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Lifelong Disadvantage and Late Adulthood Frailty

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Abstract: Frailty is a complex state of objective and subjective vulnerability. It tends to increase with age, but the process is influenced by previous life course, especially previous disadvantages. The aim of this paper is to examine how the disadvantages suffered in adulthood (25 to 59 years) in four domains (unemployment, financial hardship, stress, and bad health) affect frailty in late adulthood (60 to 79 years). Using linear regression models on data from the Survey of Health, Ageing, and Retirement in Europe (2004–2017), we estimate frailty levels for several age groups (60–64, 65–69, 70–74, 75–79) accounting for both the persistence of these disadvantages over time and their coexistence, i.e., the number of years when they were simultaneously experienced. Results show that while frailty increases with age, as expected, there is also evidence of an accumulation of risks: the longer the periods of adult life affected by unemployment, stress, financial hardship or, most importantly, bad health, the frailer individuals are in their late years. Furthermore, periods of coexisting disadvantages in adulthood translate into additional frailty in late life. Our findings highlight the importance of fighting disadvantages early in life: long-term improvements in terms of reduced frailty (a concept interrelated with health) may be substantial.

Keywords: aging; health inequality; life course; frailty

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1. Introduction

Health at older ages is subject to physiological decline [1], but it is also path-dependent: it reflects what happened in youth and adulthood [2]. Life trajectories begin in childhood [3] and evolve through the experiences made, among others, in the process of family formation (and dissolution), at reproduction [4,5], and at work [6,7]. Each stage affects the next and all are subject to several constraints, among which are the economic ones, and when these constraints are particularly binding the consequences on health in old age may be severe [8].

Health tends to deteriorate in later life, but this deterioration is not the same for everybody. It is particularly marked for those whose life trajectory was unfavorable, especially if adversities cumulated or lasted for long periods, or both [9,10]. The notion of accumulation of disadvantages relates to 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, not surprisingly, prove particularly harmful.

Two aspects may be distinguished: persistence and coexistence of disadvantages. The former refers to the length of periods of exposure to a single factor or a series of factors, even if these periods are not consecutive. Examples are spells of financial hardship or poverty [11–13], prolonged living in deprived neighborhoods [14], and long-term unemployment [15].

When disadvantages occur together, or coexist, researchers refer to multiple deprivation [9,11,14–16]. As biographies are made of interrelated trajectories—e.g., in terms of employment, education, and health—adverse events may reinforce one another [17]. Research on coexisting disadvantages has generally focused on the number and gravity

of disadvantages in specific moments of life [18,19], but it has frequently ignored their concatenation over working-age adulthood. In this paper we consider both persistence and coexistence of disadvantage in adulthood in various life domains (bad health, severe stress, financial hardship, and unemployment), and evaluate their impact on frailty in later life. Frailty is one of the most challenging expressions of population aging, with major consequences for public health and clinical practice. It is a condition of vulnerability associated with increased risk of negative outcomes, such as institutionalization, hospitalization, and death [20], especially among multi-morbid patients [21]. At the same time, frailty is an important prognostic factor to identify high risk patients, e.g., in the time of the COVID-19 pandemic, those with poorer response to vaccination [22]. As frailty, particularly in its early stages and in middle age, is reversible [21], the understanding of the its precursors—in our study, lifelong precursors—is of paramount importance for optimizing care and planning early interventions.

2. Materials and Methods

2.1. Data

Our data come from the seven waves of the Survey of Health, Ageing, and Retirement in Europe (SHARE), spanning the period 2004–2017 [23]. SHARE is a large representative biennial panel database. It collects health-related and socio-economic information, both at the time of the interview and retrospectively, on individuals aged 50 years and over and their partners. Its internationally comparable longitudinal micro data permit scholars to study several domains of the life-course of respondents from 27 European countries and Israel. The overall response rate is roughly 60% across the seven waves.

Our analysis focuses on individuals aged between 60 and 79 years for whom retrospective information is available, as collected in two SHARELIFE modules: wave 3 in 2009 and wave 7 in 2017. This selection strategy enabled us to include 19 countries: Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland. The retrospective information included in the SHARELIFE surveys is characterized by a good level of internal and external consistency [24]: the dataset seems to be reliable in this respect. After discarding 12,427 records with missing information on the variables of interest, our final sample includes 106,993 observations from 45,436 respondents, some of whom were observed more than once. Note that we dropped respondents aged 80 years and over (13,939 observations), because they are too few for our statistical analysis and because selection (due to mortality or the fact of living in nursing homes) may become a serious issue at older ages. However, as health inequalities tend to decline among the oldest old, e.g., [25], our analysis focuses on the age interval when the health impact of past adversities is more clearly identifiable.

2.2. Measures

Our dependent variable is the frailty index, a 40-item index validated on the SHARE dataset measuring the number of respondents' health deficits [20]. Both objective and subjective aspects are taken into account. Among the former are, for example, measures of grip strength and the body mass index, while, among the latter, self-reported health and mood can be found. Frailty represents a non-specific state "characterized by dysregulation of multiple biological systems, accumulation of deficits, vulnerability to stressors and increased risk of adverse outcomes such as falls, disability, hospitalization, institutionalization and death" [20] (p. 1). Frailty increases with age, but it may be more related to the biological than to the chronological age of respondents, and the frailty index, better than other health measures, reflects the lack of responsiveness and of the resources necessary for good physical and psychological functioning [21,22,26,27].

