Article

Financial fragility in older adults: a systematic review of the literature

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Abstract

The financial fragility of older adults (FFOA) is a public problem many countries face. Statistics show the world has more than 1.1 billion older adults today, and this figure is expected to reach 2 billion by 2047. Based on a systematic review, we seek to answer two questions: "What is the status of the literature on financial fragility in older adults?" and "What are the prospects for a future agenda?" Applying the preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol to guide our search, 58 articles were explicitly identified addressing FFOA. Based on the low number of articles and their descriptions and analysis, we conclude the study of FFOA is underexplored and the approaches used tend to be broad. These results contradict the pressing need to develop and implement solutions to address a significant problem. We also identified major gaps and paths for future studies.

Keywords: financial fragility, systematic literature review, preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol

Introduction

Financial fragility in older adults (FFOA) is a public problem faced by several countries (Lusardi et al., 2020; Mishra & Ahad, 2017). The aging of the world's population due to increased life expectancy and reduced birth rates significantly impacts the progression of FFOA. This fact calls for public policies to mitigate its effects in the short term and solve the problem in the long term (Ebbinghaus, 2021; Hinrichs, 2021; Yang, 2020).

The aging of countries' populations strains public policies to protect them (Yang, 2020). In countries with public pension systems, the overload eventually leads to weakening pension systems (Hinrichs, 2021). Moreover, pension systems in many countries tend to be the central public policy that supports people's incomes after retirement. However, at this point, their income from work tends to decrease systematically, making retirees dependent on other sources of income (Mitchell et al., 2022; Ortiz et al., 2019; Ring et al., 2020). In this context, the FFOA issue becomes critical in these countries due to the large number of people impacted by a drop in income after leaving the labor market and the lack of

consistent and well-informed preparation for retirement (Kalenkoski & McCarty, 2021; Moffatt & Heaven, 2017; Raab & Gannon, 2014).

Statistics, such as those presented by the aging portal (Portal do Envelhecimento, nd), show that today the world already has more than 1.1 billion older adults, and this figure is expected to be 2 billion by 2047. In a ranking presented by the United Nations, Brazil is expected to jump to fifth place among countries with older adults by the year 2050. China, India, USA, and Japan are expected to take over the top positions for the largest populations over 60 before 2050.

Another essential point in this scenario is how governments use public credit policies to promote economic development and produce social ascension for particular groups (Klein et al., 2018). Brazil, for example, has followed efforts to reduce poverty. These efforts include adopting minimum wage increases, surpassing inflation rates, and subsidizing credit policies for the poorest people (Porto, 2014; Tristão et al., 2014). These policies can improve development and social ascension, but they are also a source of indebtedness and financial fragility for older populations (Barone & Sader, 2008; Doll & Cavallazzi, 2016).

In addition to these issues, public policy has the potential to reduce (a) the exposure of older populations to the problems of financial fragility and (b) the macroeconomic consequences FFOA may trigger (Abruquah et al., 2019; Ghosh, 2023; Horioka & Ventura, 2024; Mishra & Ahad, 2017). However, designing and implementing effective public policies requires theory building addressing to understand the causes and consequences of FFOA.

All these initiatives and conditions contribute to the need to systematically study more the elements that make a person financially fragile when they reach old age. Financial fragility is defined as the inability to cope with unplanned financial adversity (Domma & Giordano, 2012; Lusardi et al., 2011; Salignac et al., 2019). In other words, financial fragility is the inability to face unexpected expenses immediately without compromising other short- and long-term responsibilities. Thus, a person already in a financial situation where they cannot use their own resources or those of third parties via loans to cover unexpected expenses is in a critical condition of fragility.

Financial fragility in older adults is becoming more relevant and deserves further research. Aging populations combined with unqualified public systems prevent the delivery of necessary income for the dignified survival of older adult populations. Existing studies address some of financial fragility's drivers, including the absence of saving behavior (Lusardi et al., 2011) and changes in mortgage behavior (Collins et al., 2020), among other factors. In addition, cognitive issues inherent to aging, such as a decline in reasoning and recent memories, also affect the way elderly people deal with their finances (Lichtenberg et al., 2022; Tang, 2021).

Another line of literature highlights the consequences of financial fragility in older adults. The main consequence is anxiety (Bialowolski et al., 2021; Cardona-Montoya et al., 2022; Xue et al., 2020). This anxiety can progress to more serious problems, such as depression and deterioration of psychological conditions (Tang, 2021; Xue et al., 2020). In addition, the lack of family support can exacerbate these problems, leading to increasing dependence on the state, whose financial support is unavailable in most countries (Ghosh, 2023; Mishra & Ahad, 2017). Finally, FFOA also pushes older people to financial fraud due to their lower emotional capacity to deal with proposals made by fraudsters (Yu et al., 2022).

This scenario motivates us to carry out a systematic review of the literature to identify well-founded and scientifically validated solutions to this problem. We seek to answer the following research questions: "What is the status of the literature on financial fragility in older adults?" and "What are the prospects for a future agenda?" We reviewed the literature on FFOA to identify information already known and the main existing gaps, and so, we can envision a future research agenda.

We searched for various terms in the Web of Science (WoS) and Scopus databases in July 2023 to achieve this goal. They are "Household Saving" and "Elderly"; "Household Saving" and "Aging"; "Economics of the Elderly"; "Retirement Schedule"; "Third Age" and "Finance"; "Financial Resilience" and "Pension"; "Financial Fragility" and "Pension"; "Personal Finance" and "Pension"; "Personal Finance" and "Elderly"; "Vulnerable Group" and "Financial" and "Elderly"; "Financial Fragility" and old* or "Personal Finance" and old*." The search returned 662 articles in the WoS database, 286 in the Scopus database, 269 in Google Scholar, 14 articles in PubMed, 1,290 articles in EBSCOhost, and 1,010 articles in Embase. After a series of refinements and merging of databases, 1,044 articles remained. The selection criteria were applied according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol (Page et al., 2021), leaving a final sample of 58 articles after excluding articles not correlated to the FFOA.

Of the 58 pieces, 52 were empirical, one was empirical/theoretical, and only five were theoretical. In reading the articles, nine main topics emerged, and several gaps were identified. With only 58 articles identified (Table 1), the main conclusion is FFOA is a fledgling field of study that needs further exploration. Secondly, existing literature allowed us to identify several causes, as well as some solutions for dealing with FFOA. The systematic review also unveiled gaps and issues being addressed for the first time and requiring further study.

Table 1. Descriptive analysis of the articles

Type of article	N	Research locus	N
Theoretical	5	USA	19
Empirical	52	European Union	4
Theoretical/empirical	1	China	3
Total	58	Italy	3
Type of research		Mexico	2
Qualitative	9	Taiwan	2
Quantitative	42	England	1
Quali/Quanti	2	England and Wales	1
Total	53	Scotland - UK	1
Data collection		Ireland	1
Secondary data/panel	32	UK	1
Primary data/ panel	4	Spain	1
Secondary data/cross section	4	German	1
Semi-structured interviews	3	Netherlands	1
Focus groups/semi-structured interviews	3	Russia	1

Table 1. Continued

Type of article	N	Research locus	N
Primary data/cross section	6	Sweden	1
Literature review	1	Myanmar, Vietnam, and Thailand	1
Total	53	India	1
Data analysis		Japan	1
Multivariate analysis - regression	19	Japan and USA	1
Logistic regression - logit/probit/tobit/multimodal	11	Malaysia	1
Content/discourse analysis	8	Thailand	1
Diff in diff	3	Vietnam	1
Simulation with micro-econometrics	2	Australia	1
ANOVA/MANOVA	2	New Zealand	1
Multi-methods	1	Ecuador	1
Exploratory factor analysis - EFA/hierarchical regression	1	South Korea	1
Comparative method of multi-criteria decision-making analysis	1	Total	54
Descriptive	1	Continent	
SEM-PLS	1	North America	21
Multinominal regression	1	Europe	17
Teste t - regression analysis OLS	1	Asia	12
Linear probability model and two-stage least squares model (2 SLS).	1	Latin America	1
		Oceania	3
Total	53	Total	54

OLS, Ordinary Least Squares

Research Method and Procedures

Our systematic literature review was based on the PRISMA protocol (Page et al., 2021). This protocol was developed for the medical field. We opted for the PRISMA protocol because it produces robustness, rigidity, and security throughout the research process, ensuring greater replicability (Denyer & Tranfield, 2009). This method is applied in several systematic literature reviews in the field of public management (Acar et al., 2025; de Souza et al., 2024; Hameduddin & Engbers, 2022; Haug et al., 2024; Idzi & Gomes, 2022; Sienkiewicz-Małyjurek & Szymczak, 2024). Before starting the protocol, we conducted a preliminary exploration to identify terms that could be used for the search. Surprisingly, the term "financial fragility in older adults" did not return any articles even when searched in all possible fields in the WoS and Scopus databases.

To identify terms to be searched, we began by exploring personal finance. We identified 251 articles from 1977 to 2022 after searching the WoS database and making some refinements, such as removing articles published in the event's proceedings and focusing only on those related to public administration. The metadata for these articles was downloaded and analyzed using the Biblioshiny

package (Aria & Cuccurullo, 2017), which runs in the RStudio 2022.07.1 interface of the R software version 4.2.1.

From the analysis of the article's metadata, especially the abstracts, we identified some important terms for the field (Fig. 1). From the combination of the terms identified in the analysis and terms that allude to the age group targeted by the research (elderly, aging, old, older), we structured a series of combinations seeking to cover all the main possibilities, without becoming too generic in the search and diverting the focus from the objective of the literature review (Fig. 2).

After this initial exploration, we conducted the search following the PRISMA protocol (Page et al., 2021) to identify the core articles for the systematic review (Fig. 3).

