



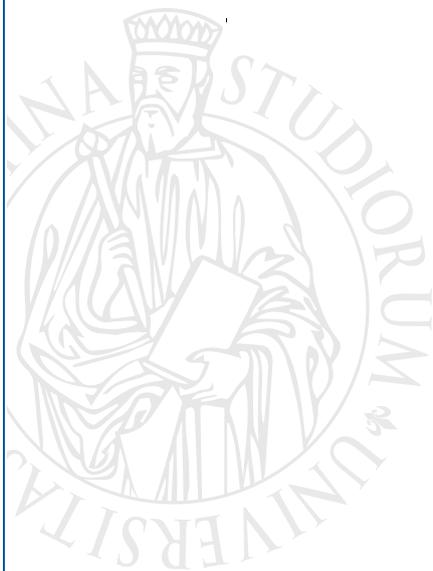
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**Frailty in late years: the legacy of
coexistence and persistence of
disadvantages in working-age adulthood**

Francesca Zanasi, Gustavo De Santis, Elena Pirani



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Frailty in late years: the legacy of coexistence and persistence of disadvantages in working-age adulthood

Francesca Zanasi, francesca.zanasi37@gmail.com

Dipartimento di Scienze Politiche, University of Bari Aldo Moro

Gustavo De Santis, gustavo.desantis@unifi.it

Dipartimento di Statistica, Informatica, Applicazioni – DiSIA, University of Florence, Italy

Elena Pirani, elena.pirani@unifi.it

Dipartimento di Statistica, Informatica, Applicazioni – DiSIA University of Florence, Italy

Abstract

Frailty increases with age, but it also depends on the disadvantages suffered in youth and working-age adulthood. Accumulating disadvantages during the life course, in terms of persistence and coexistence, reinforces their effects on frailty. However, their impact and the correct way to measure it are unclear.

We study how the disadvantages suffered in working-age adulthood (25 to 59 years) in four domains (unemployment, financial hardship, stress, and bad health) affect frailty – or a complex state of objective and subjective vulnerability – in late adulthood (60 to 79 years). We account for both the persistence over time of these disadvantages and their coexistence, i.e. the duration of periods when they were simultaneously experienced. With data from the Survey of Health, Ageing, and Retirement in Europe (2004–2017), we estimate the frailty score for several age groups (in years: 60–64, 65–69, 70–74, 75–79) using linear regression models and including, besides controls, several measures of life-course disadvantage.

While frailty increases with age, there is evidence of an accumulation of risks: the longer the periods of adult life affected by bad health, unemployment, financial hardship or stress, the frailer individuals are in their late years. Longer periods of coexisting disadvantages in adulthood translate into additional frailty in late life, especially past 70 years.

Frailty inequalities persist in later life: they are connected to the disadvantages experienced in adulthood in several life domains, both separately and, even more, cumulatively. This calls for early action against disadvantages, if “active ageing” is to be pursued.

What is already known on this subject?

Past disadvantage has long-term consequences on health, reinforcing health inequality over the entire life cycle. Each episode of disadvantage affects late life health, but persistence (or accumulation) and, separately, coexistence amplify the effects.

What does this study add?

- We reconcile two strands of the literature, the former emphasizing a life course perspective, the latter focusing on coexisting disadvantages: both perspectives matter.
- Several types of disadvantage in adulthood (ranging from health to socio-economic condition) affect frailty in late life, albeit differently. Their effects tend to pile up.

- When multiple disadvantages coexist, their persistence over time also matters. This is a rare occurrence, but its effects may be highly relevant.
- To reduce frailty in later life it is essential to prevent repeated and acute periods of disadvantage in young and adult years: this is our main policy message.

Keywords: Aging; Health inequality; Life course epidemiology

Ethical Approval Statement

The present study employs secondary data from the SHARE study. The data collection has been guided by international research ethics principles such as the Respect Code of Practice for Socio-Economic Research and the 'Declaration of Helsinki'. Authors are familiar with these principles and take them into account in an appropriate manner when conducting research using SHARE data. Further information can be found on the SHARE survey website.

<http://www.share-project.org/data-access/share-conditions-of-use.html>

Acknowledgments

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This paper uses data from SHARE Waves 1, 2, 3, 4, 5, 6, and 7 (DOIs: 10.6103/SHARE.w1.710, 10.6103/SHARE.w2.710, 10.6103/SHARE.w3.710, 10.6103/SHARE.w4.710, 10.6103/SHARE.w5.710, 10.6103/SHARE.w6.710, 10.6103/SHARE.w7.711), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782) and by DG Employment, Social Affairs & Inclusion. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

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Frailty in late years: the legacy of coexistence and persistence of disadvantages in working-age adulthood

Francesca Zanasi, Gustavo De Santis, Elena Pirani

INTRODUCTION

Old age is “a risk factor in its own right” [1], because ageing exposes individuals to exclusionary forces, such as the loss of the active worker role, the contraction of social support networks, and a physiological health decline [2], which is what we focus on in this paper.

