

# BRAZILIAN CONSENSUS ON FRAILTY IN OLDER PEOPLE: CONCEPTS, EPIDEMIOLOGY AND EVALUATION INSTRUMENTS

## Consenso brasileiro de fragilidade em idosos: conceitos, epidemiologia e instrumentos de avaliação

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### ABSTRACT

The aim of the present study was to describe the conceptual and operational definitions of the frailty syndrome recommended by the Brazilian Consensus on Frailty in Older People. In 2015, a task force consisting of Brazilian specialists on human aging conducted a bibliographical review on frailty among older people in Brazil and established a consensus on the main findings through periodic meetings. A total of 72 articles were included in the analysis, comprising one systematic review, two conceptual discussions, two methodological descriptions, four longitudinal studies focusing on mortality and worsening of the frailty profile, eight cross-cultural adaptation studies, and 55 cross-sectional or prevalence studies. Forty-five studies (62.5%) used the Cardiovascular Health Study (CHS) frailty scale, of which seven (15.2%) used unadjusted cut-off points for their samples and 17 (36.9%) modified at least one of the five items of the instrument. The prevalence of frailty varied between 6.7 and 74.1%. When the CHS frailty scale was used, the wide range of prevalence — from 8 to 49.3% — depended on the cut-off points used to classify changes in gait speed and handgrip strength, as well as the research setting. The studies were based on four major conceptual models of frailty. Frailty in older people represents a state of physiological vulnerability and should not be confused with disabilities or multi-morbidities. In the Brazilian population, the prevalence of frailty has not yet been adequately estimated, and the cut-off points of the items of the frailty scales should be adapted to the parameters of this population.

**KEYWORDS:** aging; aged; health of the elderly; health vulnerability; frail elderly.

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O objetivo do presente trabalho foi descrever as definições conceitual e operacional da síndrome de fragilidade recomendadas pelo Consenso Brasileiro de Fragilidade em Idosos. Em 2015, uma força-tarefa composta de especialistas brasileiros em envelhecimento humano conduziu uma revisão bibliográfica sobre fragilidade em idosos no Brasil e estabeleceu um consenso acerca dos principais achados por meio de reuniões periódicas. No total, 72 artigos foram incluídos para análise, entre os quais, uma revisão sistemática, duas discussões conceituais, duas descrições metodológicas, quatro estudos longitudinais focando mortalidade e piora do perfil de fragilidade, oito estudos de adaptação transcultural e 55 estudos transversais ou de prevalência. Quarenta e cinco estudos (62,5%) utilizaram a escala de fragilidade do Cardiovascular Health Study (EFCHS), dos quais sete (15,2%) usaram pontos de corte não ajustados para a amostra e 17 (36,9%) modificaram pelo menos um dos cinco itens que compõem o instrumento. A prevalência de fragilidade variou entre 6,7 e 74,1%. Quando utilizada a EFCHS, a ampla variação de prevalência — de 8 a 49,3% — dependeu dos pontos de corte empregados para classificar as alterações na velocidade de marcha e na força de preensão palmar, bem como do cenário de investigação. Os estudos foram baseados em quatro grandes modelos conceituais de fragilidade. A fragilidade em idosos representa um estado de vulnerabilidade fisiológica e não deve ser confundida com incapacidades ou multimorbidades. Na população brasileira, a prevalência de fragilidade ainda não está adequadamente estimada, e os pontos de corte dos itens que compõem as escalas de fragilidade devem ser adaptados aos parâmetros dessa população.

**PALAVRAS-CHAVE:** envelhecimento; idoso; saúde do idoso; vulnerabilidade; fragilidade; idoso fragilizado.

## INTRODUCTION

Frailty is a nonspecific state of increased risk of mortality and adverse health events such as dependence, disability, falls and injuries, acute illness, slow recovery from illness, hospitalization, and long-term institutionalization.<sup>1,2</sup> In the elderly population, frail individuals are those most in need of health care, and, thus, frailty can be used as a potential organizer for older people health management.<sup>3</sup>

Given the rapidly aging population in our country, a consequence of demographic and epidemiological transitions, the number of frail individuals is increasing rapidly.<sup>4</sup> In high-income countries, depending on the population evaluated, 10–25% of people aged 65 or over may be classified as frail,<sup>5</sup> and many forms of geriatric healthcare, such as comprehensive evaluations, preventive interventions and multidisciplinary care, are targeted for frail individuals, since, in this group, these proceedings have better cost-effectiveness. Thus, when establishing investment priorities that align financial and quality of life conditions, the frail individual should be considered the primary target of health policies directed at the elderly population.<sup>6–9</sup>