The WoS search (fill-in field: Search within - all fields) returned 654 articles using the terms listed in Fig. 1. These articles underwent a refinement process, eliminating works published in conference proceedings. This first refinement eliminated 68 articles. The second refinement excluded articles written neither in English nor Portuguese, removing 20 articles. The choice of languages was primarily based on English for being the universal language of sciences, and Portuguese for being
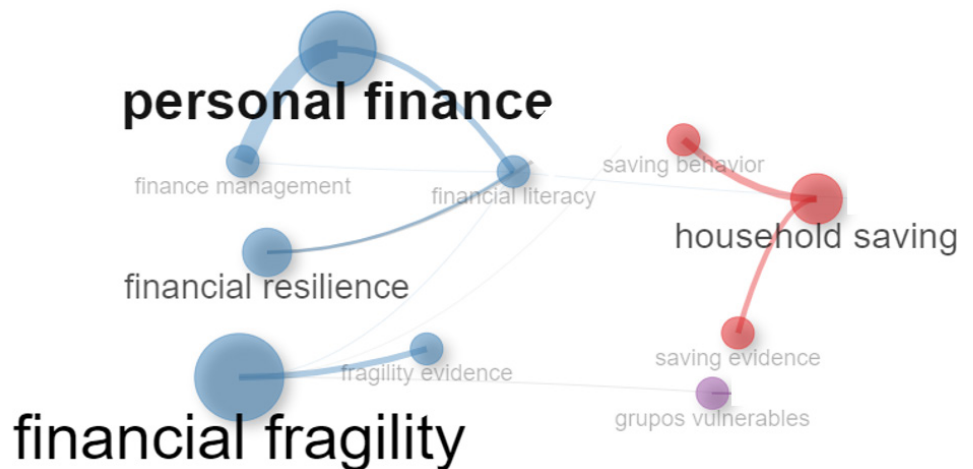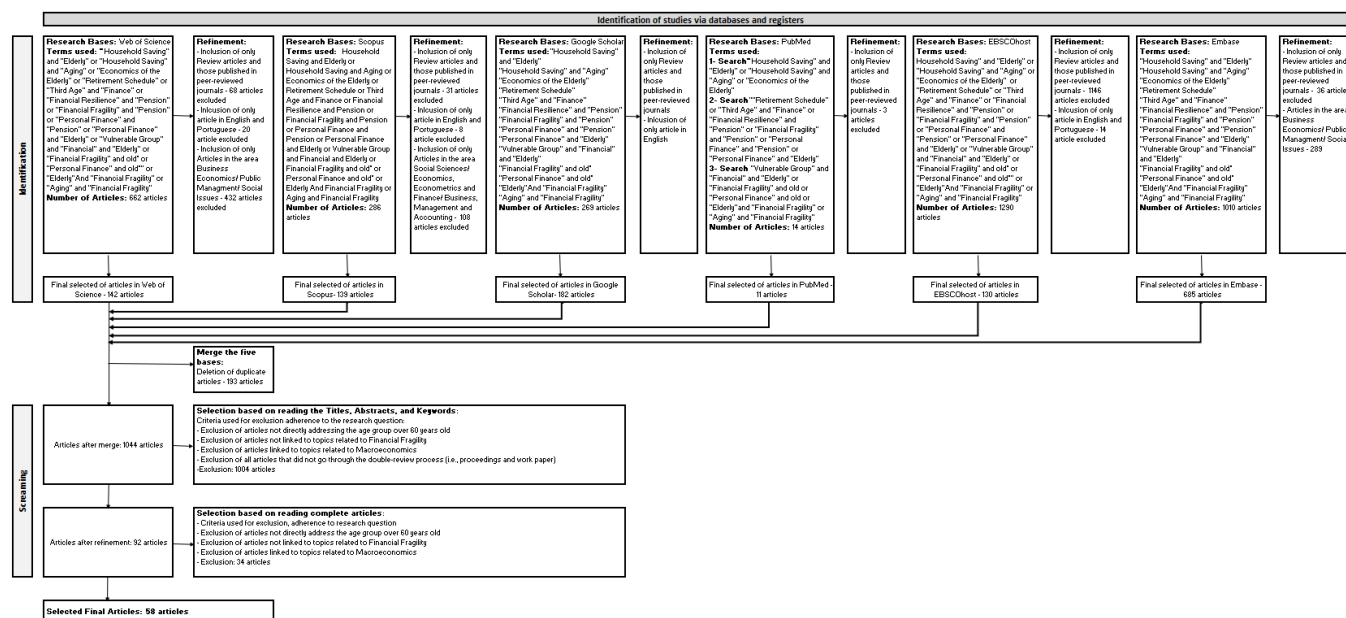

Fig. 1. Results of biblioshiny analysis co-occurrence network.

Terms Search in Web of Science	Terms Search in Scopus	Terms Search in Google Scholar *	Terms Search in PubMed **	Terms Search in EBSCOhost
"Household Saving" and "Elderly" or "Household Saving" and "Aging" or "Economics of the Elderly" or "Retirement Schedule" or "Third Age" and "Finance" or "Financial Resilience" and "Pension" or "Financial Fragility" and "Pension" or "Personal Finance" and "Pension" or "Personal Finance" and "Elderly" or "Vulnerable Group" and "Financial" and "Elderly" or "Financial Fragility" and old* or "Personal Finance" and old*" or "Elderly"And "Financial Fragility" or "Aging" and "Financial Fragility"	Household Saving and Elderly or Household Saving and Aging or Economics of the Elderly or Retirement Schedule or Third Age and Finance or Financial Resilience and Pension or Financial Fragility and Pension or Personal Finance and Pension or Personal Finance and Elderly or Vulnerable Group and Financial and Elderly or Financial Fragility and old* or Personal Finance and old* or Elderly And Financial Fragility or Aging and Financial Fragility	"Household Saving" and "Elderly" "Household Saving" and "Aging" "Economics of the Elderly" "Retirement Schedule" "Third Age" and "Finance" "Financial Resilience" and "Pension" "Financial Fragility" and "Pension" "Personal Finance" and "Pension" "Personal Finance" and "Elderly" "Vulnerable Group" and "Financial" and "Elderly" "Financial Fragility" and old* "Personal Finance" and old* "Elderly"And "Financial Fragility" "Aging" and "Financial Fragility"	1- Search"Household Saving" and "Elderly" or "Household Saving" and "Aging" or "Economics of the Elderly" 2- Search""Retirement Schedule" or "Third Age" and "Finance" or "Financial Resilience" and "Pension" or "Financial Fragility" and "Pension" or "Personal Finance" and "Pension" or "Personal Finance" and "Elderly" 3- Search "Vulnerable Group" and "Financial" and "Elderly" or "Financial Fragility" and old or "Personal Finance" and old or "Elderly"and "Financial Fragility" or "Aging" and "Financial Fragility"	Household Saving" and "Elderly" or "Household Saving" and "Aging" or "Economics of the Elderly" or "Retirement Schedule" or "Third Age" and "Finance" or "Financial Resilience" and "Pension" or "Financial Fragility" and "Pension" or "Personal Finance" and "Pension" or "Personal Finance" and "Elderly" or "Vulnerable Group" and "Financial" and "Elderly" or "Financial Fragility" and old* or "Personal Finance" and old*" or "Elderly"And "Financial Fragility" or "Aging" and "Financial Fragility"

Fig. 2. Terms searched in each of the article bases used in subsequent analyses. *The search on Google Scholar was carried out term line by term line, as the system was unable to recognize the Boolean connectives and returned the search empty, with no corresponding articles. **The terms were divided into 3 different blocks for searching in the PubMed database, as the search engine had a character limit.

Identification of studies via databases and registers

Identification

Research Bases: Web of Science
Terms used: "Household Saving" and "Elderly" or "Household Saving" and "Aging" or "Economics of the Elderly" or "Retirement Schedule" or "Third Age" and "Finance" or "Financial Fragility" and "Pension" or "Personal Finance" and "Pension" or "Personal Finance" and "Financial" and "Elderly" or "Financial Fragility" and old" or "Personal Finance and old" or "Elderly" And "Financial Fragility" or "Aging" and "Financial Fragility"
Number of Articles: 662 articles

Refinement: - Inclusion of only Review articles and those published in peer-reviewed journals - 68 articles excluded - Inclusion of only article in English and Portuguese - 20 article excluded - Inclusion of only Articles in the area Business Economics/ Public Managment/ Social Issues - 432 articles excluded

Research Bases: Scopus **Terms used:** Household Saving and Elderly or Household Saving and Aging or Economics of the Elderly or Retirement Schedule or Third Age and Finance or Financial Resilience and Pension or Personal Finance and Elderly or Vulnerable Group and Financial and Elderly or Financial Fragility and old or Personal Finance and old or Elderly And Financial Fragility or Aging and Financial Fragility **Number of Articles:** 286 articles

Refinement: - Inclusion of only Review articles and those published in peer-reviewed journals - 31 articles excluded - Inclusion of only article in English and Portuguese - 8 article excluded - Inclusion of only Articles in the area Social Sciences/ Economics, Econometrics and Finance/ Business, Management and Accounting - 108 articles excluded

Research Bases: Google Scholar **Terms used:** "Household Saving" and "Elderly" "Household Saving" and "Aging" "Economics of the Elderly" "Retirement Schedule" "Third Age" and "Finance" "Financial Resilience" and "Pension" "Financial Fragility" and "Pension" "Personal Finance" and "Pension" "Personal Finance" and "Elderly" "Vulnerable Group" and "Financial" and "Elderly" "Financial Fragility" and old" "Personal Finance" and old" "Elderly" And "Financial Fragility" "Aging" and "Financial Fragility" **Number of Articles:** 269 articles

Refinement: - Inclusion of only Review articles and those published in peer-reviewed journals - Inclusion of only article in English

Research Bases: PubMed **Terms used:** 1- **Search** "Household Saving" and "Elderly" or "Household Saving" and "Aging" or "Economics of the Elderly" 2- **Search** "Retirement Schedule" or "Third Age" and "Finance" or "Financial Resilience" and "Pension" or "Pension" or "Personal Finance" and "Pension" or "Personal Finance" and "Elderly" 3- **Search** "Vulnerable Group" and "Financial" and "Elderly" or "Financial Fragility" and old or "Personal Finance" and old or "Elderly" and "Financial Fragility" or "Aging" and "Financial Fragility" **Number of Articles:** 14 articles

Refinement: - Inclusion of only Review articles and those published in peer-reviewed journals - 3 articles excluded

Research Bases: EBSCOhost **Terms used:** Household Saving" and "Elderly" or "Household Saving" and "Aging" or "Economics of the Elderly" or "Retirement Schedule" or "Third Age" and "Finance" or "Financial Resilience" and "Pension" or "Financial Fragility" and "Pension" or "Personal Finance" and "Elderly" or "Vulnerable Group" and "Financial" and "Elderly" or "Financial Fragility" and old" or "Personal Finance" and old" or "Elderly"And "Financial Fragility" or "Aging" and "Financial Fragility" **Number of Articles:** 1290 articles

Refinement: - Inclusion of only Review articles and those published in peer-reviewed journals - 1146 articles excluded - Inclusion of only article in English and Portuguese - 14 article excluded

Research Bases: Embase **Terms used:** "Household Saving" and "Elderly" "Household Saving" and "Aging" "Economics of the Elderly" "Retirement Schedule" "Third Age" and "Finance" "Financial Resilience" and "Pension" "Financial Fragility" and "Pension" "Personal Finance" and "Pension" "Personal Finance" and "Elderly" "Vulnerable Group" and "Financial" and "Elderly" "Financial Fragility" and old" "Personal Finance" and old" "Elderly"And "Financial Fragility" "Aging" and "Financial Fragility" **Number of Articles:** 1010 articles

Refinement: - Inclusion of only Review articles and those published in peer-reviewed journals - 36 articles excluded - Articles in the area Business Economics/ Public Managment/ Social Issues - 289

Final selected of articles in Web of Science - 142 articles

Final selected of articles in Scopus - 139 articles

Final selected of articles in Google Scholar - 182 articles

Final selected of articles in PubMed - 11 articles

Final selected of articles in EBSCOhost - 130 articles

Final selected of articles in Embase - 685 articles

Merge the five bases: Deletion of duplicate articles - 193 articles

Screaming

Articles after merge: 1044 articles

Selection based on reading the Titles, Abstracts, and Keywords: Criteria used for exclusion adherence to the research question: - Exclusion of articles not directly addressing the age group over 60 years old - Exclusion of articles not linked to topics related to Financial Fragility - Exclusion of articles linked to topics related to Macroeconomics - Exclusion of all articles that did not go through the double-review process (i.e., proceedings and work paper) - Exclusion: 1004 articles

Articles after refinement: 92 articles

Selection based on reading complete articles: - Criteria used for exclusion, adherence to research question - Exclusion of articles not directly address the age group over 60 years old - Exclusion of articles not linked to topics related to Financial Fragility - Exclusion of articles linked to topics related to Macroeconomics - Exclusion: 34 articles

Selected Final Articles: 58 articles

Fig. 3. **PRISMA protocol for selecting articles for the systematic review.** PRISMA, preferred reporting items for systematic reviews and meta-analyses.

the authors' native language. The last refinement before merging the databases was to leave out articles related to the following fields: econometrics, corporate finance, business, public environment, occupational health, social work, administration, and political science. This criterion resulted in eliminating 432 articles. In summary, the WoS search contributed 142 articles (Fig. 3).