This process can be accelerated if adverse events occur in working-age adulthood, in various domains such as family [3,4], employment [5–8] and the socio-economic sphere [9–13], particularly if “insults” cumulate, reducing the resources necessary to cope with health deterioration in later life [14].

The notion of *accumulation of disadvantages* has to do with the number, duration, and severity of various types of exposure to risks. While each exposure exerts an independent effect on later life health, multiple exposures may prove particularly harmful [14,15]. Two aspects may be distinguished: persistence and coexistence of disadvantages. The former refers to the duration of periods when individuals are exposed to a single factor or a series of factors [16]. Not surprisingly, longer periods have stronger negative effects on late life outcomes than short-lived situations [17], including poverty [18,19], living in deprived neighbourhoods [20], and unemployment [21–23].

As the various components of individual biographies are interrelated – e.g., employment, education, and health –, coexisting disadvantage [24] or multiple deprivation [25] may emerge and reinforce one another [26], the latter aspect mentioned before. Research on coexisting disadvantages has generally focused on the number and gravity of disadvantages in specific moments of life [24,27,28], but it has frequently ignored their concatenation.

In this work, we aim to reconcile these two strands of the literature: the life course perspective on health inequality in later life and the framework of coexisting disadvantages. By exploiting information included in the SHARE survey (2004–2017), we analyse how coexisting *and* persistent disadvantages in various life domains (bad health, severe stress, financial hardship, and unemployment) experienced in working-age adulthood affect frailty in later life.

METHODS

Data

Our data come from the 2004–2017 waves of the Survey of Health, Ageing, and Retirement in Europe (SHARE) [29]. SHARE is a representative cross-national panel database collecting information on individuals aged 50 years and over and their partners, living in 27 European countries and Israel. The overall response rate is roughly 60% across the seven waves.

Our analysis includes individuals aged between 60 and 79 years who participated in one of the SHARELIFE modules collecting retrospective information: wave 3, in 2009, and wave 7, in 2017. Discarding 12,427 records with missing information on the variables of interest, our final sample includes 106,821 observations from respondents living in 19 countries: Austria, Belgium, Croatia,

Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland.

Measures

Frailty Index

Our dependent variable is the frailty index, a 40-item index validated on the SHARE dataset measuring the number of accumulated health deficits of respondents [30]. It summarizes frailty in objective (e.g., measures of grip strength and body mass index) and subjective terms (e.g., self-reported health and mood), taking age and gender into account. Individuals in perfect conditions score 0, while a theoretical individual with all the (40) possible deficits would score 1. Frailty represents a non-specific state of multiple biological systems dysregulations causing decreasing resistance to stressors and accelerating unfavourable outcomes, included disability, hospitalization and, ultimately, mortality [31]. Frailty increases with age, but it is more related to the biological than the chronological age of individuals [32], and the frailty index, more than other health measures, integrates and describes the lack of responsiveness and of the resources necessary for a good physical and psychological functioning.

Life course disadvantages

In the SHARELIFE modules of 2009 and 2017 respondents were asked whether they had ever experienced periods of: (i) bad health, (ii) severe stress, (iii) financial hardship, and (iv) unemployment – one or more of them. In case they did, they were also asked to specify the affected period(s). To account for persistence, we calculated the number of years respondents spent with each of these disadvantages between 25 and 59 years, and we created the following categories: never (in disadvantage), occasionally (up to 25% of adult life spent in disadvantage), and frequently (more than 25% of adult life spent in disadvantage). To measure the persistence of coexisting disadvantages, we counted the number of years respondents spent with at least two disadvantages, and we categorized answers as before (never, occasionally, frequently).

Additional covariates

In the set of control variables, we included other covariates recognized as important by previous research [see 30-35]. Adopting a life course perspective, disadvantage in childhood may matter too [33]: self-reported health at 10 years (coded excellent and good; fair and poor; varied a great deal) and a SHARE-specific variable, ranging between 0 and 4, counting the number of stressful events respondents had experienced by the age of 16 years (having missed a month or more of school, having had parents drinking heavily or with mental health problems, having experienced financial hardship or difficult living arrangements). Regarding socio-demographic variables [13] we included gender, education (low; medium; high), the self-reported economic status of respondents (how the household managed to make ends meet, coded into easily or fairly easily, vs with some or great difficulty), and the presence of a partner. Finally, we controlled for the wave (1–7), and for the type of welfare regime [34]: Scandinavian (Sweden and Denmark), Bismarckian (Austria, Belgium, France, Germany, Luxemburg, Netherlands, Switzerland), Southern Europe (Italy, Spain, Greece, Portugal), and Eastern Europe (Czech Republic, Hungary, Poland, Slovenia, Estonia, Croatia).

Analysis

We pooled together all the SHARE waves. As our dependent variable (frailty) is continuous, we ran linear regression models, separately for four five-year age groups: 60–64, 65–69, 70–74, and 75–79.