Among the various conceptual models of frailty,<sup>10</sup> reduced functional reserve, which involves multiple organ systems, has gained better acceptance among researchers in the field.<sup>11</sup> In this model, frailty represents a state of heightened physiological vulnerability of heterogeneous presentation that is associated with chronological age and reflects multisystemic physiological changes that affect homeostatic adaptability. The most commonly used scale

for instrumentalizing this definition consists of items that assess nutritional status, energy expenditure, physical activity, mobility and muscle strength.<sup>11</sup>

Another conceptual model is deficit accumulation, which is based on the sum of limitations and diseases and emphasizes the number of disorders rather than their nature. The instrument based on this model defines frailty using at least 30 variables, including disabilities and comorbidities.<sup>12</sup>

The third conceptual model is multidimensional, characterizing the condition as a dynamic state of loss that affects one or more areas, such as cognitive, physical and social domains.<sup>13–17</sup> Finally, another series of measurement instruments are primarily based on functional disability.<sup>18,19</sup>

In Brazil, the diversity of conceptual and operational models has produced questions among those involved in geriatric health issues. Such questions include: areas of research — how best to investigate frailty; teaching — how to inform undergraduate and graduate students and health professionals; and care — how to identify and treat frail individuals in public and private health care networks.

This article describes the results of the discussions by Brazilian specialists in human aging organized on the Brazilian Consensus on Frailty in Older People (*Consenso Brasileiro de Fragilidade em Idosos* — CBFi) task force. The objective was to establish a national consensus about indicators for determining the epidemiological frequency of frailty syndrome in Brazil, as well as conceptual and operational definitions that could guide care, teaching and research by Brazilian geriatrics and gerontology professionals.

## METHODS

### Creation of the Brazilian Consensus on Frailty in Older People

The CBFi was created by a decision of ten academic institutions in geriatrics and gerontology that had been meeting in monthly teleconferences (TeleGero) since July 2005 to discuss issues related to human aging. During the September 2015 TeleGero meeting, based on a proposal by one member that was unanimously accepted, a committee of experts was formed to define the CBFi's working methodology.

Following this meeting, a task force was formed with a variable number of members from each academic institution participating in TeleGero, as well as professionals from other institutions whose professional interest and/or care, teaching, research or management activities were related to frailty syndrome in older people.

The task force developed its activities through monthly teleconferences, electronic message exchange and a face-to-face meeting in 2016 in Fortaleza, Ceará, Brazil, during the XX Brazilian Congress of Geriatrics and Gerontology.

### The problem to be addressed and the objectives of the CBFi task force

The criteria and conceptual and operational diversity of the instruments used to screen/diagnose the frailty syndrome are reflected in the following areas:

- healthcare: the difficulties that public and private health managers have in selecting population screening instruments;
- teaching: the difficulties in adequately training specialized professionals in geriatrics and gerontology;
- research: the difficulties in comparing results among different research settings and populations that inhabit Brazil.

### Division of CBFi by theme

The members of the task force were subdivided into five groups, each responsible for one of the following thematic areas: conceptual definition; epidemiology; physiopathology; evaluation and diagnostic tools; prevention and treatment. Initially, each group worked independently and, subsequently, virtual meetings were held to integrate the information.

### Narrative review and expert opinion

It was decided to conduct a narrative review of the five thematic areas by searching for articles published in scientific journals between January 2009 and August 2017 that addressed frailty syndrome in Brazilian population samples. The main reference databases — PubMed and the Scientific Electronic

Library Online — were searched using the (English) MeSH keywords frail, aged, frail elderly, elderly, Brazil, elders, older, and older adults, connected by the Boolean operators AND and OR.

The task force members discussed the main findings and conclusions until reaching a consensus about each theme. These positions were discussed during the development of this report until the final text was produced, which involves some of the epidemiological and conceptual questions and assessment instruments pertinent to national scientific research and production. A future document will describe the other aspects of the thematic areas addressed by the task force.

## RESULTS AND DISCUSSION

### Epidemiological aspects

The database search found 201 articles, while a manual search for authors with publications in the field of aging and previously known bibliographic references identified another 24. Of this total, 193 articles (Figure 1) met the initial screening criteria. After title and abstract analysis, 79 of these were excluded, leaving 115 articles for full text assessment. Of these, 42 were excluded for one of the following reasons: being integrative reviews, being case reports or lacking descriptive data on frailty. Thus, a total of 72 articles were included in the analysis, including one systematic review, two conceptual discussions, two methodological descriptions, four longitudinal studies focusing on mortality and worsening of the frailty profile, eight cross-cultural adaptation studies and 55 cross-sectional or prevalence studies (Annex 1).

The study samples were selected from several settings. Three came from long-term care institutions for older people, five from hospital units, eight from outpatient clinics and 52 from community-dwelling populations. No research scenarios were presented in the four papers on methodology and concepts.