By definition, in a normalized scale, respondents range between a minimum (here 0, denoting perfect health conditions) and a maximum (here 100, characterizing those with all

of the 40 possible deficits). In our data, however, the empirical maximum is about half its theoretical limit (see Table 1 and Section 3.1 for a discussion).

Table 1. Descriptive characteristics of our sample (19 SHARE countries, 2004–2017).

Variables	Categories		Age Groups			
			60–64	**65–69**	**70–74**	**75–79**
Frailty Index		Mean	10.70	11.88	13.89	16.41
Life course disadvantages						
Unemployment	Never	%	85.88	89.07	91.76	93.81
	Occasionally	%	10.40	8.31	6.32	4.62
	Frequently	%	3.72	2.63	1.92	1.57
Severe stress	Never	%	53.57	57.48	62.88	68.57
	Occasionally	%	29.64	26.66	22.44	18.48
	Frequently	%	16.79	15.85	14.68	12.95
Illness	Never	%	85.22	86.04	87.00	88.37
	Occasionally	%	7.02	6.50	6.10	5.14
	Frequently	%	7.76	7.46	6.90	6.49
Financial hardship	Never	%	72.32	75.21	77.15	77.91
	Occasionally	%	17.42	15.72	14.14	12.87
	Frequently	%	10.25	9.07	8.70	9.22
Coexisting disadvantages	Never	%	79.36	82.21	85.30	87.96
	At least 1%	%	20.64	17.79	14.70	12.04
Additional covariates						
Childhood health	Fair, poor, 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
Wave	1 (2004–2005)	%	8.78	7.77	7.58	6.89
	2 (2006–2007)	%	13.01	11.42	11.21	11.00
	4 (2011–2012)	%	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	Austria	%	5.69	5.76	6.99	5.63
	Belgium	%	9.79	9.59	9.11	10.08
	Croatia	%	1.08	1.04	0.91	0.94
	Czech Republic	%	7.84	8.79	7.83	6.96
	Denmark	%	7.02	6.80	6.09	5.78
	Estonia	%	6.00	6.07	7.25	7.84
	France	%	7.91	7.09	6.83	7.88
	Germany	%	7.25	6.91	7.03	6.78
	Greece	%	5.07	5.07	5.18	4.89
	Hungary	%	0.99	0.75	0.65	0.45
	Italy	%	8.16	8.79	8.99	8.78
	Luxembourg	%	1.07	1.04	0.79	0.53
	Netherlands	%	4.12	3.48	3.20	2.92
	Poland	%	3.55	3.17	2.76	2.79
	Portugal	%	1.19	1.30	1.00	0.82
	Slovenia	%	4.04	3.42	3.64	3.44
	Spain	%	7.15	7.33	8.30	9.68
	Sweden	%	6.84	8.21	8.27	8.17
	Switzerland	%	5.23	5.41	5.17	5.64
N			32,809	30,960	25,044	18,180

Note: The categories of life course disadvantages have only descriptive purposes. "Occasionally" means more than 0% but less than 25% of adulthood (25–59 years) spent with that disadvantage; "Frequently" means more than 25%.

As for the independent variables, the first is age. Given the non-linearity of its influence, we decided to group it in four five-year classes: 60–64, 65–69, 70–74, and 75–79. With different approaches (e.g., as a continuous variable) results do not change in any substantial way, but its effect emerges less clearly.

Several independent variables measure the presence, persistence, and coexistence of disadvantages during the adult life course, between 25 and 59 years. In the SHARELIFE modules of 2009 and 2017, respondents were asked whether they had ever experienced: (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). First, we calculated the number of years respondents spent with each of these disadvantages between 25 and 59 years and we transformed this variable into a percentage of their adult life: this is our measure of persistence, ranging between 0% (never) and 100% (always, i.e., for 35 years). Second, we measured whether respondents had ever experienced at least two disadvantages at the same time (yes/no) – and this accounts for coexistence. We also tried more refined measures of coexistence, but their interpretation turned out to be less straightforward and the results (not reported here, but available upon request) always in line with those shown below.

In our models, we also controlled for a set of covariates that previous research had found important in shaping later life health [3,20,28,29]. To account for childhood circumstances, for instance, we included self-reported health at 10 years (coded as a binary variable: excellent or good, opposed to fair, poor, or "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 for a health condition, having had parents drinking heavily or with mental health problems, having experienced financial hardship, or difficult living arrangements).

Regarding socio-demographic variables, we included gender and educational level (primary; secondary; tertiary). Finally, we controlled for the country of residence and, since we pooled all the SHARE waves to increase the sample size, we controlled for the wave (1–7).

2.3. Analysis

As our dependent variable (frailty) is continuous, we ran linear regression models (with Stata 17 software). Given the biennial nature of the SHARE survey, within certain five-year age intervals respondents frequently happen to be observed more than once. Therefore, we clustered standard errors at the individual level, to account for correlation between observations, when these referred to the same respondent. As a robustness check, we re-ran our models discarding repeated observations, i.e., keeping respondents only once, at survey entry. The results obtained with this reduced sample (not reported here, but available on request) are in line with those shown below, although with wider confidence intervals.