We clustered standard errors at the individual-level, to account for correlation between observations referred to the same respondent. Each model includes all the variables referred to specific disadvantages during life course – unemployment, bad health, severe stress, financial hardship – and the variables indicating coexistence and persistence of these disadvantages, all coded as never, occasionally (1–25%), and frequently (25%+).

In the first step of the analysis we did not include other covariates in the models, for three main reasons. First, this makes the results comparable for different age groups. Secondly, covariates may bias the picture [35] especially when *colliders* (common effects of the exposure and the outcome) and *mediators* (intermediate variables between the exposure and the outcome) are introduced. Finally, this permits us to evaluate the global effect of age and past episodes of disadvantage on frailty. Covariates were added in the second step of the analysis, and results compared.

Ignoring the longitudinal structure of the SHARE dataset, we circumvented the problem of how to keep account of the web of possible interactions between our five indicators of past disadvantage and respondents' age. However, as a sensitivity check, we performed also a longitudinal analysis on individuals aged 60 years and over at survey entry and followed for at least two waves. Results, not reported here, are consistent with those shown below.

We analysed our data also discarding repeated observations, that is, keeping respondents only once, at survey entry. In this case too results, not reported here, are in line with those shown below, but with wider confidence interval because of the reduced sample size. Finally, we checked the consistence of our results across European countries, stratifying the analysis by welfare regimes groups.

RESULTS

Descriptive results

Table 1 shows the sample characteristics by age groups. The mean frailty index increases with age, from 0.11 to 0.16, in line with previous studies [13]. Overall, the distribution of the frailty index is right-skewed: the median is 0.10, and the 95th/99th percentile are 0.32/0.49.

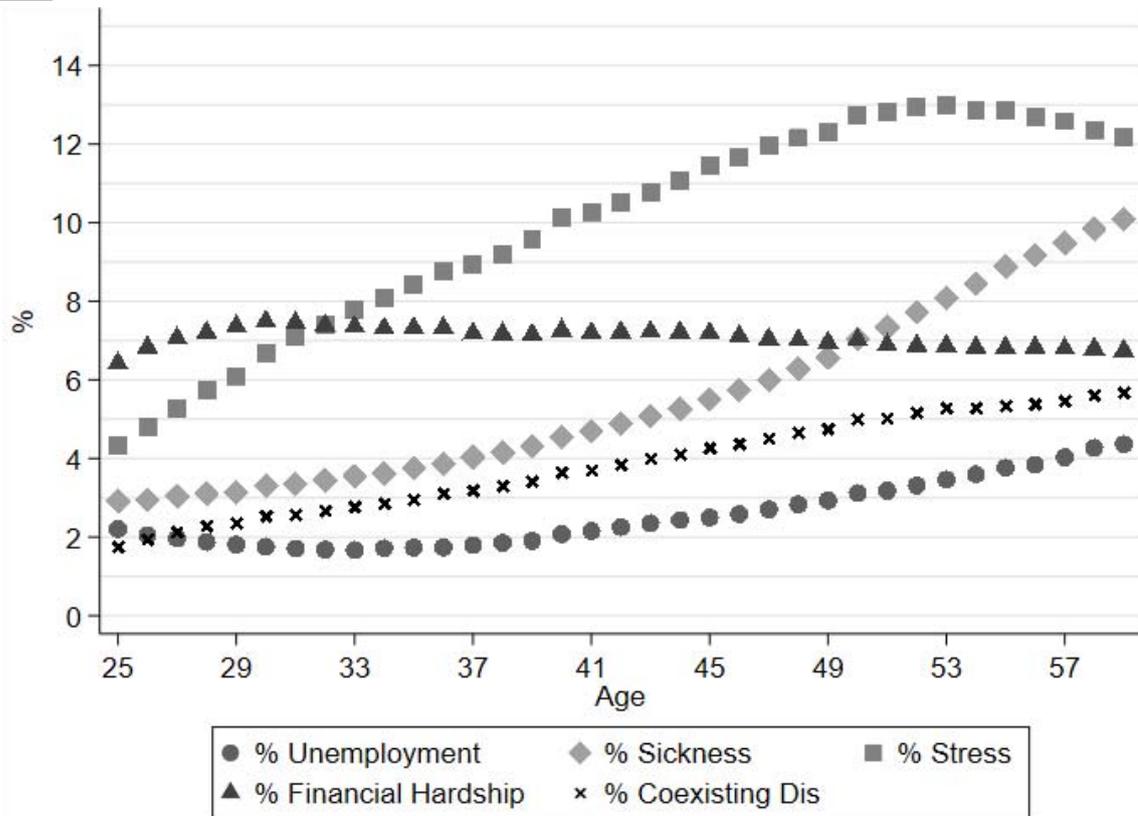
Table 1 Descriptive statistics, by age group (19 European countries, 2004–2017)

