby accurately capturing the probability of occurrence for both risk (OR > 1) and protective (OR < 1) factors without implying incident risk.

4. Results

The social and demographic profile of the study participants ranged from 60 to 94 years of age, with a mean age of 70.43 years (±7.8). A higher proportion were women (53.9%). A total of 59.4% of participants came from urban areas, and 95% reported having very low or no current income (below the legal monthly minimum wage, approximately USD 270 at the time). Educational attainment was very low: 75.8% had either never attended school or had not completed primary education. Regarding marital status, 45.2% reported being single and 5% being widowed.

A total of 23.3% of participants reported being currently employed, partly explained by the low proportion of individuals with access to a retirement or survivor's pension, which was only 21.9%. In contrast, 34.7% were women engaged in unpaid household work. Regarding living arrangements, 80.8% of older adults lived with other family members -mostly spouses, children, and/or grandchildren- while 19.2% lived alone, forming one-person households.

Finally, 47.5% of participants reported having a partner. When this information was compared with the previously reported marital status, it suggested that a significant proportion of participants had entered into consensual unions, which in turn may have facilitated cohabitation and the provision of social support (Table 1).

Table 1.
General characteristics of the study population

Variable	Category	n	%
Age (years)	Range: 60 - 94		
	Mean (SD)	70.43 (7.8)	
Sex	Women	118	53.9
	Men	101	46.1
Monthly income	< Legal minimum wage (~USD 270) / None	208	95.0
	≥ Legal minimum wage	11	5.0
Marital status	Single	99	45.2
	Married / In consensual union	104	47.5
	Widowed	11	5.0
	Divorced / Separated	5	2.3

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Variable	Category	n	%
Current employment status	Employed	51	23.3
	Unpaid household work (women)	76	34.7
	Unemployed / Retired / Other	92	42.0
Pension access	Receives retirement /survivor's pension	48	21.9
	No pension access	171	78.1
Living arrangements	Lives with family members	177	80.8
	Lives alone (one-person household)	42	19.2

Note: Author's own elaboration

According to the Tilburg Frailty Indicator (TFI), the point prevalence of frailty within the studied cohort was 49.8%, indicating that nearly half of the participating urban-dwelling older adults met the criteria for frailty. Stratified by sex, frailty was more prevalent among women (54.2%) than among men (44.6%) within this specific sample. (Table 2).

Table 2.

Prevalence of frailty according to the Tilburg Frailty Indicator

Measurement Method	Total		Prevalence Rates			
			Sex			
	Frail	Non- frail	Women		Men	
			Frail	Non-frail	Frail	Non- frail
Tilburg Frailty Indicator	49.8%	50.2%	54.2%	45.8%	44.6%	55.4%

Note: Author's own elaboration

4.1. Factors Associated with Multidimensional Frailty

Three dimensions of human functioning were explored: physiological, psychological, social.

4.1.1. Physiological Dimension

Within the physiological dimension, 18 variables were analyzed. The following section presents the results on risk factors and protective factors within this dimension (Table 3).

Table 3.

Risk Analysis of the Physiological Dimension

Variable	Tilburg Frailty		
	POR[a]	95% CI[b]	p[c]
Balance problems	4.305	2.269 – 8.168	< .001
Slowed gait speed	1.297	.678 – 2.480	.431
Self-reported hearing problems	3.406	1.764 – 6.575	< .001
Self-reported vision problems	6.634	3615–12.173	< .001
Ability to rise from a chair	1.011	.522 – 1.959	.973
Recent chronic illness	2.338	1.352 – 4.043	.002
Multimorbidity	2,002	1.162 – 3448	.012
Polypharmacy	2.058	1.200 – 3.529	.008
Recent falls	3.224	1.367 – 7.606	.005
Hospitalization	1.388	.560 – 3.442	.477

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Variable	Tilburg Frailty		
	POR[a]	95% CI[b]	p[c]
Regular physical activity	0.154	.085 – .278	< .001
Tobacco use	1.086	.518 – 2.277	.828
Childhood hunger experience	1.410	.732 – 2.713	.303
Childhood health problems	1.423	.686 – 2.951	.341
History of abuse and maltreatment	3.293	1.506 – 7.198	.002
Self-perceived lifestyle	.206	.043 – .975	.029

[a] Prevalence Odds Ratio (OR) [b] Confidence Interval (CI) [c] p-value; α = 0.05

Note: Authors' own elaboration

The results show that participants who reported vision problems were significantly more likely to present frailty (POR = 6.6; CI = 3.615–12.173). Similarly, those who reported balance problems (POR = 4.3; CI = 2.269–8.168), self-reported hearing impairments (POR = 3.4; CI = 1.764–6.575), or who had experienced physical and psychological abuse or maltreatment at some point in their lives (POR = 3.29; CI = 1.506–7.198), had an increased likelihood of frailty. In addition, having a "history of falls in the past year" (POR = 3.2; CI = 1.367–7.606), a recent diagnosis of a chronic disease (POR = 2.3; CI = 1.352–4.043), multiple chronic conditions (multimorbidity) (POR = 2.0; CI = 1.162–3.448), and polypharmacy (POR = 2.0; CI = 1.200–3.529) were, according to this study, risk factors for multidimensional frailty.