Each model includes all the variables referring to the persistence of each disadvantage during adulthood—unemployment, bad health, severe stress, financial hardship, from 0% to 100%—and a variable measuring the possible coexistence of these disadvantages (yes/no). In the first step of the analysis (models 1–4), where we focus on persistence, these variables are also included in interaction with the age groups, to allow for possible differential effects at various ages. In the second step of the analysis (model 5), where we focus on coexistence, the interaction term is instead between age groups and the dummy variable for coexisting disadvantages (yes/no).

We can model our results for all old age classes and all possible combinations of disadvantages in adulthood. However, to simplify matters, our graphs display the predicted frailty score corresponding to selected levels of prevalence of disadvantage: never, 25% of adult life, and 75% of adult life. For the coexistence part, we show estimated frailty profiles of theoretical respondents who experienced two disadvantages, each lasting for 50% of their adulthood, either with or without at least some overlapping (coexistence). All other

variables are kept at their average level. The full models can be found in the Appendix (Table A1).

3. Results

3.1. Descriptive Results

In line with previous studies, e.g., [28], the mean frailty index increases with age. As Table 1 shows, in our analytical sample it goes from 10.7 at 60–64 years to 16.4 at 75–79 years. This translates into an increase of frailty of about .38 per year, although the process accelerates with age: from 24 per year between 60–64 years and 65–69 years, to 0.50 per year between 70–74 years and 75–79 years. Overall, the distribution of the frailty index is right-skewed: the median is 10, and the 95th and 99th percentile are 32 and 49, respectively.

Figure 1 shows the prevalence of the disadvantages considered in the analysis during the respondents' adult years. Unemployment is the least frequently reported problem; financial hardship prevails initially, but stress is 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 respondents reporting coexisting disadvantages is low, but increasing with age, from below 2% to about 5%.

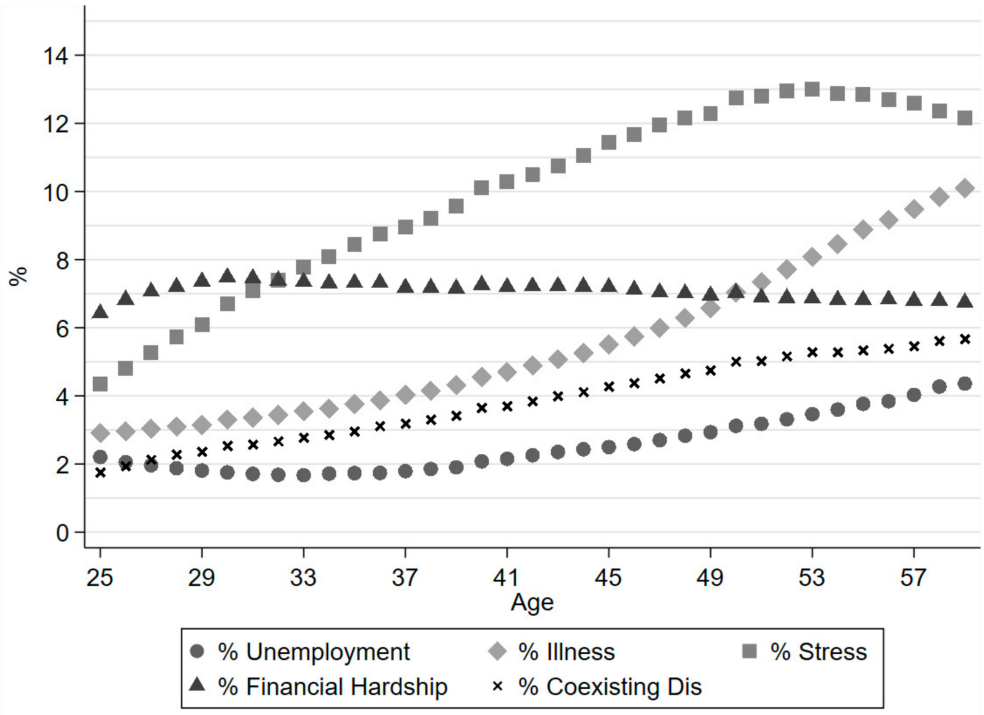

Figure 1. Prevalence of disadvantages, and coexisting disadvantages in adult years (19 SHARE countries, 2004–2017).

3.2. Lifelong Disadvantage: Persistence

The four panels of Figure 2 show the predicted frailty scores by age for selected levels of each specific disadvantage, under the assumption that no other disadvantage was experienced in adulthood.