Variables	Categories		Age groups			
			60–64	65–69	70–74	75–79
Frailty Index		Mean	0.11	0.12	0.14	0.16
		SD	0.09	0.09	0.10	0.12
Life course disadvantages						
Unemployment	Never	%	85.88	89.07	91.76	93.81
	Occasionally (1–25%)	%	10.40	8.31	6.32	4.62
	Frequently (25%+)	%	3.72	2.63	1.92	1.57
Severe stress	Never	%	53.57	57.48	62.88	68.57
	Occasionally (1–25%)	%	29.64	26.66	22.44	18.48
	Frequently (25%+)	%	16.79	15.85	14.68	12.95
Illness	Never	%	85.22	86.04	87.00	88.37
	Occasionally (1–25%)	%	7.02	6.50	6.10	5.14
	Frequently (25%+)	%	7.76	7.46	6.90	6.49
Financial hardship	Never	%	72.32	75.21	77.15	77.91
	Occasionally (1–25%)	%	17.42	15.72	14.14	12.87
	Frequently (25%+)	%	10.25	9.07	8.70	9.22
Coexisting disadvantages	Never	%	79.36	82.21	85.30	87.96
	Occasionally (1–25%)	%	14.71	12.55	10.48	8.45
	Frequently (25%+)	%	5.93	5.24	4.22	3.60
Additional covariates						
Childhood health	Fair, poor, and varied	%	9.83	10.72	11.65	12.01
Childhood stressful events		Mean	0.23	0.23	0.24	0.23
		SD	0.47	0.48	0.49	0.48
Gender	Female	%	55.41	54.46	54.29	54.82
Educational level	Low Education	%	17.50	23.16	29.73	37.23
	Mid Education	%	54.27	50.20	46.35	41.70
	High Education	%	28.23	26.64	23.93	21.07
Making ends meet	Easily and fairly easily	%	65.01	66.09	64.93	64.79
Marital status	No partner	%	22.69	24.24	28.04	35.23
	1 (2004-05)	%	8.78	7.77	7.58	6.89
	2 (2006-07)	%	13.01	11.42	11.21	11.00
	4 (2011-12)	%	21.34	19.26	19.67	18.54
	5 (2013)	%	22.97	23.38	23.19	22.56
	6 (2015)	%	27.06	28.76	28.14	29.98
	7 (2017)	%	6.85	9.42	10.20	11.04
Country cluster	Bismarckian	%	41.07	39.26	39.12	39.46
	Scandinavian	%	13.85	15.01	14.36	13.96
	Southern	%	21.57	22.50	23.46	24.16
	Eastern European	%	23.51	23.23	23.05	22.42
N			32,786	30,931	24,999	18,105

Source: Authors' calculation on SHARE data (2004–2017)

As for our main independent variables, Figure 1 shows the relative frequency of the various disadvantages by age, between 25 and 59 years. Unemployment was the least frequently reported problem; financial hardship prevailed initially, but stress was the main concern after age 30. Health problems affect about 3% of respondents at 25 years, and progressively more, up to 10% by 59 years. Overall, the share of respondent reporting coexisting disadvantages is low, but increasing with age, from below 2% to 5%.

Figure 1 Share of respondents reporting specific disadvantages, by age (25 to 59 years; 19 European countries, 2004–2017)