We conducted the same search terms listed above in the Scopus database, applying the search engine's standard choices (article title, abstract, keywords), returning a total of 286 articles. These articles underwent a refinement process, eliminating 31 works published in conference proceedings. The second refinement excluded all articles written neither in English nor Portuguese, eliminating 8 articles. Finally, we excluded 108 articles outside of the following fields: social sciences/economics, econometrics and finance/business, management and accounting. This refinement resulted in eliminating 108 articles. In summary, the Scopus database contributed 139 articles to the merger (Fig. 3).

We conducted the exact search in the Google Scholar database, applying the terms shown in Fig. 1 and using the software's default refinement choices, which returned 269 articles. As a first refinement, we altered the possibilities by sorting for relevance and indicating we only wanted "review articles." These two changes eliminated 87 articles from the database. As a result, the Google Scholar database contributed 182 articles (Fig. 3).

We also searched the PubMed database, applying the terms shown in Fig. 1, and identified 14 articles. After refining to only reviewed articles and reviews, and articles only in English, we identified 14 articles (Fig. 3). The same search procedure using the terms as shown in Fig. 2 was applied to the Ebscohost article database, which returned 1,290 articles. When we applied the first refinement restricting the search to only reviewed articles and reviews, we eliminated 1,146 articles.

The second refinement, which eliminates non-English articles, returned 14 articles. In the end, Ebscohost contributed 130 articles to the next stage of the article selection process (Fig. 3). For the Embase article database, we applied the search terms as shown in Fig. 2. The result was

1,010 articles. The first refinement, which excluded all articles that were not Reviewed Articles and Reviews, excluded 36 articles. The second refinement eliminated 289 articles, excluding those related to Business Economics, Public Management and Social Issues. The final contribution of the Embase database to the next stages was 685 articles (Fig. 3).

After these refinements, we downloaded the full metadata of articles from six databases. We merged databases, eliminating 193 duplicate articles, leaving 1,044 articles for analysis. We then analyzed the titles, abstracts, and keywords of the articles and applied the following criteria: Excluding articles not directly addressing the age group over 60 years old; excluding articles not linked to topics related to Financial Fragility; excluding articles linked to topics related to Macroeconomics; excluding all articles that did not go through the double-review process (i.e., proceedings and work paper).

As a way of reducing possible biases when selecting articles after reading the abstracts, these criteria were applied independently by one of the author researchers and two other research colleagues who were not authors of the article. After individual choices were made, results were compared and a final list was drawn up by consensus, resulting in 92 articles being chosen.

Finally, we read the articles in their entirety and eliminated another 34 articles according to the following exclusion criteria: Excluding articles not directly addressing the age group over 60 years old; excluding articles not linked to topics related to financial fragility; excluding articles linked to topics related to Macroeconomics. After all the selection process and refinements, we finished with a final sample of 58 articles (Fig. 3).

All the steps of the protocol were followed and reported in this methodology, except for those non-pertinent to a systematic review in a non-medicine field. The search included all WoS, Scopus, Google Scholar, PubMed, EBSCOhost, and Embase fields, ensuring that all important outlets were included in the initial selection. The refinement process allowed us to keep articles related to public management as the study's focus. At least two researchers read the articles, but the abstract selection process results were available to all researchers.

After reading and selecting the final articles that make up the literature review, we went into the process of analyzing and classifying the articles. First, we carried out a quantitative analysis of the various characteristics of the articles, looking at "Year of Publication", "Type of Article", "Type of Research", "Data Collection", "Data Analysis", "Research Locus", and "Continent of Publication." This information provides an overview of the selected articles, showing how the field of study is evolving in this process (Fig. 4 and Table 1). To reinforce this analysis, we also carried out a trend analysis by counting the main words in the abstracts in each year of publication and presenting the two most frequent. To do this, we used the Biblioshiny package in the "R" program.

Conducting a quantitative analysis of the articles before a qualitative analysis was a way of generating a broader knowledge of the articles studied, mapping the field of study (Donthu et al., 2021). This analysis reveals various behaviors intrinsic to the field of research studied and provides researchers and voters with an overview of how the field is evolving.

As it was not possible to present an individualized analysis of each of the 58 articles selected, we proposed grouping articles into broad lines. During the in-depth reading of the articles and codification, we identified nine topics as the main guiding principles of the articles (Page et al.,

2021). In this process, we used the method of discourse analysis, seeking to go beyond content analysis (Bardin, 2011; Caregnato & Mutti, 2006). These topics were used as a guide for analyzing and reporting on the articles and guided the construction of the research findings. However, it is important that even if articles were classified under one topic, they naturally presented issues under other topics with less emphasis. This issue was dealt with at the end of the discussion of the results, presenting an analysis of the relationships between the topics in the different articles.

Actions bias risk control

We implemented a series of actions to reduce the possible risk of bias in the selection of articles, as recommended by the PRISMA methodology (Page et al., 2021). The first action was to search for articles in different databases (WoS, Scopus, Google Scholar, PubMed, EBSCOhost, and Embase). Second, author and two non-authors read separately in different locations the abstracts downloaded from the different databases. To implement this second step, the researchers predetermined a series of criteria (presented above and listed in one of the boxes in Fig. 3). These criteria were the guidelines for selecting the abstracts and later for selecting articles when reading them in full. Then, the selectors met to identify the articles mutually selected. Articles selected by only one or two of the selectors were not automatically included. Selectors did a second reading and discussed the abstracts. Then, if consensus was achieved, the article was either added or discarded from the selection. After choosing the abstract selection process, one author and a non-author colleague thoroughly read the articles of the designated abstract, thus completing the selection of articles in the systematic review. This whole process was carried out to reduce the risk of selection bias as much as possible.

Finally, this study has been presented at several academic conferences. The feedback received has helped mitigate biases by encouraging us to add databases and making sure several selectors were part of the selection process.

Results: Quantitative descriptive analysis of results

According to Fig. 4., the first article on FFOA was published in 1997. Since 2016, we have seen a clear upward trend in articles published, with 2019 being the year with more outputs. This general description suggests that FFOA is a nascent topic yet to be explored and that needs to gain research volume to address emerging problems derived from worldwide demographic changes (Ebbinghaus, 2021; Hinrichs, 2021; Lusardi et al., 2020; Yang, 2020).

According to Table 1, the first general conclusion standing out is the dominance of empirical articles over theoretical ones. As noted earlier, 53 of 58 articles are empirical: nine employ qualitative methodology, two use a mixed method approach, and 42 are quantitative. Of articles that rely on quantitative methods, 32 used secondary data to develop a panel data set, four involved secondary data in a cross-sectional analysis, six collected primary data for a cross-sectional analysis, and four used panel data derived from primary statistics.

The second point standing out is the excellent concentration on quantitative methods, demonstrating a significant gap in qualitative studies. More qualitative research is needed to unveil the drivers and the causal mechanisms that lead to FFOA (Langan, 1997). Qualitative research also
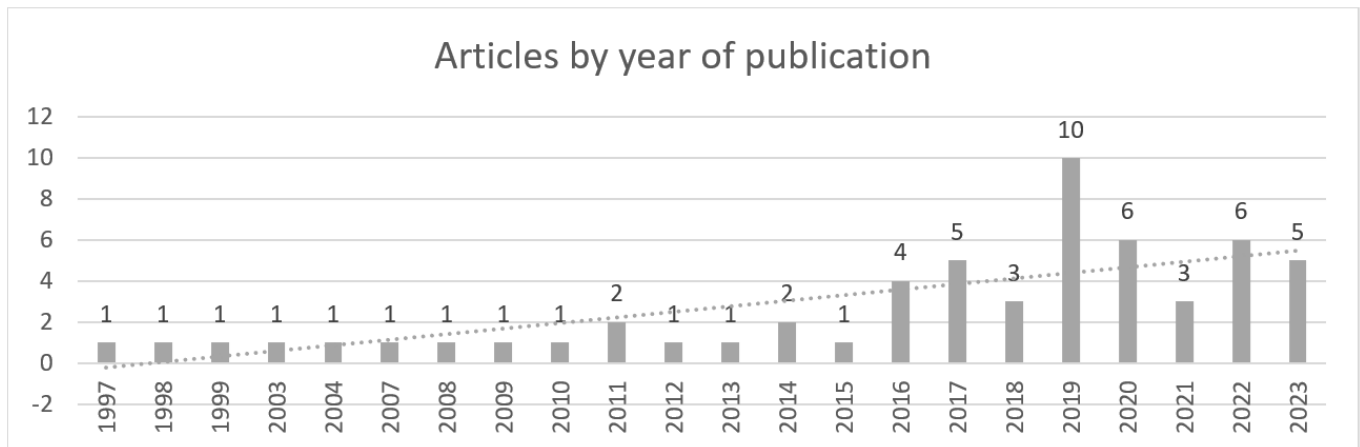
Fig. 4. Distribution of selected articles by year of publication.

can help build new theories or adapt existing ones by uncovering context-bound moderators or mediators. Qualitative work also has the potential to construct theoretical models using methods, such as Grounded Theory (Charmaz & Belgrave, 2000). A third striking fact is the considerable reliance on secondary panel data, with 32 articles doing so. Secondary data is less costly in terms of time demand and resources.

Looking at the geographical distribution of the studies (Table 1 - Continent), we see a concentration of studies in three specific regions: North America (USA), Europe, and Asia (West Asia). An essential point in this finding is the great cultural differences between these three regions. In the USA, the issue of survival of older adults is mainly treated as a personal problem, i.e., it is the person's responsibility to have accumulated resources for their old age (Gutchess & Cho, 2024; Sung & Yoon, 2024). On the other hand, European culture highlights state responsibility for providing survival conditions for older adults, especially in countries that have more deeply implemented the post-war welfare state (Miyazaki, 2023; Rummery, 2023). In contrast, Eastern culture transfers responsibility to the family for caring for older adults, treating the intergenerational transfer of resources within the family as public policy (Gutchess & Cho, 2024; Ning et al., 2019; Teerawichitchainan et al., 2015).