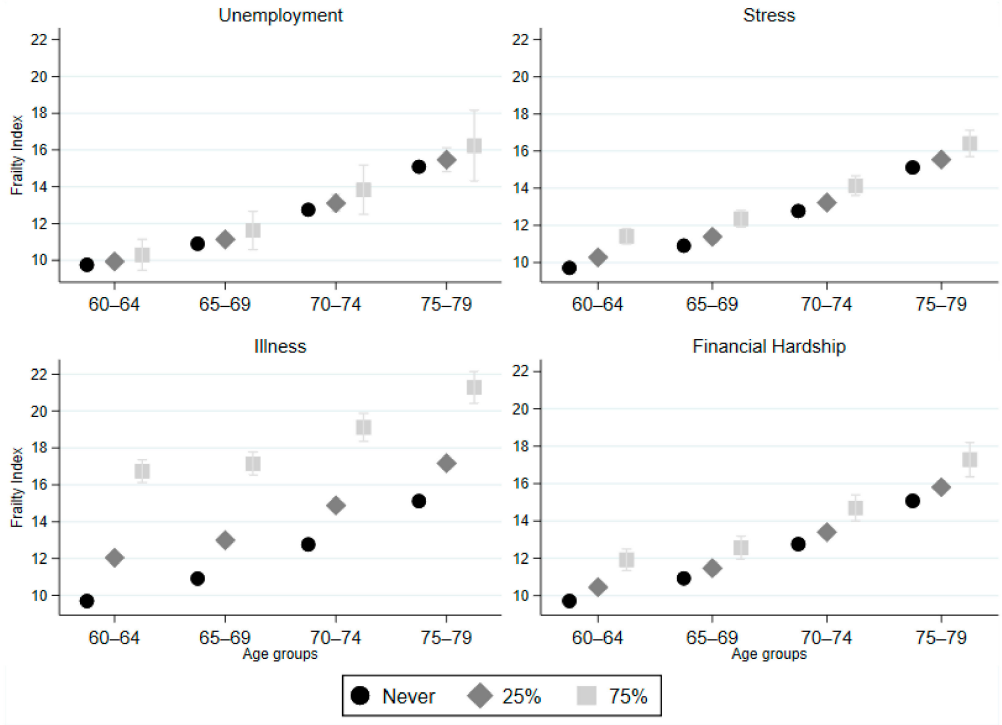

Figure 2. Predicted frailty scores by age, for various levels of past disadvantages, by type of disadvantage (19 SHARE countries, 2004–2017). 95% CI. Other covariates at their average level.

Although frailty increases with age for everybody, those who experienced adverse events in adulthood fare worse than others. As expected, the worst case emerges in relation to poor past health (illness). As the frailty index itself may not be very telling, especially to those who are not familiar with it, we suggest an alternative point of view: to consider its equivalent in terms of years of life, that is referring to the x axis (age) rather than to the y axis (frailty). This probably gives a better sense of how past disadvantages trigger earlier biological aging and a corresponding increase in vulnerability.

For instance, those whose health was occasionally poor in adulthood (25% of the time) are about as frail at 60–64 years (frailty score = 12) as those always in good health are some eight years later, between 65–69 years and 70–74 years. In other words, occasional poor health in adulthood makes people some eight years older in functional terms (here: frailty), as compared to those always in good health.

The effect of the other disadvantages is smaller, but, apart from unemployment, not negligible, especially for severe cases (disadvantage suffered during 75% of adult life). Note that all confidence intervals are very small and the evolution of frailty extremely consistent, both with age and with the increasing prevalence of past disadvantages.

3.3. Lifelong Disadvantage: Coexistence

Turning to the case of coexisting disadvantages, Table 2 displays the predicted frailty score and their standard errors at different ages for all possible combinations of disadvantages, assuming (for illustrative purposes) that the respondents experienced them for 50% of their adult life. The table contains three blocks of columns. The first column ("Only one disadvantage") reports the predicted frailty score by age class for those who experienced just one disadvantage, for 50% of their adult life. The columns of the second block ("Not coexisting") report the predicted frailty score for theoretical respondents of various ages who suffered two disadvantages, each for 50% of their adult life, but with no overlapping (which means that their entire adult life was affected). The columns of the third block ("Coexisting") do the same, but in this case, there is at least some coexistence of disadvantages in adulthood. All these theoretical values derive from the parameters of model 5

of Table A1 in the Appendix A, from which confidence intervals can also be derived (see also Figure 3). Note that Table 2 is symmetrical, and this explains why certain values are apparently missing. Consider for instance those aged 70–74 years, whose adulthood was marked by both stress (row) and illness (column), in both cases for 50% of the time, with no overlap between the two disadvantages. Their predicted frailty score is 18.1. The same value, not reported in the table, is estimated for those who suffered from both illness (row) and stress (column). Figure 3 reports a few selected cases taken from this table.

Table 2. Predicted frailty scores, and standard errors, by age and combination of disadvantages, with and without coexistence (19 SHARE countries, 2004–2017).

		Additional Disadvantage, 50% of Adult Life							
	Only One	**Not coexisting**				**Coexisting**			
	Disadvantage	**Unempl.**	**Stress**	**Illness**	**Fin. Hard.**	**Unempl.**	**Stress**	**Illness**	**Fin. Hard.**
Unemployment (50%)									
60–64	10.1		11.2	14.5	11.5		12.6	15.9	12.9
	0.29		*0.26*	*0.29*	*0.29*		*0.27*	*0.29*	*0.28*
65–69	11.4		12.4	15.8	12.7		13.5	16.8	13.8
	0.35		*0.27*	*0.29*	*0.29*		*0.29*	*0.30*	*0.29*
70–74	13.5		14.3	17.6	14.6		15.4	18.7	15.7
	0.46		*0.27*	*0.29*	*0.29*		*0.33*	*0.35*	*0.34*
75–79	15.8		16.7	20.0	17.0		17.2	20.6	17.6
	0.65		*0.28*	*0.30*	*0.30*		*0.40*	*0.41*	*0.40*
Stress (50%)									
60–64	10.8			15.0	12.0			16.4	13.4
	0.14			*0.19*	*0.18*			*0.20*	*0.18*
65–69	11.9			16.2	13.2			17.3	14.3
	0.15			*0.20*	*0.19*			*0.22*	*0.20*
70–74	13.7			18.1	15.1			19.2	16.2
	0.18			*0.20*	*0.19*			*0.27*	*0.25*
75–79	16.0			20.5	17.5			21.1	18.0
	0.24			*0.21*	*0.20*			*0.34*	*0.32*
Illness (50%)									
60–64	14.4				15.4				16.7
	0.21				*0.22*				*0.21*
65–69	15.1				16.6				17.6
	0.21				*0.22*				*0.23*
70–74	17.0				18.4				19.5
	0.26				*0.23*				*0.27*
75–79	19.2				20.8				21.4
	0.30				*0.24*				*0.34*
Financial Hardship (50%)									
60–64	11.2								
	0.20								
65–69	12.0								
	0.21								
70–74	14.0								
	0.23								
75–79	16.5								
	0.31								

Note: other covariates at their average level, standard errors in italic.