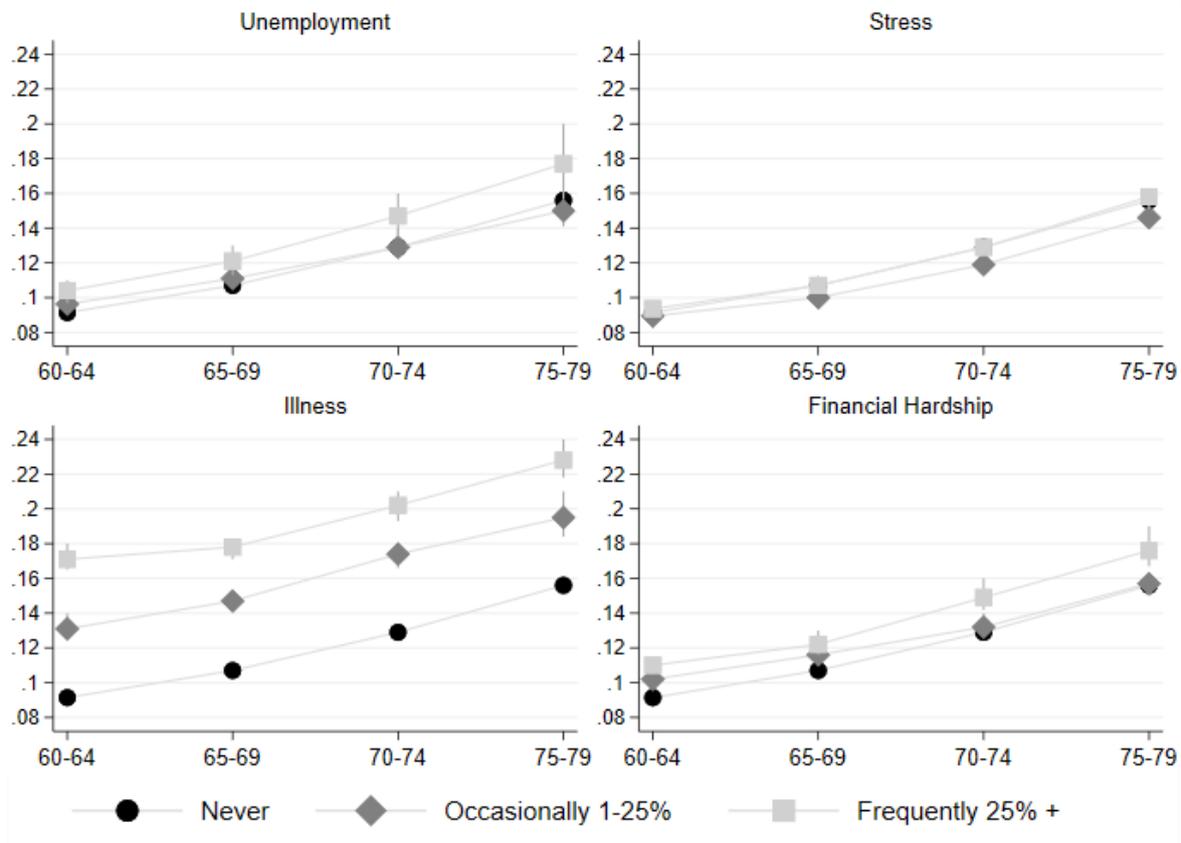


Source: Authors' calculation on SHARE data (2004–2017)

Lifelong disadvantage: persistence and coexistence

Figure 2 displays the results obtained from linear regression models without covariates. The four panels show the predicted evolution of frailty under the assumption that no other disadvantage was experienced in adulthood. The full models are detailed in the Appendix (Table A1).

Figure 2 Predicted frailty scores by age group and life course disadvantages (unemployment, severe stress, illness, financial hardship). 19 European countries, 2004–2017.



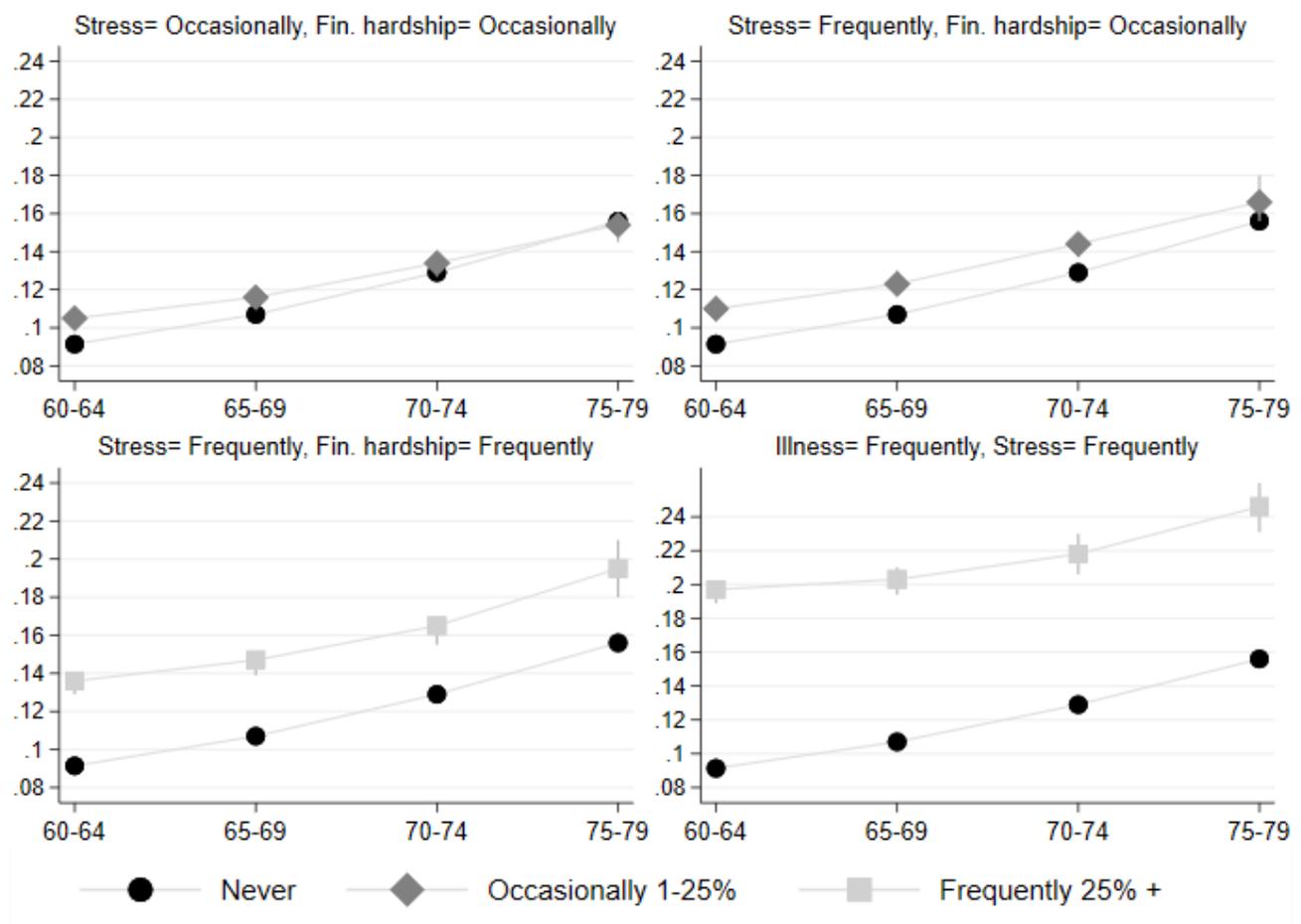
Source: SHARE data (2004–2017)