To identify the main terms of analysis and their trend over time, we analyzed the abstracts of the articles available in the Biblioshiny package of Biblometrx (Aria & Cuccurullo, 2017). For articles published in 2020, the most frequent terms were "Financial Literacy," "Retired elderly," and "Financial Vulnerability" (Fig. 5). For works published in 2023, the most covered terms were "Cognitive Ability," "Financial Inclusion," and "Debt Anxiety." These identified terms were essential for the researchers to generate nine main topics, thus allowing us to group the 58 articles by these nine subjects.

Fig. 6 shows topics that emerged from reading the articles and the number of articles dedicated to each. This classification becomes the basis of our analysis below.

Emerging topics in the analysis of articles on financial fragility of older adults
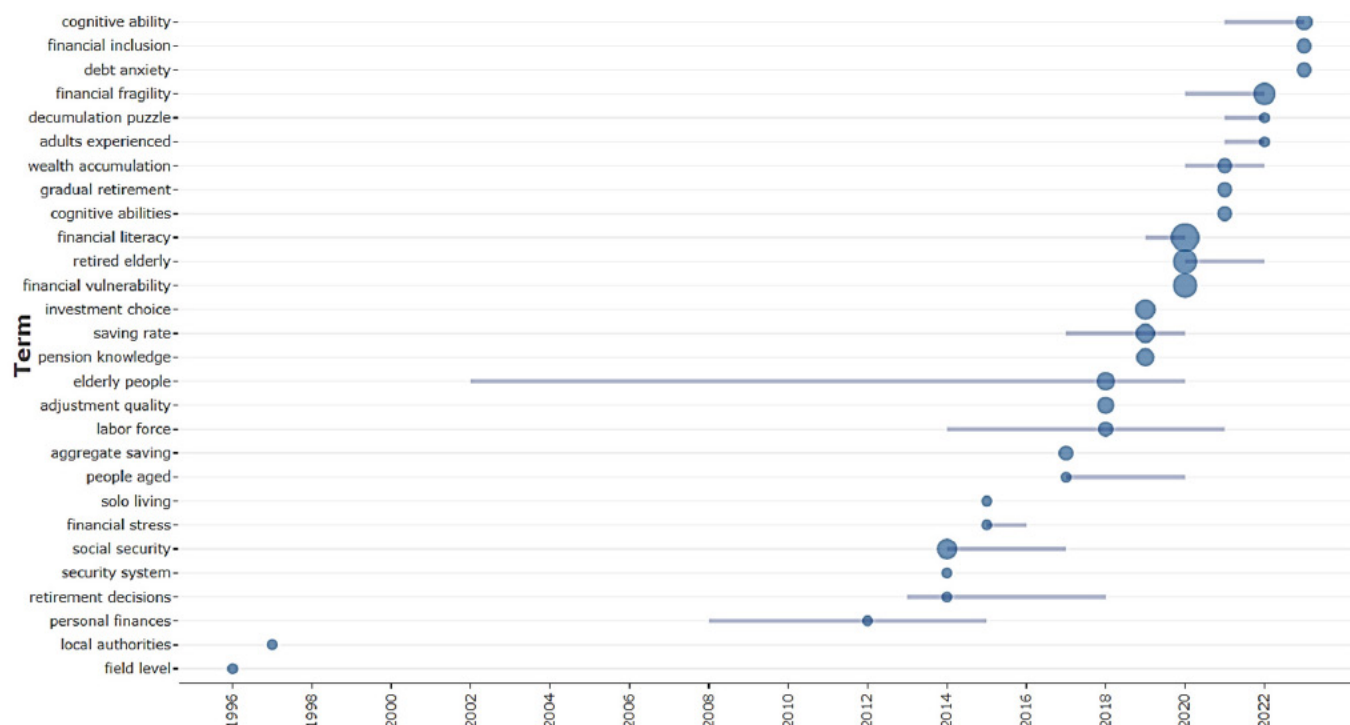
Fig. 5. Trend of main terms emerging from the analysis of words in abstracts of articles making up related database by year of article publication.
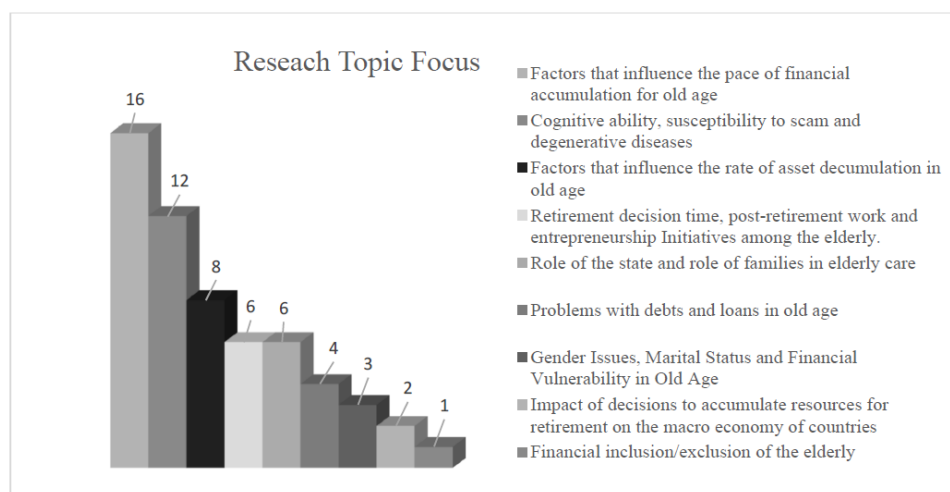
Fig. 6. Research topic focus.

For each of the nine topics that emerged after reading the 58 articles, we described how each was addressed when mentioned. This analysis should unveil the importance of each topic and the study's relevance in providing valuable and practical information for constructing pre-retirement and post-retirement public policies aimed at protecting financially older adults. These topics do not seek to generate correlations between them. They only seek to group the articles together to cover all the articles because an individualized analysis would be too extensive. However, at the end of the analysis we present some relationships appearing in the articles that may be important for

understanding the field studied.

The most common topic addressed in 16 articles refers to "factors that influence the pace of financial accumulation for old age." This topic includes the most comprehensive age range for public policies, covering young people and adults close to retirement age. Identifying factors that influence accumulating resources to sustain a financially healthy life for older adults may suggest areas on which governments should focus to reduce older adults' dependence on government cash transfer programs (Le Blanc et al., 2016; Mahmud et al., 2019; Yang, 2020).

The articles that address this topic of financial accumulation cover factors that impact the accumulation process. One factor refers to how reforms to the pension system impact the accumulation process (Ohinata & Picchio, 2020; Yang, 2020). These articles conclude that changes in the design and implementation of compulsory public pension systems impact on people's propensity to save for old age. For instance, people tend to replace personal savings with mandatory savings.

Articles addressing the first topic also explore the financial literacy effects on the accumulation process (Bucciol et al., 2021; Christelis et al., 2009; Nguyen et al., 2019; Xue et al., 2020). A clear conclusion emerges here: The positive influence of financial education on changing people's behavior to accumulate resources for retirement and associated consumption patterns (Xue et al., 2020). However, studies suggest that learned financial education tends to dilute over time (Bucciol et al., 2021). Besides dealing with financial literacy, some articles also explore the effects that increase risk (Nguyen et al., 2019) and resistance to adopting banking technology on people's propensity to accumulate resources for old age (Xue et al., 2020).

Within this topic, Moffatt & Heaven (2017) present a survey analysis to explore how 52 men and women living in northern England planned their retirement process. The results of their article point to an inconsistency in planning and executing steps used in retirement. Various contingent factors in life have a direct impact on this accumulation, leading to behaviors that distort the execution of plans and result in failing to achieve the expected result. Planning for accumulation is only normative without deeper reflection (Moffatt & Heaven, 2017). According to the authors, "The results offer insights into why many people do not plan and indicate that many assumptions associated with retirement planning deserve further consideration, both theoretical and practical" (Moffatt & Heaven, 2017, p. 879).

Literature has explored additional questions within the first common topic. Some authors focus on how self-efficacy (Asebedo et al., 2019), equity values (Blanchett et al., 2018), and private accumulation products, such as Individual Retirement Accounts (IRAs) (Garcia & Marques, 2017; Raab & Gannon, 2014), can increase or decrease accumulated resources and, in some cases, produce financial vulnerability after retirement.

The second most popular topic is "Cognitive Ability, Susceptibility to Scam and Degenerative Diseases," which is covered in 12 articles. The authors here investigated the impact of cognitive capacities on older adults' dealings with their finances. The notion is that cognitive abilities decline as people get older (Finke et al., 2017; Lichtenberg et al., 2020). Clinical studies corroborate this premise, especially concerning the ability to access accumulated knowledge and crystallized memory fluidly (Finke et al., 2017).

Natural cognitive decline can be further aggravated when degenerative diseases appear, i.e., those that accelerate the process of partial or total dementia in older adults (Gresenz et al., 2020; Langan, 1997; Means & Langan, 1996). This process exposes older adults to great financial fragility because they cannot manage their finances efficiently or are exposed more to fraud and scams (Tang, 2021; Yu et al., 2022). In addition, diseases such as Alzheimer's tend to be detected in more advanced stages, which leads sufferers to carry out banking and consumer transactions that ultimately produce poor results, exposing them to increased vulnerabilities (Gresenz et al., 2020).

Governments must address the reduced cognitive capacity of older adults to create protection mechanisms that guarantee their financial security (Langan, 1997; Mishra & Ahad, 2017). Social protection systems that ensure care for older adults who do not have family support are essential in the process of inclusion. Further, financial institutions and workers in these institutions need special training to reduce losses in the senior population (Gresenz et al., 2020; Mishra & Ahad, 2017).

The third identified common topic was "Factors that Influence the Rate of Asset Decumulation in Old Age," covered in eight articles. Although the decumulation movement occurs in some cases, more than 40% of Italy's older adults accumulate wealth even after retirement. This finding contradicts expectations and points to the role of intergenerational transfers (inheritances and inter-vivo transfers) and precautionary savings as elements that reduce decumulation and instead accumulate new resources.

Within this decumulation theme, Murata's study of Japanese household microdata showed that the rate of wealth decumulation was much lower than expected, compared to the standard living/ permanent income class. Murata (2019) finds differences in the decumulation rate between older adults who decide to leave an inheritance to their heirs and those who opt not to or have no heirs. In this case, the second group has a much higher decumulation rate than the first, showing this factor's importance in older adults' consumption decisions.

Within this fourth topic, Shimizutani & Yamada (2020) compare post-retirement investments between American and Japanese pensioners. Their main conclusion is that educational knowledge, cognitive skills, economics or finance courses, and income level influence both the Japanese and American samples.