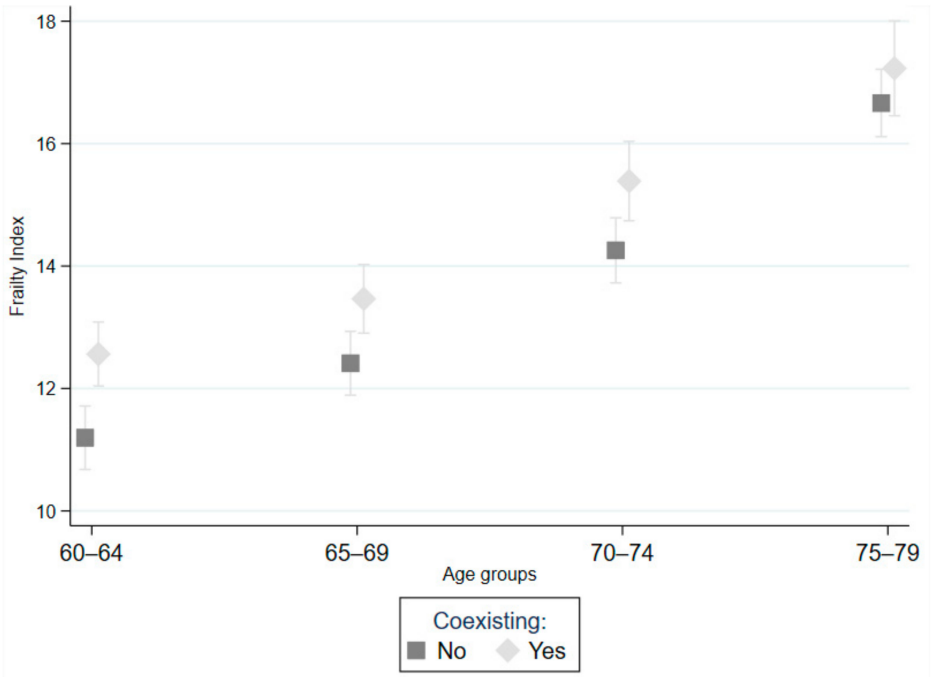

Figure 3. Predicted frailty scores by age, when unemployment and stress were experienced for 50% of respondents' adult life, with and without coexistence of disadvantages (19 SHARE countries, 2004–2017). 95% CI. Other covariates at their average level.

What emerges is that coexistence of disadvantage systematically leads to a significant greater frailty and the worsening is stronger and more important at relatively young ages. At 60–64 years, for instance, focusing on the combination of unemployment and stress (Figure 3), frailty worsens by about 1.4 points (from 11.2 to 12.6, non-overlapping CIs) if there is also coexistence. This coexistence-led increase corresponds to about five years of functional aging at those ages: it is as if respondents aged 60–64 years were in fact aged 65–69 years.

Consistently with the literature, e.g., [26], these detrimental effects tend to decline at older ages: at 75–79 years, for instance, the worsening in frailty due to coexistence of disadvantages is much smaller (about 0.6), and not significant.

3.4. A Breakdown by Welfare Regime

As a sensitivity check, and because the issue has an interest in itself, we broke down our results running separate models by country groups, that is by welfare regime, e.g., [29]:

- Bismarckian Europe (Austria, Germany, Netherlands, France, Switzerland, Belgium, and Luxembourg),
- Scandinavian countries (Sweden and Denmark),
- Southern Europe (Spain, Italy, Greece, and Portugal), and
- Eastern Europe (Czech Republic, Poland, Hungary, Slovenia, Estonia, and Croatia).

Unfortunately, our sample is too small to run separate, country-specific models. The results that we obtained (not reported here, but available upon request) confirm those presented in the previous sections. What emerges in particular is that Southern and Eastern Europe display the highest frailty scores, further worsened by previous disadvantages, especially poor health.

While everybody becomes frailer with age, the process is accelerated in Bismarckian, Southern, and Eastern Europe, while it is relatively modest in Scandinavian countries. Although in all groups of countries previous disadvantages exert an analogous frailty-increasing effect, final results differ markedly. Figure 4 suggests what our region-specific models (not reported here, but available upon request) indicate: in Scandinavia, those with

very poor conditions in adulthood (e.g., with health problems 75% of the time) have frailty levels that are comparable to those of the healthiest in Eastern Europe—especially past 70 years of age.