Regarding the instruments used to evaluate frailty, one study used a frailty index, one used the Clinical-Functional Vulnerability Index-20, one used an instrument developed by the Brazilian Ministry of Health, one used a self-report instrument, three used the Tilburg Frailty Indicator, three used the Kihon Checklist, three used the *FRAIL* scale (FS) and nine used the Edmonton Frail scale. Forty-five studies (62.5%) used the Cardiovascular Health Study (CHS) frailty scale, of which seven (15.2%) used unadjusted cut-off points for their sample and 17 (36.9%) modified at least one of the items of the instrument (Annex 1).

The prevalence of frailty in a 2016 systematic review ranged from 7.7 to 42.6%.<sup>20</sup> In our review, this number was between 6.7 and 74.1%. The main sources of variation were the instrument used to classify individuals as frail and the

assessment setting. When the CHS frailty scale was used, the broad prevalence range — from 8 to 49.3% — depended on the cutoff points used to classify the research setting (community, hospital, ambulatory or long-term care), changes in gait speed and handgrip strength.

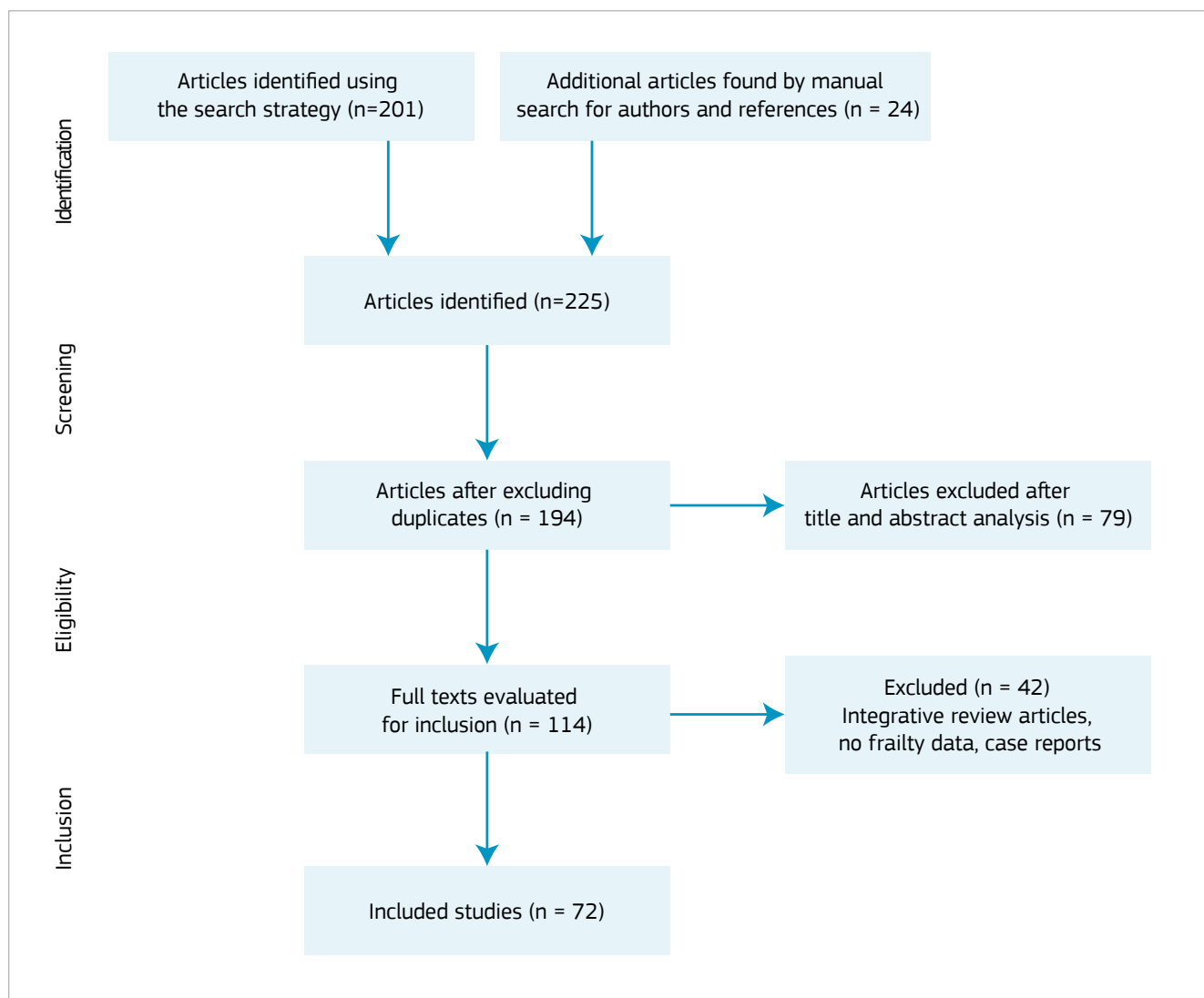
### Conceptual aspects

The instruments identified in this report used four major conceptual models of frailty and, corroborating the international literature, the CHS frailty scale was the most commonly applied instrument in Brazilian studies. The use of so many different instruments led to uniformity difficulties among the prevalence rates. The significant variation indicates that there is an expressive limitation on the results and the comparisons that can be made between them. The need for standardizing the model, and