In contrast, two of the variables examined in this study showed a protective association with multidimensional frailty and may be considered protective factors: regular participation in physical activity" (POR = 0.154; CI = 0.085–0.278) and a positive self-perception of lifestyle" (POR = 0.206; CI = 0.043–0.975).

4.1.2. Psychological Dimension

In this dimension, five psychological variables were analyzed. The literature reveals a relative lack of research and, consequently, limited scientific evidence regarding the contribution of psychological and social aspects to the development of frailty. Nevertheless, in recent years both empirical and scientific evidence have emerged, indicating that frailty is not only the result of biomedical changes and physiological decline, but is also associated with psychological and social variables. The following section presents the results for the psychological dimension (Table 4).

Table 4.
Risk Analysis for the Psychological Dimension

Variable	Tilburg Frailty		
	POR[a]	95% CI[b]	p[c]
Ability to cope with problems	0.141	0.047 – 0.424	< .001
Cognitive function	1.270	.747 – 2.160	.378
Depressive affect	3.703	1.946 – 7.045	< .001
Self-perceived memory problems	8.457	4.566 – 15.665	< .001
Self-reported anxiety	4.990	2.750 – 9.053	< .001

[a] Prevalence Odds Ratio (POR) [b] Confidence Interval (CI) [c] p-value; α = 0.05

Note: Authors' own elaboration

In this dimension, subjective memory complaints (POR = 8.457; CI = 4.566–15.665), self-reported anxiety (POR = 4.990; CI = 2.750–9.053), and depressive symptoms (POR = 3.703; CI = 1.946–7.045) were identified as risk factors for multidimensional frailty.

It is noteworthy that cognitive function did not show an association with multidimensional frailty in this study - a finding that contradicts previous research. In particular, the association between physical frailty and

mild cognitive impairment (MCI) has been reported elsewhere; and several studies have shown that frail individuals are more likely to develop cognitive decline.

Finally, the self-efficacy in coping with problems appears to be a protective factor against frailty (POR = 0.141; CI = 0.047–0.424; p = 0.000).

4.1.3. Social and Demographic Dimension

In the social dimension, sixteen variables were analyzed. The study found that low current income (POR = 10.800; CI = 1.358–85.892), living alone (POR = 2.705; CI = 1.319–5.546), having a partner with illness" (POR = 2.693; CI = 1.069–6.785), and perceived loneliness (POR = 2.689; CI = 1.282–5.639) were identified as risk factors for multidimensional frailty, whereas life satisfaction (POR = 0.305; CI = 0.095–0.978) and having a social support network (POR = 0.331; CI = 0.191–0.574) were identified as protective factors against frailty (see Table 5). It is important to note, however, that the finding regarding low current income exhibits a very wide confidence interval, indicating reduced statistical precision potentially caused by sample size constraints.

Table 5.

Risk Analysis for the Social and Demographic Dimension

Variable	Tilburg Frailty		
	POR[a]	95% CI[b]	p[c]
Level of education	.644	.345 – 1.205	.167
Low current income	10.800	1.358 – 85.892	.006
Place of origin	1.138	.663 – 1.951	.639
Recent widowhood	1.528	.250 – 9.331	.644
Partner's illness	2.693	1.069 – 6.785	.030
Life satisfaction	.305	.095 - .978	.036
Living alone	2.705	1.319 – 5.546	.005
Receiving support	1.123	.558 – 2.263	.744
Age >80	1.835	.849 – 3.968	.119
Sex	1.475	.865 – 2.516	,153
Having a partner	.608	.356 – 1.037	.067
Functional partnership	.279	.051 – 1.510	.117
Marital status	1.592	.931 – 2.720	.088
Perceived loneliness	2.689	1.282 – 5.639	.007
Support network	.331	.191 – .574	<. 001
Perception of sufficient support	1.328	.716 – 2.463	.367

[a] Prevalence Odds Ratio (POR) [b] Confidence Interval (CI) [c] p-value; α = 0.05

Note: Authors' own elaboration

5. Discussion

From a multidimensional model assessed with the Tilburg Frailty Indicator (TFI), the results indicate that the prevalence of frailty affects nearly half of community-dwelling older adults. Various studies on frailty demonstrate that prevalence rates vary from one study to another, a phenomenon generally explained by differences in frailty measurement methods and geographic region. Reported frailty prevalence ranges from 3.9% in China to 51.4% in Cuba, while prefrailty prevalence ranges from 13.4% in Tanzania to 71.6% in Brazil (Siriwardhana et al., 2018).