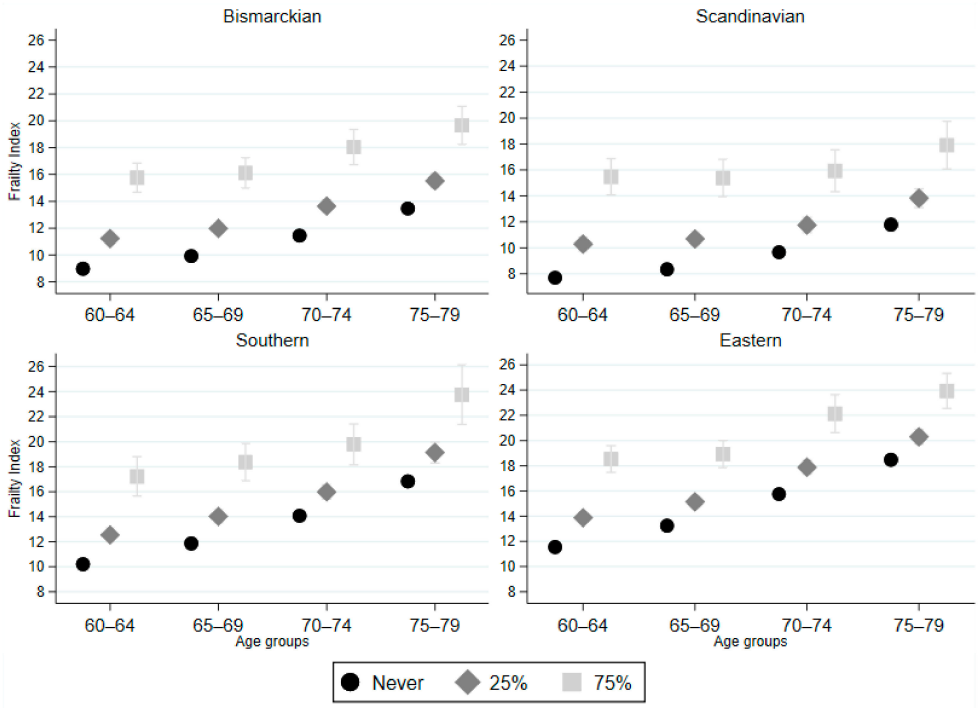

Figure 4. Predicted frailty scores by age, for various levels of past illness (in adult years), by welfare regime (19 SHARE countries, 2004–2017). 95% CI. Other covariates at their average level.

4. Discussion

In this article, we studied later life frailty accounting for adverse events suffered by individuals throughout their life, and especially in adulthood, adopting a life course perspective, or at least a perspective that is as close to it as our (SHARE) data allow. We focused on frailty, a non-specific and complex indicator of health, covering physical and mental dimensions, measured in both objective and subjective terms. We considered different kinds of disadvantages suffered in adulthood: 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 stress and disadvantage. Apart from unemployment, the frailty effects of which are relatively minor, these long-term consequences may be relevant, especially when past episodes were prolonged (persistence) or simultaneous (coexistence). Multiple disadvantages occur rarely, but when they do, the consequences on frailty may be serious. Note that this finding has policy implications: problems, such as poor health and unemployment, for instance, which are typically targeted separately in most welfare systems, should instead be addressed simultaneously, because they tend to be particularly harmful when they occur together or persist in adult life.

Poor health in adulthood (and, additionally, during childhood) is the single disadvantage most closely associated with high frailty in late life, and these effects are strong already at relatively young ages (60–64 years) – a result that stands out more clearly if one transforms the worsening of the frailty index into an "individual aging" index. In short, it is as if affected respondents were N years older that non-affected respondents, despite having lived the same number of years. This aging effect, N, may be strong, frequently

between 5 and 10 years, and it remains large throughout the observed age interval (60 to 79 years), although it shows signs of decline (health convergence) at older ages.

We also accounted for the clustering effect of these disadvantages, i.e., when they persist for long periods, when they coexist (two or more disadvantage at the same time), or both. The results that we found are not a surprise in themselves: coexisting disadvantages lead to greater frailty. What strikes is the strength of the effect, especially after transforming this increased frailty into additional years of biological aging.

Our results are not driven by a peculiar subgroup of countries. In line with previous literature (see e.g., [29]), we found that individuals are in worse health in Bismarckian, Eastern, and Southern Europe than in Scandinavian countries, and their health deteriorates more quickly as they age. Although our data do not permit us to investigate the underlying causal mechanisms, our findings reinforce the general impression about the effectiveness of the universalistic and redistributive social protection system of Scandinavian welfare states. Even there, however, health inequalities in later life prove non-negligible and reflect previous experiences of disadvantage.

Unfortunately, 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, feelings of personal security (against crime and violence), and measures of neighborhood quality, e.g., [16]. To date, no data covering all life course dimensions, with retrospective questions spanning long time periods and for a large group of countries, are available. We solicit a further effort in this direction, which will enable future research to understand mechanisms relating certain past disadvantages (e.g., not having close relationships) to health and frailty in later life.

5. Conclusions

With population aging, the sustainability of welfare in Western societies has come into question. Both the WHO's "healthy ageing" action [27] and the European Commission's "healthy and active ageing" framework [30] underline the need to improve older people's life and well-being, insisting on the notion of healthy lifestyles and subscribing to a life course approach. In this respect, the WHO encourages a prompt identification of people – especially elderly – in the community with higher frailty profiles, as a fundamental instrument to make intervention to prevent, or at least delay, functional decline. Early action, the socio-economic background, and life-course experiences have been recognized as important determinants of later life health [2,3,8] and our results support this view, showing that frailty has life-course determinants: persistent and cumulative disadvantages during youth and adulthood tend to have long-lasting effects, clearly detectable already at relatively young ages (e.g., at 60–64 years). The early identification of frailty is crucial, as it can be stopped, and even reverted, with adequate prognosis and care [21].