especially the diagnostic tool, is one of the challenges to identifying the frail elderly, and, in the light of the present consensus, still needs scrutiny. However, all of the studies, regardless of the model used, were unanimous in pointing out the urgent need to identify frailty syndrome, given its innumerable negative outcomes.

### Evaluation instruments

Among the instruments observed in the present study, some valued the multidimensional aspects of older people (social, psychological, and cognitive), while others dealt exclusively with the physical elements of frailty. A clear distinction could be seen between these instruments and, from the point of view of definition, two major models were used: the vulnerability and the physiological frailty models. This issue permeated the discussion while this study was being



**Figure 1** Selection flowchart for frailty studies with Brazilian population samples. Brazilian Consensus on Frailty in the Elderly, 2017.

prepared and will be the exclusive subject of a subsequent publication. In simplified terms, it was concluded that vulnerability is a comprehensive term that encompasses numerous dynamic dimensions — physiological, psychological, cultural and social.<sup>21</sup> Physiological frailty, as defined by Buchner and Wagner,<sup>22</sup> is a state of organic vulnerability, associated with aging and triggered by stressful events, in which an imbalance of homeostatic mechanisms occurs, promoting a negative spiral of undesirable events. With advancing age, the prevalence of comorbidities and limitations to functional capacity increases. Although these conditions usually accompany physiological frailty, they are distinct from it.<sup>23</sup>

Regarding instruments based on the physiological frailty model, especially the CHS frailty scale, it was observed that, even with five well-defined criteria — handgrip strength, gait speed, feeling of exhaustion, caloric expenditure and weight loss — many studies resorted to cut-off points that were not adapted to their respective studies, specifically for the first two criteria. In addition, other studies chose to use only four of the five proposed criteria due to the existing limitations and diagnostic difficulties for this condition. Modifying these items leads to even further limitations in adequately identifying frailty in clinical practice.

## CONCLUSIONS

The task force agreed on the following definitions and recommendations for care, teaching and research:

- frailty represents an age-related physiological vulnerability, produced by diminished homeostatic reserve and the organism's reduced ability to cope with a variety of negative health outcomes, including hospital admissions, falls, and functional loss, which increases the likelihood of mortality;
- frailty should not be confused with disability, non-physiological vulnerability or multimorbidity;
- every health professional who assists older people must be familiar with frailty syndrome and its consequences;

- there is insufficient evidence to establish population strategies for frailty syndrome screening in the general elderly population. However, the task force considers that recognition of this syndrome is important, since it identifies elderly individuals at greater risk of unfavorable outcomes and, consequently, can impact individualized care;
- the FS and CHS frailty scale address frailty syndrome. The Edmonton, Tilburg and Kihon scales involve the concept of vulnerability. Studies should apply instruments that are relevant to their research objective: to identify the frail elderly or the vulnerable elderly;
- although normative data are not available for the Brazilian population, the cut-off points of frailty scale items, such as gait velocity and handgrip strength, should be adapted for the study population.
- Brazilian researchers should investigate simpler methods of identifying frailty syndrome that facilitate use in both specialized care settings, such as geriatrics clinics, and primary health care.

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## CONFLICT OF INTERESTS

The authors declare no conflicts of interest.

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**Annex 1** Description of the sample, instruments and main results of Brazilian frailty studies published between January 2009 and August 2017 (n = 73).

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Fabrício-Wehbe et al. <sup>13</sup>	Reproducibility of the Brazilian version of the Edmonton FRAIL Scale	Edmonton FRAIL Scale	103	Community	This study suggests adequate psychometric properties for Brazil. Kappa = 0.83.
Fabrício-Wehbe et al. <sup>15</sup>	Cross-cultural adaptation	Edmonton FRAIL Scale	137	Community	Synthesis version of two translations and back-translations. Negative convergent correlation with MMSE and MIF. High sensitivity and low specificity with CDT.
Santiago et al. <sup>16</sup>	Psychometric properties of the Tilburg Frailty Indicator	Tilburg Frailty Indicator	219	Community	Analysis of the instrument's internal consistency and validation: total score r = 0.88/alpha 0.78.
Moraes et al. <sup>19</sup>	Cross-sectional study: adequacy of the Clinical-Functional Vulnerability Index-20	Clinical-Functional Vulnerability Index-20	397	Clinic and community	Positively correlated with a comprehensive geriatric assessment.
Da Mata et al. <sup>20</sup>	Systematic review	NA	43.083	Miscellaneous	Frailty prevalence = 7.7 to 42.6%.