Within these variations, gender dynamics play a consistent role: Women experience and endure frailty to a greater extent than men, According to several authors, women experience higher levels of frailty than

men of the same age (Shamliyan, Talley, Ramakrishnan & Kane, 2013; Gordon, Peel, Samanta, Theou, Howlett & Hubbard, 2016). Frailty levels as high as those reported serve as a warning sign for policymakers in the field of older care. Without an adequate response, this situation poses a high probability that, in the short and medium term, older adults will lose functional capacity and develop disabling conditions, with consequent impacts on health services and on the informal care provided by family members.

Risk and protective factors across dimensions

In general, some of the risk and protective factors for frailty identified in this study do not differ significantly from those reported in numerous studies worldwide, regardless of the assessment method used. In this regard, the findings confirm that, in this context, many of the variables examined behave similarly to those observed in other regions.

Regarding the physical domain, several studies and authors have reported results consistent with those presented here: vision problems (Sonnenfeld & Al Snih, 2021; Swenor et al., 2020) and hearing impairments (Kamil et al., 2015; Tian et al., 2022); having been diagnosed with a chronic disease (Lee, Auyeung, Leung, Kwok & Woo, 2014; Wang, Wang, Xie, Liu & Wang, 2021); experiencing multimorbidity (Zucchelli et al., 2019; Nguyen, Wu, Odden & Kim, 2019); polypharmacy (Thiruchelvam, Byles, Shahzad, Egan & Kairuz, 2021; Veronese et al., 2017); balance problems (Machado et al., 2021); and falls within the past year (Sánchez-García et al., 2017; Menéndez-González, Izaguirre-Riesgo, Tranche-Iparraguirre, Montero-Rodríguez & Orts-Cortés, 2021).

For the latter two variables, there are studies that contradict these findings. Thiede et al. (2016), for example, did not find an association between balance and frailty, and Schoufour et al. (2015) also found no association between frailty and falls. Finally, with regard to abuse and maltreatment, few theoretical references demonstrate a clear association with frailty. Nevertheless, Gomes et al. (2018) found that those who had experienced childhood physical abuse (OR = 1.68) or psychological violence by an intimate partner (OR = 2.07) were more likely to develop frailty in old age.

Conversely, on the protective side of this dimension, regular engagement in physical activity as a protective factor against frailty is strongly supported by the literature, with consistent evidence of its positive impact and the lower likelihood of becoming frail, even though light-intensity or low-resistance activity (Ziller, Braun & Thiel, 2020; Chen, Chen, Kishimoto, Yatsugi & Kumaga, 2020). On the other hand, self-perceived healthy lifestyle in this study -as in that of Gobbens & Van Assen (2016)- showed that subjective evaluation of lifestyle quality, rather than a detailed list of specific behaviors, is sufficient to predict frailty.

With respect to the psychological dimension, this study did not find an association between cognitive function and frailty, but it did find a link with subjective memory loss complaints self-reported by participants. Similarly, Gifford et al. (2019) reported an association between frailty and subjective cognitive decline -an indicator of perceived memory loss -prior to the onset of manifest dementia.

Regarding depressive affect, individuals with depressive symptoms were found to be 3.7 times more likely to become frail than those without such symptoms. Several studies have demonstrated that frailty is significantly influenced by the presence of depressive symptoms (Brown et al., 2019; Liu et al., 2021). A similar pattern was observed among individuals with self-reported anxiety symptoms, who had 4.9 times higher odds of frailty compared with those without. Other authors have reported that comorbid depression and anxiety are significantly associated with higher prevalence of pre-frailty and frailty (Zhao et al., 2020). In contrast to these psychological risks, coping self-efficacy emerged as a broad psychological construct that evaluates confidence in one's problem-solving and social coping abilities. These perceived capacities are directly relevant to how individuals adapt and adjust to change. This study found that coping self-efficacy served as a protective factor against frailty. The findings are consistent with those of Hladek et al. (2019) and Gobeil-Lavoie et al. (2019), who reported that higher coping self-efficacy was associated with a 92% lower likelihood of prefrailty or frailty.