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Institutional Review Board Statement: This research has been conducted using secondary date, namely data coming the Survey of Health, Ageing and Retirement in Europe. Access to the SHARE data is provided free of charge on the basis of a release policy that gives quick and convenient access to all scientific users world-wide after individual registration. All details about the application and registration process can be found at http://www.share-project.org/data-access/user-registration.html. In accordance with the legal requirements and ethical commitments related to the SHARE data collection, we registered to the Share system, acknowledging and agreeing with all the Share

conditions of use. The SHARE study is subject to continuous ethics review. During Waves 1 to 4, SHARE was reviewed and approved by the Ethics Committee of the University of Mannheim. Wave 4 of SHARE and the continuation of the project were reviewed and approved by the Ethics Council of the Max Planck Society. For more details, please see: http://www.share-project.org/fileadmin/pdf_documentation/SHARE_ethics_approvals.pdf.

Informed Consent Statement: Informed consent was obtained by SHARE from all subjects involved in the study.

Data Availability Statement: SHARE data access is publicly granted upon completion of the application form: http://www.share-project.org/data-access/user-registration.html (accessed on 30 November 2016).

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Conflicts of Interest: The authors declare no conflict of interest.**Ethical Statement:** Access to the SHARE data is provided free of charge on the basis of a release policy that gives quick and convenient access to all scientific users worldwide after individual registration. All details about the application and registration process can be found at http://www.share-project.org/data-access/user-registration.html. In accordance with the legal requirements and ethical commitments related to the SHARE data collection, the authors acknowledged and agreed with all the Share conditions of use.

Appendix A

Table A1. Results from linear regression models for frailty. Models 1 to 4 consider the effect of persistence on frailty, exploring each disadvantage separately (unemployment, stress, illness, and financial hardship, respectively) in interaction with age groups. Model 5 highlight the effects of having experienced coexisting disadvantages in interaction with age groups.

	Model 1			**Model 2**			**Model 3**			**Model 4**			**Model 5**		
	Coef.		**SE**	**Coef.**		**SE**	**Coef.**		**SE**	**Coef.**		**SE**	**Coef.**		**SE**
Age: 60−64															
65−69	1.15	***	0.07	1.19	***	0.08	1.22	***	0.07	1.21	***	0.07	1.22	***	0.07
70−74	3.00	***	0.09	3.06	***	0.10	3.06	***	0.09	3.04	***	0.09	3.06	***	0.09
75−79	5.33	***	0.12	5.41	***	0.13	5.42	***	0.12	5.35	***	0.12	5.47	***	0.12
Unemployment (U)	0.01		0.01	0.01	*	0.00	0.01	*	0.00	0.01	*	0.00	0.01	*	0.00
Stress (S)	0.02	***	0.00	0.02	***	0.00	0.02	***	0.00	0.02	***	0.00	0.02	***	0.00
Illness (I)	0.09	***	0.00	0.09	***	0.00	0.09	***	0.00	0.09	***	0.00	0.09	***	0.00
Financial Hardship (FH)	0.03	***	0.00	0.03	***	0.00	0.03	***	0.00	0.03	***	0.00	0.03	***	0.00
Coexisting Disadvantages (CD) = Yes	1.13	***	0.15	1.12	***	0.15	1.12	***	0.15	1.13	***	0.15	1.37	***	0.17
65−69 # U	0.00		0.01												