The fourth topic with the highest frequency of articles in our sample is "Retirement Decision Time, Post-Retirement Work and Entrepreneurship Initiatives among the Elderly." Six articles seek to identify and measure the impact of retirement decisions on workers (Raab & Gannon, 2014) and how these decisions can be biased (Kalenkoski & McCarty, 2021) at different times (Nilsson, 2012). In this case, both the time of retirement and the decision whether to continue working can be addressed by public policies helping workers choose the best option given their (a) desires, (b) conditions for accumulating resources, (c) physical and psychological dispositions, and (d) conditions at work (Lanchimba et al., 2020).

Nudge policies (Thaler & Sunstein, 2009), which seek to influence behavior, play a fundamental role in the accumulation and decision-making process. Nudge policies help citizens choose more appropriately, depending on their conditions and aspirations (Kalenkoski & McCarty, 2021; Nilsson, 2012; Raab & Gannon, 2014). Entrepreneurship among older adults is another topic addressed by one of the six articles (Zhang & Sorokina, 2022). Entrepreneurship contributes to maintaining an

active professional life after retirement and to generating jobs for other people.

The fifth most frequent topic was "Role of the State and Role of Families in Elderly Care," with six articles covering it. These studies explore how to protect older adults already in this situation and who depend on state protection programs and intergenerational resource transfers within families for financial protection (Abruquah et al., 2019; Ning et al., 2019; Teerawichitchainan et al., 2015). The primary conclusion of these articles is that this process is dynamic and they are complementary. It is worth noting these articles focus on East Asia (China, Myanmar, Vietnam, and Thailand), leaving the question of how this process happens in other worldwide cultures, especially in more individualistic cultures like the West.

Another point addressed in the articles is how the scarcity of income in a previous period impacts the future perception of financial fragility (Baldini et al., 2020). This impact is strongly influenced by the type of financial protection system the state offers its citizens in times of loss of income from work. The greater the protection provided at these times, the lower the impact of the perception of financial fragility in the post-crisis period (Baldini et al., 2020). This information is essential for accumulating resources for retirement and the post-retirement period, as it guarantees a positive assessment of public protection policies in times of difficulty and how they have a long-term effect.

The sixth topic with the highest number of articles was "Problems with Debts and Loans in Old Age," included in four articles. This is a topic that shows how many older people are getting into debt as a way of maintaining a certain standard of living. These older people take out loans backed by their assets instead of using them to generate income, such as renting (Collins et al., 2020). This behavior exposes these older adults to greater financial fragility, as economic shocks, such as high interest rates, affect their finances more (Lusardi et al., 2020).

In addition, behavioral issues, risk aversion, and many other factors can influence the way an older adult deals with loans and debts, causing more significant anxiety and even illnesses that significantly worsen quality of life (Noviarini et al., 2023). Within this topic, we also face the problem of how the elderly deal with debts. Here, income plays a fundamental role in the process of reducing debts. However, the financial life cycle, pointed out by Ando & Modigliani (1963), still holds older people to having less debt than younger people (Brown et al., 2022).

The seventh topic is "Gender Issues and Financial Vulnerability in Old Age," with three articles. The study of gender in finance is relatively recent (Roy & Patro, 2022). In the studies selected in our sample, authors seek to identify causes that lead older women to financial fragility. For Into (2003), financial education appears to be fundamental to improving conditions in which older women manage their finances. This better management will produce a gain making the financial lives of these older adults more sustainable, thus escaping the condition of FFOA. This problem was identified because the generation of older adults studied had received little instruction on finances during their lives. In many cases, they had spent their lives with other people, husbands, and children taking care of financial decisions and responsibilities (Into, 2003). In the search for solutions, the authors argue governments must create public policies to help older women develop and gain control and autonomy over their finances.

Another problem studied in this group is the impact of divorce on the different genders when

they reach old age (Stroup & Pollock, 1999). Stroup & Pollock (1999) demonstrate statistically that women tend to fare worse financially and are therefore more financially fragile in older adulthood than men when divorced. A second study deals with the effect of marital status on the evolution of income in old age, indicating this issue has a major impact on greater financial fragility in the post-retirement years (Ozawa & Lum, 1998).

The eighth topic identified was "Impact of Decisions to Accumulate Resources for Retirement on the Macro Economy of Countries." Two articles covered this topic, which deals with how formal and behavioral aspects influence macroeconomic issues. İmrohoroğlu & Zhao (2020) start analyzing the investment behavior abroad of capital accumulated for retirement by the Chinese to determine its impact on the exchange rate and growth in China itself. In the process, they conclude changing rules governing these investments after 2008, with the possibility of investments in Chinese companies, led to reducing the exchange rate surplus, altering the exchange rate relationship that existed until then.

The second article explored how older adults of the Russian population impact economic factors, highlighting that new generations are accumulating more resources than previous generations (Bussolo et al., 2017). However, shocks caused by changes in pension systems or the economic growth rate can affect this process by changing the accumulation trajectory.

The ninth topic identified was "Financial Inclusion/Exclusion of the Elderly." Only one article discussed it. Financial exclusion has gained increasing attention in the academic world (Leandro & Botelho, 2022). However, when it comes to older adults, our research points to a low production level. This is a necessary topic that demands excellent progress in the modern world, where many advantages exist to having a well-developed financial citizenship (BCB, 2021). Given this need, the article points to the financial exclusion of older adults in Thailand, a country with a highly financially inclusive population (Bui & Luong, 2023). In the research, authors show the older sections of the population are proportionally more excluded than younger ones, reaching 55% of the sample collected.

The relationship between the topics is also important for understanding the studies listed here. Despite the initial choice to classify all articles according to main topics to facilitate analyzing and reporting findings, this does not exclude the existence of a relationship between the different topics both theoretically and in the articles themselves. The first important relationship is that although it is usually treated in isolation is "Factors that influence the pace of financial accumulation for old age" and "Factors that influence the rate of asset decumulation in old age." This relationship appears mainly in the pattern of behavior, since people who show financially regulated behavior during their life tend to maintain this behavior in their older adult life (Asebedo et al., 2019; Xue et al., 2020). In addition to this issue, financial literacy also has an impact on both topics and ends up bridging the gap between them since this is knowledge not lost over time (Chhatwani & Mishra, 2021; Mitchell & Lusardi, 2022; Shimizutani & Yamada, 2020). This also ends up touching on the topic, "Cognitive ability, susceptibility to scam and degenerative diseases," through studies seeking to identify how cognitive decline affects using financial knowledge accumulated during life in greater or lesser FFOA (Finke et al., 2017; Gerstenecker et al., 2016).

In addition to questions like this, studies dealing with the issue of "Cognitive ability, susceptibility to scam and degenerative diseases" are always linked to "Factors that influence the rate of asset

decumulation in old age." Although the second subject is not the focus of the article, it is addressed head-on, given articles seek to identify how cognitive issues affect decumulation of these people's assets as they get older and suffer from diseases (Finke et al., 2017; Gerstenecker et al., 2016; Gresenz et al., 2020). The issues of "Gender Issues, Marital Status and Financial Vulnerability in Old Age" are also linked to "Factors that influence the rate of asset decumulation in old age." That's true because authors are investigating how gender can affect the process of decumulation or even income (Into, 2003; Ozawa & Lum, 1998; Stroup & Pollock, 1999).

What is important to understand from this analysis is none of these topics appear in isolation in the articles. They are all related to each other and have different influences and importance in studies. All the articles studied at some point relate the themes, sometimes even more than two themes. However, this relationship is always treated as a consequence of the main subject and not as a second subject with no direct link to the main one.

Discussion of results, gaps, and future research paths

Based on the nine topics that emerged from reading the articles, we identify the gaps in the literature and suggest future research paths. The first emerging topic was: "Factors that Influence the Pace of Financial Accumulation for Old Age." The existing work focuses on factors that precede retirement age. Therefore, future research should explore the role of certain factors in FFOA after retirement. Some potential factors to be explored include financial risk aversion, financial fragility, poverty, financial inclusion, unemployment, and entrepreneurship, among others (Mahmud et al., 2019; Mitchell et al., 2022; Moffatt & Heaven, 2017; Nguyen et al., 2019; Xue et al., 2020).

A preventive public policy implemented during an individual's active working life can benefit that individual by preparing for old age. The policy also would help the government by reducing its financial responsibility for that person's well-being. Having healthier and less dependent older adults would leave the government with greater resource capacity to solve other problems, thus benefiting society.

While nudging theories help us understand behavioral change for financial accumulation (Thaler & Sunstein, 2009), more theoretical development is needed. For instance, future theories help us understand how culture, institutions (formal and informal), and government interventions encourage or discourage people's financial accumulation habits for retirement age. Identifying these antecedents has practical policy design implications (Moffatt & Heaven, 2017).

The second topic, "Cognitive Ability, Susceptibility to Scam and Degenerative Diseases," presents many possibilities for studies that address different gaps. First, further study is needed on cognitive abilities and their decline in old age. Research can help show how these characteristics in people without cognitive impairment due to disease act on issues, such as financial literacy, risk aversion, resistance to adopting banking technology, and many other constructs we know impact how adults deal with finances and, consequently, expose them to financial fragility (Angrisani et al., 2023; Finke et al., 2017; Noviarini et al., 2023; Xue et al., 2020).

Another gap points to the need to understand how older adults are exposed to fraud and scams, identify factors causing this exposure, and how these factors can be mitigated. This knowledge would help governments design public policies to protect seniors and prevent them from being

victims of fraud (Lichtenberg et al., 2020; Xue et al., 2020). Guaranteeing greater security for older adults would result in more life satisfaction and a lower incidence of illness and depression (Yu et al., 2022).

Another issue raised by authors who highlighted the topic of financial accumulation is how cognitive degenerative diseases impact exposure to FFOA and how this can be addressed. While studies have documented cognitive degeneration's effects on FFOA, more research is needed here. For instance, future studies may analyze the support programs financial institutions handling retirees' resources have to deal with this situation (Gresenz et al., 2020; Langan, 1997; Means & Langan, 1996). Other studies may compare the effects government programs have on dealing with this reality. Finally, scholars may study the diffusion mechanisms of social programs addressing this situation.

The third identified topic, "Retirement Decision Time, Post-Retirement Work and Entrepreneurship Initiatives among the Elderly," also reveals research gaps. For example, further studies should explore the effects of inflation on people's decisions to retire. The recent experience with an unexpected pandemic also encourages us to uncover the impact of external shocks on people's retirement decisions. These effects also may vary by country, culture, context, and individual characteristics (Raab & Gannon, 2014). Therefore, considerable research is needed on this topic. Assessing the role of different decision-making processes should also shed more light on this consequential decision.

As with the previous three topics, the fourth one, "Factors that Influence the Rate of Asset Decumulation in Old Age," also merits further research. We encourage scholars to explore how the decumulation process can affect the reserves accumulated during preparation for retirement (Bonekamp & van Soest, 2022). Although Ventura & Horioka (2024) and Murata (2019) point to a lower-than-expected decumulation considering the traditional financial life cycle (Ando & Modigliani, 1963), more in-depth studies are needed. The regional concentration of existing studies calls for further research in other world regions, especially in developing countries where exposure to FFOA is more prevalent. In addition, future research should uncover other factors affecting the decumulation process. Does decumulation happen more frequently in certain countries than in others? If so, what are the contextual and conditioning factors? How do macroeconomic policies accelerate decumulation?