As expected, frailty increases with age also for individuals who never experienced disadvantages, but its levels and evolution depend on the adverse events experienced earlier in life (in this case, in adulthood). The worst case emerges in relation to past health conditions (Illness). For instance, those whose health was frequently poor in adulthood (more than 25% of the time) were frailer (0.17, 0.16–0.17) at 60–64 years than those always in good health were 15 years later, at 75–79 years (0.16, 0.15–0.16). On the age, rather than on the frailty axis, the huge difference between the two cases is likely to stand out more clearly: the chronological age of individuals matters but life-long exposure to adverse events accelerates biological ageing and increases vulnerability.

While short periods of unemployment are physiological, especially young ages, and this probably explains its modest impact on frailty, long periods of unemployment (more than 25% of the adult years) do leave a scar: at 75–79 years, the frailty score climbs up to 0.18 (0.16–0.20) as opposed to 0.15 (0.14–0.16) of the reference category (“Never unemployed”). A similar pattern emerges for financial hardship. For severe stress, differences are present only at late ages, 75–79 years, and with a limited overall effect, with those frequently under stress scoring 0.16 (0.15–0.16) against 0.15 (0.15–0.16) of those who never experienced episodes of severe stress.

Turning to coexisting disadvantages, Figure 3 displays the two most common disadvantage profiles for individuals who endured simultaneous disadvantages only occasionally (1-25% of their adult lives – upper panels); and those who endured them frequently (more than 25% of the adult years - bottom panels). In the former group, the 19% experienced simultaneously stress and financial hardship (upper left), while the 10% stress and financial hardship (upper right). In the latter group, the 34% had stress and financial hardship (bottom left), while the 15% illness and stress (bottom right), simultaneously.

Figure 3 Predicted frailty scores by age group and most common profiles of life course coexisting disadvantages (19 European countries, 2004–2017)



Source: SHARE data (2004–2017)

Experiencing coexisting disadvantages only occasionally (upper panels of Figure 3) does not significantly affect frailty: in other words, a sporadic coexistence of multiple disadvantages is about as harmful as a single (persistent) trouble (as shown in Figure 2). Conversely, suffering multiple disadvantages for a long time (25% or more of the adult life, bottom panels) may have grave consequences. For example, while the experience of frequent stress is associated with a frailty score of roughly 0.16 (0.15–0.16, Figure 2) by the age of 75-79 years, the combination with financial hardship raises it to 0.20 (0.18–0.21, bottom left panel of Figure 3). Worse still when illness and severe stress overlapped for long years: in this case the frailty index is high even at relatively young ages (0.20, 0.19–0.21, at age 60-64) and rises to 0.25 (0.23–0.26) by age 75-79 (bottom right panel of Figure 3).

As a sensitivity check (results not reported here but available upon request), we verified whether our results were driven by certain countries, or groups of countries. While the age-related increase in frailty is a general pattern, Southern and Eastern Europe display the worst frailty scores, further worsened by previous disadvantages, especially poor health. Health inequalities between individuals with a different load of lifelong disadvantages across age-groups are present in Bismarckian, Eastern, and Southern Europe, but not in Scandinavian countries. Overall, welfare regime-specific results confirm the regularities found with the pooled sample.

Frailty in later life: other correlates

Table 2 presents frailty scores by different types of disadvantages, introducing a set of covariates recognized as important by previous research [13,33]. As the effect of our main explanatory variables (age and disadvantages in adulthood) does not change in this analysis (although it is sometimes dampened) let us briefly examine the (net) role of the other covariates.

Having had poor health in childhood increases frailty by 0.027 (0.022–0.031) points at 60–64 years, and by a comparable amount later. Also, stressful events experienced in childhood increase frailty, although somewhat less (from 0.006 to 0.011 frailty points for each additional event, depending on the age group). Socio-economic resources, not surprisingly, exert their usual protective effect: the higher the educational level, the less frail individuals are in later life. The association is stronger at later ages: highly educated individuals have 0.034 (0.031–0.038) less frailty at 60–64 years, and 0.040 (0.035–0.046) less frailty at 75–79 years. A similar effect emerges for the self-reported economic condition of the household (making ends meet easily). Not having a partner is associated with worse health at all ages. However, for the last two variables, caution is required in the interpretation, because reverse causality may operate, with frailty negatively affecting economic resources and family relations.