Continue...



Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Tribess et al. <sup>24</sup>	Physical activity in several domains as a predictor of lack of frailty	Modified CHS frailty scale. Three items: HS tailored to sample, weight loss and feeling of exhaustion	622	Community	Frailty prevalence: 19.7% in men and 20% in women. Moderate or intense physical activity predicts lack of frailty.
Costa e Neri <sup>25</sup>	Cross-sectional study associating frailty with markers of physical activity	CHS frailty scale. Five original items. Cut-off points tailored to the Brazilian population.	689	Community	Low caloric expenditure associated with frailty and physical activity associated with health status.
Miguel et al. <sup>26</sup>	Cross-sectional study of osteoarthritis in frail elderly	CHS frailty scale. Five original items. Cut-off points used for the North American population	58	Community	Frail elderly with osteoarthritis use more medications, are more obese, more depressed, and have poorer self-perception of health and physical function.
Andrade et al. <sup>27</sup>	Conceptual analysis of frailty in the elderly	Concepts	NA	NA	Reflection on concepts of frailty.
Bastos-Barbosa et al. <sup>28</sup>	Cross-sectional study: association between frailty and hypertension with cardiovascular risk factors	CHS frailty scale. Five original items. Cut-off points tailored to the sample	77	Community	Higher blood pressure levels, abdominal fat and lower HDL in the frail elderly.
Macuco et al. <sup>29</sup>	Cross-sectional study: frail, pre-frail and robust cognitive performance	CHS frailty scale. Five original items. Cut-off points tailored to the sample	384	Community	8% frailty prevalence. Lower cognitive performance in the frail elderly.
Santiago et al. <sup>30</sup>	Cross-cultural adaptation of the Tilburg Frailty Indicator	Tilburg Frailty Indicator	30	Community	Synthesis version of two translations and back-translations. Discussion among experts.
Sousa et al. <sup>31</sup>	Cross-sectional study: prevalence of frailty and associated factors in community-dwelling elderly in the Northeast Region	CHS frailty scale. Five original items. Cut-off points of the North American population	391	Community	17.1% frailty prevalence; associated with age, comorbidities, functional capacity and self-perception of health.
Yassuda et al. <sup>32</sup>	Cross-sectional study: cognition and frailty	CHS frailty scale. Five original items. Cut-off points tailored to the sample	384	Community	7% frailty prevalence. Frail patients presented lower cognitive performance.
Fattori et al. <sup>33</sup>	Cross-sectional study: relationship between arterial hypertension and frailty phenotype	CHS frailty scale. Five original items. Cut-off points tailored to the sample	900	Community	Frail elderly had lower blood pressure.

Continue...

## Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Lenardt et al. <sup>34</sup>	Cross-sectional study: prevalence of pre-frailty and associated factors	Gait speed	195	Community	27.3% frailty prevalence. Associated with age, low education, use of antihypertensive drugs, cardiovascular disease and overweight.
Borges et al. <sup>35</sup>	Cross-sectional study: frailty prevalence in institutionalized elderly	Edmonton FRAIL Scale	54	LTC	74.1% frailty prevalence. Associated with age, sex, comorbidities and medications.
Faria et al. <sup>36</sup>	Cross-sectional study: cognition and frailty	CHS frailty scale. Five original items. Cut-off points tailored to the sample	737	Community	Frail patients had lower cognitive performance.
Neri et al. <sup>37</sup>	Description of the FIBRA Network methodology used in seven Brazilian cities	Methodological description	NA	NA	Fibra Network methodology
Perez e Lourenço <sup>38</sup>	Cross-sectional study: frailty proxy: PRA	Eight questions	764	Community	6.7% prevalence of individuals with high risk of hospitalization. Associated with falls, COPD, medications, living alone and prior functional capacity.
Moreira e Lourenço <sup>39</sup>	Cross-sectional study: frailty prevalence and associated factors	CHS frailty scale. Five original items. Cut-off points tailored to the sample	847	Community	9.1% frailty prevalence. Associated with age, functional capacity, cognition and self-perception of health.
Duarte et al. <sup>40</sup>	Cross-sectional study: frailty prevalence and associated factors	Edmonton FRAIL Scale	166	Community	Age, education and income were associated with frailty.
Vieira et al. <sup>41</sup>	Cross-sectional study: frailty prevalence and associated factors	CHS frailty scale. Five original items. Cut-off points tailored to the sample	601	Community	8.7% frailty prevalence. Associated with functional capacity, falls, depression, hospitalization and age.
Oliveira et al. <sup>42</sup>	Cross-sectional study: frailty prevalence among hospitalized elderly	CHS frailty scale. Five original items. Cut-off points tailored to the sample	99	Hospital	46.5% frailty prevalence.
de Andrade et al. <sup>43</sup>	Cross-sectional study: oral health and frailty	Modified CHS frailty scale. Three original items. Two modified items. No information on cut-off point adaptation.	1.374	Community	8.5% frailty prevalence. Higher use of dental prostheses among frail elderly.