For the fifth topic, "Role of the State and Role of Families in Elderly Care," the most important gap is understanding how the state and families can help elderly people in a situation of FFOA. Future studies should compare the effects of potential solutions. While some suggest implementing public income transfer policies makes sense (Porto, 2014; Tristão et al., 2014), research should disentangle moderating effects of contextual and personal conditions. Others have offered to adopt legal mechanisms that oblige family members to transfer part of their income to older adults (Ning et al., 2019). Do legal compulsory tools apply to all contexts? The previous gap creates further questions: who should care for older adults without family support, and who needs long-term care? Mishra & Ahad (2017) reminds us of the need for public policies aimed at this problem. However, studies are required to identify the intended and unintended consequences of existing tools addressing these concerns.

The sixth identified topic, "Problems with Debts and Loans in Old Age," appeared in research and was closely linked to the issue of the behavior of elderly people in managing their assets (Collins et al., 2020). Risk aversion and consumption patterns (Noviarini et al., 2023) also can be addressed from various other perspectives, representing another venue for further research. Determining aspects influencing the behavior of older adults when it comes to taking out credit and issues related to debt is fundamental to understanding a large part of the FFOA.

Issues, such as legislation linked to forms of loans aimed at retired older adults in emerging and developing countries with public pension systems, can be of great value in understanding the processes of indebtedness of older people (Leandro & Botelho, 2022). The behavior of family members close to older adults also can be explored in the search for causes of indebtedness among older adults, i.e., when the elderly are used as a source of funds for third parties through loans taken out in their names (Porto, 2014). These gaps call for ways and solutions to adjust laws, protecting older adults from being exposed to FFOA through poorly taken or poorly managed loans.

The seventh topic "Gender Issues and Financial Vulnerability in Old Age," is also vital to generating a look at more vulnerable groups within the elderly group itself (Into, 2003; Ozawa & Lum, 1998; Stroup & Pollock, 1999). Understanding that subgroups, such as older adults, exist within a vulnerable group with different characteristics requiring different approaches is fundamental to addressing a problem as broad and diverse as FFOA. It is not essential to consider older adults as a homogeneous group that only needs mass solutions. Instead, it's better to take a more diverse view that seeks to generate data and information showing this diversity and how public policies can address these specific groups and their particular problems.

The eighth topic, "Impact of Decisions to Accumulate Resources for Retirement on the Macro Economy of Countries," opens up many possibilities for new research. Studies need to focus on how retirement behaviors influence macroeconomic issues. Further, studies can examine how FFOA can be aggravated or mitigated in the face of these influences and how governments can act through public policies to ensure this mitigation in the short and long term.

The ninth topic, "Financial Inclusion/Exclusion of the Elderly," is relevant for democratic strengthening. Additional research will bring gains from citizens' financial inclusion, both for the economy (Allen et al., 2016; Sela et al., 2020) and for citizens themselves (BCB, 2021). Future studies could help identify levels of elderly exclusion and factors that cause this exclusion.

The financial inclusion of older people generates a considerable gain in their quality of life (Sakyi-Nyarko et al., 2022). Wang & Mao (2023) identified the extensive use of digital finance by elderly families, as a tool to alleviate their financial vulnerability by increasing their property income. However, the digital inclusion of elderly households also has its perverse side. With access to more significant means of borrowing, especially in countries that encourage consumption through indebtedness (Machado & Milanez, 2022; Porto, 2014), digital inclusion ends up leading to over-indebtedness (Doll & Cavallazzi, 2016). This requires governments to have public policies aimed at this age group, taking actions far beyond financial literacy (García & Vila, 2020).

Digital inclusion also can be a barrier depending on older adults' ability and willingness to engage in a world of digital finance (Begum, 2023; Onay et al., 2023; Rajan & Ghosh, 2023). Older adults are more resistant to technology adoption than younger populations (Onay et al., 2023),

thus reducing potential gains. In addition, the lower cognitive capacity of aging can lead to greater exposure of older people to scams (Yu et al., 2022), a problem exacerbated by greater possibility of fraud in the digital environment (Burma, 2023; Kemp & Erades Pérez, 2023).

Results' implication for theory, policy, and practice

Our study shows the need to expand the existing literature on FFOA. For instance, further analyses are needed to explore the determinants of individual saving behavior, either by applying established theories or by creating new theoretical framework based on context and institutional settings. Identifying the causes of individual saving behavior should help design policy to mitigate FFOA.

Concerning the application of existing theories, we point to theories of rational decision-making (Ajzen, 1991, 2011; Shih et al., 2022; Valois et al., 2020), Life Cycle Theory (Ando & Modigliani, 1963; Biederman & Goenner, 2008; Bonekamp & van Soest, 2022; Groneck et al., 2016), and institutional theories (Parsons, 1951; Scott, 2014) as potential frameworks to understand individual saving behavior. These theories have the potential to explain decision-making behavior when accumulating resources for retirement to reduce risks of FFOA. Another individual decision with strong implications is 'when to retire.' Theories such as the life cycle should contribute to this analysis (Ando & Modigliani, 1963; Biederman & Goenner, 2008; Bonekamp & van Soest, 2022; Groneck et al., 2016). This theory alone (Lu et al., 2021) fails to explain the decision of when to retire. Therefore, other broader and more diverse perspectives should be considered

In addition, theories related to public policies can also help understand the FFOA and propose new solutions. Nudges' theory, along with experimental analysis, may provide insights to governments into how to induce saving patterns (Beshears et al., 2021; Kahneman, 2013; Sunstein, 2020; Thaler & Sunstein, 2009). Moreover, theories related to public policy classifications based on their beneficiaries (Schneider & Ingram, 1993) may also explain citizens' support for policies targeting older adults. Other theories, such as institutional theory (Parsons, 1951; Scott, 2014) and public policy narrative theory (Kuhlmann & Blum, 2021; Picazo-Vela et al., 2012; Strömberg, 2001) may also contribute to our understanding of FFOA across different institutional settings and across gender issues and marital status.

As for new theories, our study shows the lack of studies addressing new theories to solve FFOA. The existing studies fail to combine theoretical frameworks to explain FFOA. Of the 58 studies selected, only five are theoretical and tend to focus on issues related to the accumulation and decumulation of resources within the retirement process (Bonekamp & van Soest, 2022; Mahmud et al., 2019; Schieber, 2004). This lack of theoretical studies prevents answering essential questions related to FFOA. These questions include the consequences of FFOA on individuals, the role of individuals and the state of the FFOA process, or how to test new tools and policies to address FFOA giving the specific contexts.

The implications for public policies of the review's findings point to the need for studies that more precisely identify the antecedent and consequent factors of the FFOA. Although some of the included studies tried to do so (Asebedo et al., 2019; Bialowolski et al., 2021; Bonekamp & van Soest, 2022; Fan et al., 2022; Finke et al., 2017), further studies are needed. A clear gap exists in exploring

preventive solutions rather than reactive approaches. More discussion should also be devoted to understanding the policy-making process for policies targeting the elderly, a vulnerable and increasing population (Mishra & Ahad, 2017; Suwanrada, 2008; Teerawichitchainan et al., 2015).

Another fundamental issue is the impact of the gaps identified in practice. A central point for practice is the issue that not everyone prepares for retirement by making rational decisions (Hausman & Welch, 2010; Lin et al., 2017; Shah et al., 2015). In this case, governments may opt for tools and incentives to influence individual behavior by encouraging savings for retirement. Others may see this as a utopian (Curchin, 2017; Goodwin, 2012). The issue of voluntary intergenerational transfer of resources can also be an important gap to study (Abruquah et al., 2019; Ning et al., 2019; Ohinata & Picchio, 2020; Teerawichitchainan et al., 2015). This calls for comparison studies across individualistic societies, such as the West, and more collectivist societies. These studies have the potential to uncover new lessons for formulation of public policies for intergenerational income transfer.

A second fundamental point for practice is the need for new studies dealing with public policies aimed at public problems that impact older adults. Many of these problems are considered wicked problems, as they seem to lack a definitive solution or cannot be dealt with by just one public entity or body (Alford & Head, 2017). FFOA problems require a multidisciplinary, multi-level, multi-agency approach, as they are caused by diverse and often uncontrollable factors. In this context, interagency collaboration may guarantee risk mitigation and consequence mitigation (Alford & Head, 2017; Escobedo et al., 2021). In doing so, collaborative governance and the collaborative network can help in the process of finding effective solutions (Bryson et al., 2021; Emerson & Nabatchi, 2015; Martins et al., 2023). Here it is worth highlighting the concepts of co-creation, co-designer, and co-implementation of public policies. These governance tools may have a direct impact on public management by formulating FFOA policies aimed at beneficiary populations (Bentzen, 2022; Crompton, 2019; Osborne et al., 2016; Woo, 2021).

Conclusion

Financial fragility in older adults is a public problem several countries currently face (Lusardi et al., 2020; Mishra & Ahad, 2017). The aging of the world's population, due to increased life expectancy and reduced birth rates, significantly impacts the progression of financial fragility in older adults (FFOA). This fact calls for public policies to mitigate its effects in the short term and solve the problem in the long term (Ebbinghaus, 2021; Hinrichs, 2021; Yang, 2020).

This scenario led us to propose the following research questions: "How robust is the literature on financial fragility in older adults?" and "What are the scenarios for the future agenda?" The aim was to map the literature on FFOA, pointing out what is known through existing articles and identifying possible gaps to be filled by future research.

The research question arose from the need to understand why older adults become more financially fragile when they need money the most. Understanding this topic in-depth is increasingly pressing due to the aging population (Ebbinghaus, 2021; Hinrichs, 2021; Lusardi et al., 2020; Mishra & Ahad, 2017) and the inability of governments to administer retirement systems

(Ortiz et al., 2019; Ring et al., 2020). This is a long-standing problem that is becoming increasingly relevant. However, our preliminary exploration and a Bibliometric study indicated a general need for studies on the issue, especially on public policy.

Our analysis of the selected sample of articles using the PRISMA protocol (Page et al., 2021) generated the following findings:

a) There is a considerable lack of theoretical studies on financial fragility.

b) A predominant number of studies take a preventive rather than reactive approach to examining the financial vulnerability of older adults.

c) It's important to engage financial institutions to protect older adults by reducing their exposure to financial fragility.

d) Studies are needed to understand the policy-making process for policies targeting the elderly, especially those without family support.

e) Consider the potential effects of public policies redistributing income between generations.

f) Indebtedness levels of elderly families and their exposure to macroeconomic problems can alter interest levels.

g) The lack of studies in some regions indicates the topic is still in its infancy. It needs the scientific community's attention in the search for more efficient solutions.

h) There are few studies pointing to possible scales that can be used to access information that secondary databases cannot provide.

First, this study indicates that FFOA still needs to be explored, as few articles have been published specifically on the subject. Secondly, although some causes and solutions to the problem have been studied, much more research is needed. We suggest some lines of research to encourage colleagues to address them.