Regarding contextual differences, Scandinavian respondents score systematically better than Bismarckian respondents do (between 0.007 and 0.015), while Eastern European individuals score worse (about 0.015 more frailty). Southern European score better at first (up to 70 years), and worse later on.

Table 2. Linear regression models for frailty, by age group (19 European countries, 2004–2017)

	60–64			65–69			70–74			75–79		
	Coef.	CI		Coef.	CI		Coef.	CI		Coef.	CI	
Unemployment: Never												
Occasionally (1–25%)	0.003	-0.001	0.006	0.006	0.002	0.010	0.005	-0.002	0.011	0.002	-0.007	0.011
Frequently (25%+)	0.002	-0.005	0.009	0.006	-0.003	0.014	0.006	-0.006	0.017	0.004	-0.016	0.024
Stress: Never												
Occasionally (1–25%)	0.003	0.001	0.006	0.001	-0.002	0.003	-0.001	-0.005	0.002	0.001	-0.004	0.007
Frequently (25%+)	0.008	0.005	0.011	0.009	0.005	0.013	0.010	0.005	0.015	0.014	0.008	0.021
Illness: Never												
Occasionally (1–25%)	0.036	0.031	0.041	0.036	0.030	0.041	0.037	0.030	0.044	0.030	0.020	0.041
Frequently (25%+)	0.069	0.064	0.075	0.061	0.055	0.068	0.061	0.053	0.068	0.062	0.053	0.072
Financial Hardship: Never												
Occasionally (1–25%)	0.008	0.005	0.011	0.007	0.003	0.011	0.003	-0.002	0.007	0.003	-0.003	0.010
Frequently (25%+)	0.011	0.006	0.015	0.007	0.001	0.012	0.012	0.005	0.019	0.013	0.005	0.022
Coexisting Disadvantages: Never												
Occasionally (1–25%)	0.002	-0.002	0.006	0.003	-0.002	0.008	0.008	0.001	0.014	0.001	-0.008	0.010
Frequently (25%+)	0.016	0.008	0.024	0.013	0.004	0.022	0.005	-0.006	0.016	0.007	-0.009	0.022
Childhood health (fair, poor, varied)	0.027	0.022	0.031	0.026	0.022	0.031	0.028	0.023	0.034	0.024	0.017	0.030
Childhood stressful events	0.006	0.003	0.008	0.006	0.003	0.009	0.005	0.002	0.008	0.011	0.007	0.015
Female	0.010	0.008	0.012	0.015	0.013	0.017	0.024	0.021	0.027	0.033	0.029	0.037
Educational level: Low												
Mid Education	-0.023	-0.026	-0.019	-0.023	-0.027	-0.020	-0.021	-0.025	-0.017	-0.024	-0.029	-0.019
High Education	-0.034	-0.038	-0.031	-0.035	-0.039	-0.032	-0.034	-0.038	-0.030	-0.040	-0.046	-0.035
Making ends meet (fairly easily)	-0.030	-0.032	-0.027	-0.034	-0.037	-0.031	-0.034	-0.038	-0.031	-0.033	-0.037	-0.029
No partner	0.005	0.002	0.007	0.007	0.004	0.010	0.007	0.004	0.010	0.004	0.000	0.009
Wave: 1												
2	-0.002	-0.006	0.001	0.000	-0.004	0.004	0.002	-0.003	0.007	0.002	-0.005	0.008
4	0.006	0.002	0.009	0.010	0.006	0.014	0.011	0.006	0.016	0.008	0.001	0.015
5	0.007	0.004	0.010	0.007	0.003	0.011	0.011	0.006	0.016	0.004	-0.003	0.010
6	0.005	0.001	0.008	0.008	0.005	0.012	0.008	0.003	0.013	0.009	0.003	0.016
7	0.001	-0.003	0.005	0.003	-0.001	0.008	0.007	0.002	0.013	0.009	0.002	0.017
Country cluster: Bismarckian												
Scandinavian	-0.007	-0.010	-0.004	-0.012	-0.015	-0.008	-0.015	-0.019	-0.011	-0.015	-0.021	-0.010
Southern	-0.007	-0.010	-0.004	-0.001	-0.005	0.002	0.005	0.001	0.010	0.012	0.006	0.017
Eastern European	0.015	0.012	0.018	0.018	0.015	0.021	0.029	0.025	0.033	0.036	0.030	0.041
Constant	0.118	0.113	0.120	0.128	0.123	0.130	0.136	0.129	0.140	0.154	0.146	0.160
N	32,833			30,961			25,030			18,140		

Standard errors clustered at the individual level. 95% CI (Confidence interval)

Source: SHARE data (2004–2017)

DISCUSSION

Using SHARE data, in this article we studied later life frailty accounting for adverse events of individuals throughout their life, in life course perspective as data allow. We focused on frailty, a non-specific and complex indicator of health, covering the physical and mental dimensions, measured in both objective and subjective ways. We considered different kinds of disadvantage: unemployment, severe stress, financial hardship, and bad health. Of these we measured both

persistence over the life course (share of adult life affected by each of these events) and coexistence (simultaneous presence of two or more of these disadvantages).