In the social dimension, several economic and interpersonal risks were identified. it was found that individuals with low income were significantly more likely to develop frailty in old age. Aging has traditionally been conceptualized as being associated with a significant decline in income, often due to retirement or widowhood. These results are consistent with studies showing financial insecurity in later life is the socioeconomic indicator most strongly linked to frailty (Herr et al., 2015; Menéndez-González, et al., 2021).

Furthermore, from a gerontological perspective, older adults who live alone are considered socially vulnerable individuals. The findings of this study align with those of authors who report that living alone is a risk factor for adverse health outcomes, including frailty (Makizako et al., 2015). However, Bessa, Coelho & Ribeiro (2021) argued otherwise, concluding that the mechanisms linking living alone with frailty remain unclear. Thus, living alone may play a more nuanced role than initially thought and may not necessarily represent a significant criterion or predictor of frailty.

While living alone is an objective measure of social isolation, perceived loneliness represents the subjective experience of lacking social networks or companionship. In this study, an association between perceived loneliness and frailty was found, which is consistent with Gale, Westbury and Cooper (2018), who reported that higher levels of loneliness were associated with an increased risk of frailty or pre-frailty after a four-year follow-up. The presence of illness of an older adult's partner was also identified as a risk factor for frailty. The results indicate that older adults whose partner has a chronic illness were 2.6 times more likely to develop frailty. The partner's health condition and the caregiving demands imposed by a chronic illness may create physical and psychological burdens on other household members, particularly spouses who regularly provide direct care (Agree & Glaser, 2009).

Shifting focus to social resources, life satisfaction and having a social support network emerged as significant protective factors against frailty in this study. Regarding life satisfaction, evidence suggests that older adults may employ more effective strategies than younger or middle-aged individuals for adapting to health-related limitations, thereby mitigating the negative impact of frailty on subjective well-being (Jopp & Rott, 2006). Concerning social support networks, the results showed that those surrounded by family, neighbors, friends, and groups were better protected than those without such networks. Consistent with these findings, Hoogendijk et al. (2016) reported that older adults with smaller social networks and higher levels of loneliness exhibited higher rates of prefrailty and frailty.

Several limitations should be considered when interpreting these findings. The sampling design, based on a 6% margin of error and a 90% confidence level ($\alpha = 0.10$), resulted in a relatively small sample, which may have reduced the precision of some estimates. In addition, the sampling strategy limits the extent to which the findings can be generalized to the broader older adult population of the department.

The cross-sectional design does not allow causal inferences or the establishment of temporal relationships between frailty and the associated factors identified. This is particularly relevant given the complex interplay of biological, psychological, and social processes in aging. The use of self-reported measures may also have introduced recall or social desirability bias. Finally, although frailty was examined from a multidimensional perspective, the lack of objective biomarkers means that residual confounding cannot be entirely excluded.

Despite these limitations, the study provides useful evidence on the prevalence and correlates of frailty and contributes to a better understanding of its multidimensional nature in this population.

6. Conclusions

The study reveals a high prevalence of multidimensional frailty, affecting nearly half of the analyzed older adult population, with a notably higher vulnerability among women. While these findings cannot be generalized to the entire Department of Quindío due to sampling limitations, they highlight a critical baseline of vulnerability within the studied cohort that demands targeted attention.

The integration of physical, psychological, and social dimensions confirms that frailty is a fundamentally complex and dynamic phenomenon. Assessing frailty through a multidimensional lens—rather than a strictly biomedical or unidimensional approach—is essential to capturing the true heterogeneity of the aging process and understanding how non-physiological factors alter health trajectories.

Both risk and protective factors for frailty operate across interconnected life domains. While clinical conditions, psychological distress (such as depression and anxiety), and social isolation significantly elevate the risk of frailty, modifiable resources like regular physical activity, high coping self-efficacy, and robust social support networks act as vital counterweights. Consequently, effective interventions must move beyond clinical management to incorporate psychological support and social network strengthening.

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Data Availability

The authors state that this article includes all relevant and sufficient data necessary to understand the research.

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Ethical Considerations

This research was approved by the Research Bioethics Committee of the Faculty of Health Sciences at the University of Quindío, established under Resolution No.0600 of October 29, 2001 (Minutes No. 19 dated August 21, 2020). Participation in the study was voluntary and granted after presentation and explanation of the study objectives, followed by the signing of informed consent.

Technological Support

The authors confirms that no artificial intelligence tools, language models, machine learning systems, or similar technologies were used to create, assist or edit any portion of the content in this document.

Authors' Contributions

César-Augusto Gómez-Santos: Conceptualization, methodology, formal analysis, project administration, and original draft preparation.

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