Continue...

Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Alencar et al. <sup>44</sup>	Cross-sectional study: frailty and cognitive loss	CHS frailty scale. Five original items. Cut-off points tailored to the sample	211	Community	23.2% frailty prevalence. Frail elderly had lower cognition.
Fhon et al. <sup>45</sup>	Cross-sectional study: prevalence of falls among frail elderly	Edmonton FRAIL Scale	240	Community	9.3% prevalence of severe frailty. Increased risk of falls among frail elderly.
Ricci et al. <sup>46</sup>	Cross-sectional study: frailty and cardiovascular risk	CHS frailty scale. Five original items. Cut-off points tailored to the sample	761	Community	9.7% frailty prevalence. Associated with hypertension and diabetes.
Santos et al. <sup>47</sup>	Cross-sectional study: sleep disorder and frailty	CHS frailty scale. Five original items. Cut-off points tailored to the sample	3.075	Community	No associations found between sleep disturbances and frailty, except for the caloric expenditure item.
Mansur et al. <sup>48</sup>	Cross-sectional study: frailty and quality of life in patients with chronic renal disease	CHS frailty scale. Five modified items.	61	Hospital	42.6% frailty prevalence, poor quality of life for the frail.
Melo et al. <sup>49</sup>	Cross-sectional study: the relation between health self-evaluation frailty and cADL	CHS frailty scale. Four original items. Cut-off points tailored to the sample	150	Clinic	56% frail prevalence. Positive health self-assessment and continued social involvement help mitigate the impact of performance losses in cADL in frail older adults.
Santiago e Mattos <sup>50</sup>	Cross-sectional study: fragility prevalence and associated factors among elderly in LTC	Tilburg Frailty Indicator	442	LTC	52% frail prevalence. Association with age, illiteracy, comorbidities and polypharmacy.
Sewo Sampaio et al. <sup>51</sup>	Validation and translation of the Kihon Checklist	Kihon Checklist	161	Community	Internal consistency with alpha = 0.78.
Silva et al. <sup>52</sup>	Cross-sectional study: blood markers and frailty	CHS frailty scale. Five original items. Cut-off points tailored to the sample	255	Community	Positive association with Hb and reticulocytes.
Vidal <sup>53</sup>	Reflection on frailty and public health	Reflection	NA	Reflection	Reflection.
Pegorari e Tavares <sup>54</sup>	Cross-sectional study: factors associated with frailty in community elderly	CHS frailty scale. Four original items. One modified item. CHS cut-off points	958	Community	12.8% frailty prevalence. Age, medication use, morbidity and functional disability associated with frailty.

Continue...

## Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Guedes et al. <sup>55</sup>	Cross-sectional study: evaluation of the effects of double task and frailty on gait ability	CHS frailty scale. Four original items. One modified item. Cutoff points tailored to the sample.	81	Community	The gait of the frail was more affected than that of the non-frail in the double task.
Nóbrega et al. <sup>56</sup>	Cross-sectional study: evaluation of frailty and sleep among elderly in LTC	CHS frailty scale. Four original items. One modified item. Cutoff points tailored to the sample.	69	LTC	49.3% frail prevalence. Changes in sleep, sleep quality and prolonged latency were associated with frail elderly.
Reis Júnior et al. <sup>57</sup>	Cross-sectional study: evaluation of the prevalence of frailty and pre-frailty in elderly living in low human development index areas.	CHS frailty scale. Three original items. Two modified items. Cutoff points tailored to the sample.	316	Community	23.8% frail prevalence. Association with age, sex, BMI, functional capacity and institutionalization.
Alexandre et al. <sup>58</sup>	Cross-sectional study: similarity analysis of risk factors for items on the CHS frailty scale	CHS frailty scale. Four original items. One modified item. Cutoff points tailored to the sample.	1.413	Community	Sex, age, education, sedentary lifestyle and depression screening were associated with more than one frailty component.
Azevedo da Silva et al. <sup>59</sup>	Cross-sectional study: the influence of frailty on functional capacity and risk of falls	CHS frailty scale. Five original items. Cut-off points tailored to the sample	617	Community	Association between reduced gait speed and compromised ADL. Lower overall functional capacity.
Varela et al. <sup>60</sup>	Cross-sectional study: evaluation of quality of life in frail elderly	Ministry of Health Instrument	122	Clinic	WHOQOL-BREF score = 56.6 mean; MOS 36-Item Short-Form Health Survey score = physical 43.5, mental 43.6.
Lourenço et al. <sup>61</sup>	Methodological description FIBRA Network (Rio de Janeiro)	Methodological description	NA	NA	FIBRA Network methodology (Rio de Janeiro)
Pires Corona et al. <sup>62</sup>	Cross-sectional study: anemia, Hb concentration and frailty	CHS frailty scale. Three original items. Two modified items. Cutoff points tailored to the sample.	1.256	Community	Association with anemia, Hb concentration and number of frailty items.
Falsarella et al. <sup>63</sup>	Cross-sectional study: body composition and frailty	CHS frailty scale. Five original items. Cut-off points tailored to the sample	235	Community	Frail elderly presented lower muscle mass and higher fat percentage.
Katayama et al. <sup>64</sup>	Cross-sectional study: frailty and autonomic cardiac modulation	CHS frailty scale. Five original items. Cut-off points tailored to the Brazilian population.	23	Community	Cardiac autonomic activity was altered in the frail elderly.