The findings show the importance of advancing theory related to the antecedents and consequences that lead to FFOA. As a practical contribution, we indicate the need for more studies that point out how the state, through public policies aimed at FFOA, can reduce financial fragility and be productive and fruitful for managers and politicians to deal with these policies.

All these issues point to the need for a more comprehensive public policy, moving away from just encouraging the creation of savings for retirement as if this incentive alone would solve the problems (Curchin, 2017; Shah et al., 2015). Much more is needed, as Ghosh (2023) and Mishra & Ahad (2017) and other authors point out. They stress public policies need to be broad and offer older adults more than financial support, such as care from social workers, companionship for those with no relatives, and a humanized reception system.

Public policies are needed to address the financial and digital inclusion of older adults. These policies must consider contextual and individual attributes (Burma, 2023; Rajan & Ghosh, 2023), such as cognitive decline and susceptibility to scams (Wang & Mao, 2023; Yu et al., 2022). Public policies also should consider ways to prevent seniors with cognitive degenerative diseases from reducing their assets (Gresenz et al., 2020). This calls for cooperation between public and private banks, as they can monitor erratic behavior in advance.

Cultural issues also should be considered when implementing policies. As pointed out above, people's choice of models for preparing for retirement varies across world regions (Ingale & Paluri, 2023). Cultural differences are rarely covered in existing studies, as they tend to prescribe standard solutions, usually based on experiences developed in more prosperous countries (the US and Europe). A few exceptions are already starting to look at culture and prescribe solutions aimed at these problems, taking into account local characteristics and cultures (Ghosh, 2023; Mishra & Ahad, 2017; Murata, 2019; Ning et al., 2019; Teerawichitchainan et al., 2015).

Limitation of the study

Our study is not without limitations. Restricting the scope of this study by excluding (a) articles that do not directly address the 60+ age group; (b) articles not linked to topics related to financial fragility; (c) articles linked to macroeconomic issues, and (d) non-peer reviewed articles (i.e., proceedings and working papers) reduced our sample size. Our study also excludes books and book chapters. However, our limitations should create opportunities for new studies to dive into different insights into the problem. For example, looking at causes of financial fragility in populations with different age ranges should help us uncover unexplored causal mechanisms. The inclusion of topics, such as financial literacy, closely linked to lowering financial fragility (Finke et al., 2017; Jappelli et al., 2013) would contribute to our understanding of FFOA. Further studies also should explore the impact of FFOA on macroeconomic indicators.

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Xue, R., Gepp, A., O'Neill, T. J., Stern, S., & Vanstone, B. J. (2020). Financial well-being amongst elderly Australians: The role of consumption patterns and financial literacy. *Accounting* & *Finance*, *60*(4), 4361-4386. https://doi.org/10.1111/acfi.12545

Yang, T. T. (2020). The effect of workplace pensions on household saving: Evidence from a natural experiment in Taiwan. *Journal of Risk and Insurance*, *87*(1), 173-194. https://doi.org/10.1111/jori.12254

Yu, L., Mottola, G., Barnes, L. L., Valdes, O., Wilson, R. S., Bennett, D. A., & Boyle, P. A. (2022). Financial fragility and scam susceptibility in community dwelling older adults. *Journal of Elder Abuse* & *Neglect*, *34*(2), 93-108. https://doi.org/10.1080/08946566.2022.2070568

Zhang, L., & Sorokina, N. (2022). A study on elderly entrepreneurial intention in the hospitality and tourism industry in China. *Journal of Asian Finance, Economics and Business*, *9*(2), 335-346. https://doi.org/10.13106/jafeb.2022.vol9.no2.0335

Appendices

Appendix 1. List of articles that entered the review process as articles selected for analysis - Database

Year	Articles systematic review	Google academic				Scimago		
		Article		Journal		Journal		
		Total citations	Citation per year	H5	Median H5	SJR	SJR	H-Index
2023	Horioka, C. Y., & Ventura, L. (2024). Do the retired elderly in Europe decumulate their wealth? The importance of bequest motives, precautionary saving, public pensions, and homeownership. *Review of Income and Wealth*, *70*(1), 187-212. doi:10.1111/roiw.12632	13	13.00	31	43	1.16	Q1	69
2023	Noviarini, J., Coleman, A., Roberts, H., & Whiting, R. H. (2023). Financial literacy and retirees' resource allocation decisions in New Zealand. *Pacific-Basin Finance Journal*, *79*, 101985.	16	16.00	63	90	1.14	Q1	75
2023	Bui, M. T., & Luong, T. N. O. (2023). Financial inclusion for the elderly in Thailand and the role of information communication technology. *Borsa Istanbul Review*, *23*(4), 818-833.	10	10.00	52	78	1.04	Q1	42
2023	Angrisani, M., Burke, J., & Kapteyn, A. (2023). Cognitive ability, cognitive aging, and debt accumulation. *Journal of Banking & Finance*, *148*, 106747.	4	4.00	73	106	1.66	Q1	197
2023	Ghosh, D. (2023). Social support system and old age vulnerability: An investigation in India. *Studies in Microeconomics*, 23210222231171495. https://doi.org/10.1177/23210222231171495	0	0.00	-	-	0.19	Q3	7
2022	Mitchell, O. S., Clark, R. L., & Lusardi, A. (2022). Income trajectories in later life: Longitudinal evidence from the health and retirement study. *The Journal of the Economics of Ageing*, *22*, 100371. https://doi.org/10.1016/j.jeoa.2022.100371	9	4.50	26	37	0.88	Q2	24
2022	Yu, L., Mottola, G., Barnes, L. L., Valdes, O., Wilson, R. S., Bennett, D. A., & Boyle, P. A. (2022). Financial fragility and scam susceptibility in community dwelling older adults. *Journal of Elder Abuse & Neglect*, *34*(2), 93-108. doi:10.1080/08946566.2022.2070568	9	4.50	17	22	0.46	Q2	48
2022	Zhang, L., & Sorokina, N. (2022). A study on elderly entrepreneurial intention in the hospitality and tourism industry in China. *The Journal of Asian Finance*, *Economics and Business*, *9*(2), 335-346.	8	4.00	90	126	-	-	-
2022	Brown, M., Collins, J. M., & Moulton, S. (2022). Economic impacts of the COVID-19 crisis: Evidence from credit and debt of older adults. *Journal of Pension Economics & Finance*, *23*(1), 53-71.	6	3.00	21	38	0.74	Q2	36
2022	Lichtenberg, P. A., Tarraf, W., Rorai, V. O., Roling, M., Moray, J., Gross, E. Z., & Boyle, P. A. (2022). The WALLET study: Examining early memory loss and personal finance. *Innovation in Aging*, *6*(5), igac038.	5	2.50	41	65	1.05	Q1	29
2022	Bonekamp, J., & van Soest, A. (2022). Evidence of behavioural life-cycle features in spending patterns after retirement. *The Journal of the Economics of Ageing*, *23*, 100408.	4	2.00	26	37	0.88	Q2	24
2021	Tang, N. (2021). Cognitive abilities, self-efficacy, and financial behavior. *Journal of Economic Psychology*, *87*, 102447.	41	13.67	39	61	1.4	Q1	118
2021	Bucciol, A., Quercia, S., & Sconti, A. (2021). Promoting financial literacy among the elderly: Consequences on confidence. *Journal of Economic Psychology*, *87*, 102428.	24	8.00	39	61	1.4	Q1	118
2021	Kalenkoski, C. M., & McCarty, S. H. (2021). In or out or somewhere in between? The determinants of gradual retirement. *Journal of Family and Economic Issues*, *42*(2), 387-394. doi:10.1007/s10834-020-09734-4	1	0.33	37	71	0.72	Q2	56
2020	İmrohoroğlu, A., & Zhao, K. (2020). Household saving, financial constraints, and the current account in China. *International Economic Review*, *61*(1), 71-103. https://doi.org/10.1111/iere.12417	30	7.50	32	50	2.35	Q1	97
2020	Collins, J. M., Hembre, E., & Urban, C. (2020). Exploring the rise of mortgage borrowing among older Americans. *Regional Science and Urban Economics*, *83*, 103524. https://doi.org/10.1016/j.regsciurbeco.2020.103524	27	6.75	39	66	1.41	Q1	96
2020	Ventura, L., & Horioka, C. Y. (2020). The wealth decumulation behavior of the retired elderly in Italy: The importance of bequest motives and precautionary saving. *Review of Economics of the Household*, *18*, 575-597. https://doi.org/10.1007/s11150-020-09486-y	20	5.00	32	71	1.83	Q1	45
2020	Baldini, M., Gallo, G., & Torricelli, C. (2020). The scars of scarcity in the short run: An empirical investigation across Europe. *Economia Politica*, *37*, 1033-1069. doi:10.1007/s40888-020-00187-4	11	2.75	24	35	0.7	Q1	20
2020	Lichtenberg, P. A., Paulson, D., & Han, S. D. (2020). Examining health and wealth correlates of perceived financial vulnerability: A normative study. *Innovation in Aging*, *4*(4), igaa039.	10	2.50	41	65	1.05	Q1	29