In line with previous research, and with expectations, frailty, while increasing with age, reflects past experiences of disadvantages. In some cases, these long-term consequences are truly relevant, especially when past episodes were prolonged (persistence) or simultaneous (coexistence). Multiple disadvantages are rarely observed, but when they do coexist, the consequences on frailty may be serious.

Poor health in adulthood (and, additionally, during childhood) is the single disadvantage most strongly associated with high frailty in late life, and these effects are extremely strong already at relatively young ages (60–64 years). Although frailty differences between the best and the worst off tend to diminish with age, they remain large throughout the observation period.

While the persistence of severe stress in working-age adulthood does not lead to significantly worse frailty in later life, we found evidence of a persistence-gradient for unemployment and financial hardship. In these cases, the various disadvantage groups start at a similar frailty levels when they are 60–64 years old, but frailty levels diverge subsequently, and the difference becomes remarkable, and statistically significant, after the age of 70 years.

We also accounted for the clustering effect of these disadvantages, measuring their coexistence and accounting for the persistence of this multiple disadvantages over adulthood. We found that the persistence of coexisting disadvantages leads to a pronounced frailty gradient.

Socio-demographic characteristics of individuals account for part of the inequalities in frailty in late adulthood, but lifelong disadvantage continue to exert an independent effect. Finally, in line with previous literature [13,36], we found these associations are more clearly present in Bismarckian, Eastern, and (past 70 years) Southern Europe than in Scandinavian countries [37]. Although our data do not permit us to investigate the underlying causal mechanisms, our findings reinforce the general impression of the effectiveness of the universalist and redistributive social protection system of these welfare systems.

This study is not without limitations. While we covered several life domains for a relatively long period (25 to 59 years), data limitations forced us to ignore a few important dimensions in the study of multiple deprivation, such as social relationships, personal security, and neighbourhood quality (see, e.g., [25]).

An “active ageing” framework is frequently evoked as an opportunity for “participation and security in order to enhance quality of life as people age” [38], which includes maintaining autonomy and independence, and keeping frailty low, throughout the life course. Our results confirm this view, showing that enduring and cumulative disadvantages during youth and adulthood tend to have long-lasting effects. Moreover, problems such as poor health and unemployment, which are typically targeted separately, tend to be particularly harmful when they coexist or persist in adult life. These occurrences may leave a “scar” on individuals, and timely action may be highly beneficial, not only in the short term: addressing the negative (health, economic or social) consequences of these disadvantages in late adulthood risks to be much less effective.

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APPENDIX

Table A1. Linear regression models for frailty, by age group, without covariates

	60–64			65–69			70–74			75–79		
	Coef.	CI		Coef.	CI		Coef.	CI		Coef.	CI	
Unemployment: Never												
Occasionally (1–25%)	0.005	0.001	0.009	0.004	0.000	0.009	0.000	-0.006	0.007	-0.006	-0.015	0.003
Frequently (25%+)	0.012	0.005	0.019	0.014	0.006	0.023	0.018	0.006	0.029	0.021	0.001	0.041
Stress: Never												
Occasionally (1–25%)	-0.002	-0.005	0.001	-0.007	-0.010	-0.004	-0.010	-0.014	-0.007	-0.009	-0.015	-0.004
Frequently (25%+)	0.002	-0.001	0.006	0.000	-0.004	0.004	0.000	-0.005	0.005	0.002	-0.005	0.010
Illness: Never												
Occasionally (1–25%)	0.039	0.034	0.045	0.040	0.035	0.046	0.045	0.037	0.052	0.039	0.028	0.050
Frequently (25%+)	0.079	0.073	0.086	0.071	0.065	0.078	0.073	0.064	0.081	0.072	0.062	0.083
Financial Hardship: Never												
Occasionally (1–25%)	0.011	0.007	0.014	0.009	0.005	0.013	0.003	-0.002	0.008	0.001	-0.005	0.008
Frequently (25%+)	0.018	0.013	0.023	0.015	0.009	0.020	0.020	0.013	0.027	0.021	0.011	0.030
Coexisting Disadvantages: Never												
Occasionally (1–25%)	0.006	0.001	0.010	0.007	0.002	0.012	0.013	0.005	0.020	0.006	-0.003	0.016
Frequently (25%+)	0.024	0.015	0.032	0.025	0.016	0.034	0.016	0.004	0.028	0.016	-0.001	0.033
Constant	0.091	0.090	0.093	0.107	0.105	0.110	0.129	0.127	0.130	0.156	0.153	0.160
N	32,786			30,931			24,999			18,105		

Standard errors clustered at the individual level. 95% CI (Confidence interval)

Source: SHARE data (2004–2017)