Continue...

Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Mansur et al. <sup>65</sup>	Cross-sectional study: frailty in elderly with chronic renal disease	CHS frailty scale. Five modified items.	61	Hospital	42.6% frailty prevalence. Pre-dialysis patients presented a higher frailty prevalence.
Bastone et al. <sup>66</sup>	Cross-sectional study: aerobic ability and physical activity in frail elderly	CHS frailty scale. Five modified items.	26	Community	Frail patients presented less physical activity.
Frisoli et al. <sup>67</sup>	Cross-sectional study: frailty as a predictor of undesirable outcomes in elderly patients with heart disease	CHS frailty scale. Five original items. Cut-off points tailored to the sample	172	Ambulatory	Fragility was an indicator of functional disability and mortality; those with cardiovascular disease were more likely to be frail.
Sampaio et al. <sup>68</sup>	Cross-sectional study: comparison of frailty in elderly Brazilian, Japanese and Nippo-Brazilian women	Kihon Checklist	211	Community	There is more frailty among Brazilian women.
Parentoni et al. <sup>69</sup>	Cross-sectional study: evaluation of gait speed, frailty and respiratory function	CHS frailty scale	106	Community	Gait speed associated with respiratory muscle fragility and dysfunction.
Lanziotti Azevedo da Silva et al. <sup>70</sup>	Longitudinal study evaluating frailty factors that trigger clinical worsening in elderly patients	CHS frailty scale	200	Community	Handgrip strength, weight loss and low physical activity were most associated with poorer prognosis.
Nunes et al. <sup>71</sup>	Frailty screening instrument validation	Self-applied instrument	433	Community	Reduced gait speed and reduced strength had good internal consistency ( $\alpha = 0.77$ and $\alpha = 0.72$ , respectively), while "low physical activity" ( $\alpha = 0.63$ ) was somewhat less satisfactory. The sensitivity and specificity were 89.7 and 24.3% for identifying the pre-fragile and 63.2 and 71.6% for identifying for the fragile, respectively.
Faria et al. <sup>72</sup>	Longitudinal study: transition between fragility levels	CHS frailty scale. Five original items. Cut-off points tailored to the sample	22	Community	The majority of frail participants improved their CHS frailty scale classification over time
Carneiro et al. <sup>73</sup>	Cross-sectional study: prevalence of fragility and associated factors	Edmonton FRAIL Scale	686	Community	41.3% frailty prevalence. Associated with female sex, age, low education, falls and comorbidities.