Year	Articles systematic review	Google academic				Scimago		
		Article		Journal		Journal		
		Total citations	Citation per year	H5	Median H5	SJR	SJR	H-Index
2020	Lanchimba, Cintya, Quisnancela, Joselyn, & Salazar Mendez, Yasmin. (2020). The choice of elderly labor: Evidence from Ecuador. *Revista de Análisis Económico*, *35*(1), 75-97. https://dx.doi.org/10.4067/S0718-88702020000100075	5	1.25	-	-	0.2	Q3	8
2019	Lusardi, A., Mitchell, O. S., & Oggero, N. (2020). Debt and financial vulnerability on the verge of retirement. *Journal of Money, Credit and Banking*, *52*(5), 1005-1034. https://doi.org/10.1111/jmcb.12671	151	30.20	41	66	1.88	Q1	123
2019	Xue, R., Gepp, A., O'Neill, T. J., Stern, S., & Vanstone, B. J. (2020). Financial well-being amongst elderly Australians: The role of consumption patterns and financial literacy. *Accounting & Finance*, *60*(4), 4361-4386. https://doi.org/10.1111/acfi.12545	59	11.80	52	82	0.82	Q1	64
2019	Asebedo, S. D., Seay, M. C., Archuleta, K., & Brase, G. (2019). The psychological predictors of older preretirees' financial self-efficacy. *Journal of Behavioral Finance*, *20*(2), 127-138.	50	10.00	27	39	0.47	Q2	32
2019	Nguyen, T. A. N., Polách, J., & Vozňáková, I. (2019). The role of financial literacy in retirement investment choice. *Equilibrium*, *14*(4), 569-589. https://doi.org/10.24136/eq.2019.027	34	6.80	30	49	0.62	Q1	26
2019	Shimizutani, S., & Yamada, H. (2020). Financial literacy of middle-aged and older individuals: Comparison of Japan and the United States. *The Journal of the Economics of Ageing*, 16, 100214. doi:10.1016/j.jeoa.2019.100214	29	5.80	26	37	0.88	Q2	24
2019	Ning, M., Liu, W., Gong, J., & Liu, X. (2019). Does the new rural pension scheme crowd out private transfers from children to parents? Empirical evidence from China. *China Agricultural Economic Review*, *11*(2), 411-430. https://doi.org/10.1108/caer-02-2017-0019	20	4.00	34	63	1.15	Q1	39
2019	Murata, K. (2019, August 30). Dissaving by the elderly in Japan: Empirical evidence from survey data. Papers.ssrn.com. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3445330	17	3.40	-	-	-	-	-
2019	Ohinata, A., & Picchio, M. (2020). Financial support for long-term elderly care and household saving behaviour. *Oxford Economic Papers*, *72*(1), 247-268. https://doi.org/10.1093/oep/gpy073	14	2.80	25	38	0.65	Q2	79
2019	Mahmud, M. S., Foziah, H., Ghazali, P. L., Rashid, N. M. N. N. M., & Yazid, A. S. (2019). Islamic wealth management towards retirement planning among private sector workforce in Malaysia. *International Journal of Recent Technology and Engineering*, *8*(3), 7100-7103.	11	2.20	30	46	-	-	31
2019	Gresenz, C. R., Mitchell, J. M., Marrone, J., & Federoff, H. J. (2020). Effect of early-stage Alzheimer's disease on household financial outcomes. *Health Economics*, *29*(1), 18-29. https://doi.org/10.1002/hec.3962	9	1.80	39	53	1.14	Q1	128
2018	Le Blanc, J., Porpiglia, A., Teppa, F., Zhu, J., & Ziegelmeyer, M. (2016). Household saving behavior in the Euro area. *International Journal of Central Banking*, 44.	91	15.17	29	54	1.47	Q1	40
2018	Blanchett, D., Finke, M., & Guillemette, M. (2018). The effect of advanced age and equity values on risk preferences. *Journal of Behavioral Finance*, *19*(4), 434-441. doi:10.1080/15427560.2018.1431884	25	4.17	27	39	0.47	Q2	32
2018	Yang, T.-T. (2020). The effect of workplace pensions on household saving: Evidence from a natural experiment in Taiwan. *Journal of Risk and Insurance*, *87*(1), 173-194. https://doi.org/10.1111/jori.12254	15	2.50	25	32	1.12	Q1	72
2017	Finke, M. S., Howe, J. S., & Huston, S. J. (2017). Old age and the decline in financial literacy. *Management Science*, *63*(1), 213-230. doi:10.1287/mnsc.2015.2293	425	60.71	123	178	5.44	Q1	290
2017	MacLeod, S., Musich, S., Hawkins, K., & Armstrong, D. G. (2017). The growing need for resources to help older adults manage their financial and healthcare choices. *BMC Geriatrics*, *17*(1), 1-9. doi:10.1186/s12877-017-0477-5	58	8.29	82	111	1.2	Q1	100
2017	Topa, G., & Pra, I. (2017). Retirement adjustment quality: Optimism and self-efficacy as antecedents of resource accumulation. *Applied Research in Quality of Life*, *13*, 1015-1035. doi:10.1007/s11482-017-9571-2	38	5.43	47	71	0.93	Q2	49
2017	Metzger, C. (2017). Who is saving privately for retirement and how much? New evidence for Germany. *International Review of Applied Economics*, *31*(6), 811-831. doi:10.1080/02692171.2017.133867	23	3.29	26	43	0.47	Q2	48
2017	Bussolo, M., Schotte, S., & Matytsin, M. (2017). Accounting for the bias against the life-cycle hypothesis in survey data: An example for Russia. *The Journal of the Economics of Ageing*, *9*, 185-207. doi:10.1016/j.jeoa.2017.03.001	10	1.43	26	37	0.88	Q2	24

Year	Articles systematic review	Google academic				Scimago		
		Article		Journal		Journal		
		Total citations	Citation per year	H5	Median H5	SJR	SJR	H-Index
2016	De Nardi, M., French, E., & Jones, J. B. (2016). Savings after retirement: A survey. *Annual Review of Economics*, *8*(1), 177-204. doi:10.1146/annurev-economics-080315-015127	201	25.13	33	60	8.93	Q1	76
2016	Moffat, S., & Heaven, B. (2017). "Planning for uncertainty": Narratives on retirement transition experiences. *Ageing and Society*, *37*(5), 879-898. doi:10.1017/s0144686x15001476	110	13.75	44	73	1.03	Q1	97
2016	Gerstenecker, A., Eakin, A., Triebel, K., Martin, R., Swenson-Davis, D., Petersen, R. C., & Marson, D. (2016). Age and education corrected older adult normative data for a short form version of the Financial Capacity Instrument. *Psychological Assessment*, *28*(6), 737-749.	57	7.13	54	73	1.36	Q1	173
2016	Garcia, M. T. M., & Marques, P. D. C. V. (2016). Ownership of individual retirement accounts: An empirical analysis based on SHARE. *International Review of Applied Economics*, *31*(1), 69-82. https://doi.org/10.1080/02692171.2016.1221389	21	2.63	26	43	0.47	Q2	48
2015	Teerawichitchainan, B., Knodel, J., & Pothisiri, W. (2015). What does living alone really mean for older persons? A comparative study of Myanmar, Vietnam, and Thailand. *Demographic Research*, *32*, 1329-1360. https://doi.org/10.4054/demres.2015.32.48	84	9.33	36	48	1.03	Q1	81
2014	Nishiyama, S., & Smetters, K. (2014). Financing old age dependency. *Annual Review of Economics*, *6*(1), 53-76. doi:10.1146/annurev-economics-080213-041304	12	1.20	33	60	8.93	Q1	76
2014	Raab, R., & Gannon, B. (2014). Diversity of labor supply incentives and retirement: Evidence from Ireland. *Journal of Economic Policy Reform*, *17*(4), 303-321. https://doi.org/10.1080/17487870.2014.912582	7	0.70	27	42	0.81	Q1	32
2013	Aguila, E. (2013). Male labor force participation and social security in Mexico. *Journal of Pension Economics & Finance*, *13*(2), 145-171. doi:10.1017/s1474747213000292	36	3.27	21	38	0.74	Q2	36
2012	Nilsson, K. (2012). Why work beyond 65? Discourse on the decision to continue working or retire early. *Nordic Journal of Working Life Studies*, *2*(3), 7-28.	90	7.50	17	24	0.34	Q3	25
2011	Han, C. K., & Hong, S. I. (2011). Assets and life satisfaction patterns among Korean older adults: Latent class analysis. *Social Indicators Research*, *100*, 225-240.	87	6.69	69	101	0.97	Q1	136
2011	Pu, C., Huang, N., Tang, G. J., & Chou, Y. J. (2011). When does poor subjective financial position hurt the elderly? Testing the interaction with educational attainment using a national representative longitudinal survey. *BMC Public Health*, *11*, 1-8.	23	1.77	141	189	1.25	Q1	197
2010	Reeves, S., & Wysong, J. (2010). Strategies to address financial abuse. *Journal of Elder Abuse & Neglect*, *22*(3-4), 328-334.	33	2.36	17	22	0.46	Q2	48
2009	Noel-Miller, C., & Tfaily, R. (2009). Financial transfers to husbands' and wives' elderly mothers in Mexico: Do couples exhibit preferential treatment by lineage? *Research on Aging*, *31*(6), 611-637.	8	0.53	26	39	0.95	Q1	76
2008	Suwanrada, W. (2008). Poverty and financial security of the elderly in Thailand. *Ageing International*, *33*, 50-61.	84	5.25	20	30	0.47	Q2	44
2007	Means, R., & Langan, J. (1996). Money "handling", financial abuse and elderly people with dementia: Implications for welfare professionals. *Health & Social Care in the Community*, *4*(6), 353-358. https://doi.org/10.1111/j.1365-2524.1996.tb00082.x	21	1.24	57	77	0.83	Q1	81
2004	Schieber, S. J. (2004). Retirement income adequacy: Good news or bad? *Benefits Quarterly*, *20*(4), 27-39. PMID: 15628616.	26	1.30	4	6	-	-	9
2003	Into, F. H. (2003). Older women and financial management: Strategies for maintaining independence. *Educational Gerontology*, *29*(10), 825-839. doi:10.1080/716100365	18	0.86	22	38	0.48	Q2	61
1999	Stroup, A. L., & Pollock, G. E. (1999). Economic weil-being among white elderly divorced. *Journal of Divorce & Remarriage*, *31*(3-4), 53-68.	17	0.68	19	32	0.3	Q2	36
1998	Ozawa, M. N., & Lum, Y. S. (1998). Marital status and change in income status 10 years after retirement. *Social Work Research*, *22*(2), 116-128.	16	0.62	18	28	0.42	Q2	60
1997	Langan, J. (1997). In the best interests of elderly people? The role of local authorities in handling and safeguarding the personal finances of elderly people with dementia. *Journal of Social Welfare and Family Law*, *19*(4), 463-477. doi:10.1080/09649069708410211	2	0.07	17	25	0.36	Q2	30

Appendix 2. Check List Prefered reporting intens for Systematic Reviews and meta-analyses - PRISMA protocol

Section and topic	Item #	Checklist item	Location where item is reported
Title			
Title	1	Identify the report as a systematic review.	Pg. 1
Abstract			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Pg. 1
Introduction			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pg. 3 and 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Pg. 4
Methods			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pg. 8
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Fig. 3 and Pg. 6 to 10
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Fig. 2 and 3
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Fig. 3 and Pg. 8
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Pg. 6 to 8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g., for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Pg. 6 to 9
	10b	List and define all other variables for which data were sought (e.g., participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Pg. 5 to 11
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Pg. 10 and 12
Effect measures	12	Specify for each outcome the effect measure(s) (e.g., risk ratio, mean difference) used in the synthesis or presentation of results.	No applicable
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g., tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5).	Pg. 9 and Fig. 6
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Pg. 8 and 9
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Pg. 13 and 16
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Pg. 8, 9 and 13 to 16
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g., subgroup analysis, meta-regression).	No applicable
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Appendix 1
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Pg. 10 and 11
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	No applicable
Results			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Pg. 12/ Fig. 3
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	No applicable
Study characteristics	17	Cite each included study and present its characteristics.	Pg. 13 to 16

Section and topic	Item #	Checklist item	Location where item is reported
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	No applicable
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g., confidence/credible interval), ideally using structured tables or plots.	No applicable
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	No applicable
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g., confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Pg. 13 to 16
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Pg. 13 to 16
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	No applicable
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	No applicable
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	No applicable
Discussion			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pg. 32 and 34
	23b	Discuss any limitations of the evidence included in the review.	Pg. 35
	23c	Discuss any limitations of the review processes used.	Pg. 35
	23d	Discuss implications of the results for practice, policy, and future research.	Pg. 34
Other information			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	No applicable
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	No applicable
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	No applicable
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Pg. 35
Competing interests	26	Declare any competing interests of review authors.	Pg. 35
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	No applicable