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## Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Calado et al. <sup>74</sup>	Cross-sectional study: frailty in independent community-dwelling elderly	CHS frailty scale. Five original items. Cut-off points tailored to the sample	385	Community	9.1% frailty prevalence. Associated with comorbidities, age and hospitalizations.
Tavares et al. <sup>75</sup>	Cross-sectional study: analysis of cardiovascular risk and frailty factors in hospitalized elderly	CHS frailty scale. Four original items. One modified item. CHS cut-off points.	205	Hospital	High prevalence of fragility in the hospital unit (26.3%). Inverse association between pre-frail and overweight.
Sewo Sampaio et al. <sup>76</sup>	Cross-sectional study: lifestyle, physical performance and quality of life among frail and robust women in the community	Kihon Checklist	109	Community	Frailty associated with financial limitations, sedentary lifestyle, falls and malnutrition.
Fabício-Wehbe et al. <sup>77</sup>	Cross-sectional study: the association of frailty with institutionalization and hospitalization	Edmonton FRAIL Scale	515	Community	Higher frailty scores among the institutionalized and hospitalized.
Lenardt et al. <sup>78</sup>	Cross-sectional study: quality of life and frailty among elderly in primary care	CHS frailty scale. Three original items. Two modified items. Cut-off points tailored to the sample.	203	Community	Frailty was inversely proportional to quality of life.
Teixeira-Gasparini et al. <sup>79</sup>	Cross-sectional study: assistive technologies and frailty in elderly ≥80 years	Edmonton FRAIL Scale	144	Community	7.8% frailty prevalence. Associated with greater use of wheelchair, walkers and canes.
Silva et al. <sup>80</sup>	Cross-sectional study: the participation of each CHS frailty scale item in determining frailty	CHS frailty scale. Five original items. Cut-off points tailored to the sample	5.532	Community	The most frequently altered items were physical activity, muscle weakness and slow gait.
Zazzetta et al. <sup>81</sup>	Cross-sectional study: frailty and associated factors in socially vulnerable and poor elderly	CHS frailty scale. Five original items. Cut-off points tailored to the sample	363	Community	36.7% frailty prevalence. Frailty associated with falls, mobility deficits and depressive symptoms.
Mello et al. <sup>82</sup>	Cross-sectional study: anthropometric characteristics and feeding in frail elderly	CHS frailty scale. Four original items. One modified item. Cutoff points tailored to the sample.	137	Community	The frail and pre-frail had higher BMI and abdominal fat. Muscle parameters lowered as the syndrome level increased.

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Annex 1 Continuation.

Author	Study design (prevalence/validation/study design)	Instruments (operational definition of frailty)	n	Research setting	Results
Marchiori e Tavares <sup>83</sup>	Longitudinal study: change in frailty condition one year after hospital discharge.	CHS frailty scale. Four original items. One modified item. CHS cutoff points.	129	Hospital	The condition of 56.7% changed from non-fragile to pre-fragile. Morbidities were a fatigue predictor in the group whose fragility profile worsened. Greater dependence was a predictor of weight loss.
Santos-Orlandi et al. <sup>84</sup>	Cross-sectional study: frailty prevalence among caregivers of the elderly in a context of social vulnerability	CHS frailty scale. Four original items. One modified item. No information on cut-off point adjustment.	40	Community	10% frailty prevalence. Correlated with sex, functional capacity and cognition.
Carneiro et al. <sup>85</sup>	Cross-sectional study: frailty prevalence of and associated factors in northern Minas Gerais state	Edmonton FRAIL Scale	360	Clinic	47.2% frailty prevalence. Associated with age, social isolation, caregiver presence, depressive symptoms, joint disease, falls and hospitalizations.
Pereira et al. <sup>86</sup>	Longitudinal study: frailty and mortality index	Frailty index	689	Community	No association between frailty and mortality index.
Liberalesso et al. <sup>87</sup>	Cross-sectional study: frailty prevalence in a population with advanced age	CHS frailty scale. Five original items. Cut-off points tailored to the Brazilian population.	69	Community	Frail prevalence: 58%; pre-frail: 42%. Higher frequency of lower gait speed, weight loss and fatigue.
Aprahamian et al. <sup>88</sup>	Cross-sectional study: frailty prevalence; psychometric properties of the instrument; associated factors	FRAIL scale	811	Ambulatory	Frail prevalence: 37.7%; pre-frail: 48.7%; robust: 13.6%; Frailty associated with age, depression, dementia, number of medications.
Cezar et al. <sup>89</sup>	Cross-sectional study: prevalence and markers of frailty in elderly with cognitive deficits	CHS frailty scale. Five original items. Cut-off points tailored to the Brazilian population. Edmonton FRAIL Scale	66	Ambulatory	The identification of frailty varied according to the evaluation protocol. Visual and spatial function associated with a greater risk of frailty on the CHS frailty scale.
Aprahamian et al. <sup>90</sup>	Cross-sectional study: comparison of diagnostic properties between frailty instruments	CHS frailty scale. Five original items. Cut-off points tailored to the Brazilian population. FRAIL Scale	124	Clinical	Ability of the FRAIL Scale to identify frail elderly—screening instrument.

ADL: activities of daily living; cADL: complex activities of daily living; CHS: Cardiovascular Health Study; COPD: chronic obstructive pulmonary disease; FIBRA: Fragilidade em Idosos Brasileiros (Frailty in Brazilian Older People); HS: handgrip strength; Hb: hemoglobin; HDL: high-density lipoprotein; LCH: long-term healthcare institution for older people; BMI: body mass index; MMSE: mini-mental state exam; MFI: measure of functional independence; NA: not applicable; PRA: Probability of Repeated Admission; CDT: clock drawing test; WHOQOL-BREF: World Health Organization Quality of Life assessment.