Table A1. *Cont.*

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Coef.		SE	Coef.		SE	Coef.		SE	Coef.		SE	Coef.		SE
70−74 # U	0.01		0.01												
75−79 # U	0.01		0.01												
60−64 # S															
65−69 # S				0.00		0.00									
70−74 # S				0.00		0.00									
75−79 # S				−0.01		0.01									
65−69 # I							−0.01	*	0.00						
70−74 # I							−0.01		0.01						
75−79 # I							−0.01		0.01						
65−69 # FH										−0.01		0.00			
70−74 # FH										0.00		0.01			
75−79 # FH										0.00		0.01			
65−69 # CD = 1													−0.32		0.19
70−74 # CD = 1													−0.24		0.27
75−79 # CD = 1													−0.80	*	0.36
Childhood health (fair, poor, varied)	2.47	***	0.16	2.48	***	0.16	2.47	***	0.16	2.48	***	0.16	2.48	***	0.16
Childhood stressful events	0.73	***	0.10	0.73	***	0.10	0.73	***	0.10	0.73	***	0.10	0.73	***	0.10
Female	2.05	***	0.08	2.04	***	0.08	2.05	***	0.08	2.05	***	0.08	2.05	***	0.08
Educational level: Low															
Mid Education	−2.45	***	0.12	−2.45	***	0.12	−2.45	***	0.12	−2.45	***	0.12	−2.45	***	0.12
High Education	−4.14	***	0.13	−4.14	***	0.13	−4.14	***	0.13	−4.14	***	0.13	−4.14	***	0.13
Wave: 1 (2004–2005)															
2 (2006–2007)	−0.05		0.09	−0.05		0.09	−0.05		0.09	−0.05		0.09	−0.05		0.09
4 (2011–2012)	0.33	**	0.10	0.33	**	0.10	0.32	**	0.10	0.33	**	0.10	0.33	**	0.10
5 (2013)	0.40	***	0.11	0.40	***	0.11	0.40	***	0.11	0.40	***	0.11	0.40	***	0.11
6 (2015)	0.37	***	0.11	0.37	***	0.11	0.37	***	0.11	0.37	***	0.11	0.37	***	0.11
7 (2017)	0.19		0.13	0.19		0.13	0.19		0.13	0.19		0.13	0.19		0.13
Country: Austria															
Germany	1.61	***	0.23	1.61	***	0.23	1.61	***	0.23	1.61	***	0.23	1.61	***	0.23
Sweden	−1.30	***	0.22	−1.30	***	0.22	−1.30	***	0.22	−1.30	***	0.22	−1.30	***	0.22
Netherlands	−1.14	***	0.25	−1.14	***	0.25	−1.14	***	0.25	−1.14	***	0.25	−1.14	***	0.25
Spain	2.13	***	0.25	2.12	***	0.25	2.13	***	0.25	2.13	***	0.25	2.13	***	0.25
Italy	1.33	***	0.24	1.32	***	0.24	1.33	***	0.24	1.33	***	0.24	1.32	***	0.24
France	0.79	***	0.23	0.78	***	0.23	0.79	***	0.23	0.79	***	0.23	0.79	***	0.23
Denmark	−0.51	*	0.24	−0.51	*	0.24	−0.51	*	0.24	−0.51	*	0.24	−0.51	*	0.24
Greece	−0.28		0.23	−0.28		0.23	−0.28		0.23	−0.28		0.23	−0.28		0.23
Switzerland	−2.37	***	0.22	−2.37	***	0.22	−2.36	***	0.22	−2.36	***	0.22	−2.37	***	0.22
Belgium	1.21	***	0.23	1.21	***	0.23	1.21	***	0.23	1.21	***	0.23	1.21	***	0.23
Czech Republic	2.14	***	0.23	2.14	***	0.23	2.14	***	0.23	2.14	***	0.23	2.14	***	0.23
Poland	6.48	***	0.33	6.47	***	0.33	6.47	***	0.33	6.47	***	0.33	6.46	***	0.33
Luxembourg	1.76	***	0.41	1.76	***	0.40	1.76	***	0.41	1.76	***	0.41	1.76	***	0.41
Hungary	7.55	***	0.43	7.56	***	0.43	7.56	***	0.43	7.55	***	0.43	7.56	***	0.43
Portugal	4.85	***	0.44	4.85	***	0.44	4.85	***	0.44	4.85	***	0.44	4.85	***	0.44
Slovenia	2.10	***	0.26	2.10	***	0.26	2.11	***	0.26	2.11	***	0.26	2.10	***	0.26
Estonia	5.08	***	0.24	5.08	***	0.24	5.08	***	0.24	5.08	***	0.24	5.08	***	0.24
Croatia	3.11	***	0.35	3.11	***	0.35	3.11	***	0.35	3.12	***	0.35	3.12	***	0.35
Constant	8.97	***	0.23	8.93	***	0.23	8.93	***	0.23	8.95	***	0.23	8.91	***	0.23

Note: other covariates at their average level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. # is used to indicate interactions.

References

1. Walsh, K.; Scharf, T.; Keating, N. Social exclusion of older persons: A scoping review and conceptual framework. *Eur. J. Ageing* **2017**, *14*, 81–98. [CrossRef] [PubMed]
2. Blane, D.; Higgs, P.; Hyde, M.; Wiggins, R. Life course influences on quality of life in early old age. *Soc. Sci. Med.* **2004**, *58*, 2171–2179. [CrossRef] [PubMed]
3. Pakpahan, E.; Hoffmann, R.; Kröger, H. The long arm of childhood circumstances on health in old age: Evidence from SHARELIFE. *Adv. Life Course Res.* **2017**, *31*, 1–10. [CrossRef]
4. Hank, K.; Wagner, M. Parenthood, Marital Status, and Well-Being in Later Life: Evidence from SHARE. *Soc. Indic. Res.* **2013**, *114*, 639–653. [CrossRef]
5. Keenan, K.; Grundy, E. Fertility History and Physical and Mental Health Changes in European Older Adults. *Eur. J. Popul.* **2019**, *35*, 459–485. [CrossRef]
6. Lu, W.; Benson, R.; Glaser, K.; Platts, L.G.; Corna, L.M.; Worts, D.; McDonough, P.; Di Gessa, G.; Price, D.; Sacker, A. Relationship between employment histories and frailty trajectories in later life: Evidence from the English Longitudinal study of ageing. *J. Epidemiol. Community Health* **2017**, *71*, 439–445. [CrossRef]
7. Comolli, C.L.; Bernardi, L.; Voorpostel, M. Joint Family and Work Trajectories and Multidimensional Wellbeing. *Eur. J. Popul.* **2021**, *37*, 643–696. [CrossRef]
8. Corna, L.M. A life course perspective on socioeconomic inequalities in health: A critical review of conceptual frameworks. *Adv. Life Course Res.* **2013**, *18*, 150–159. [CrossRef]
9. Ljung, R.; Hallqvist, J. Accumulation of adverse socioeconomic position over the entire life course and the risk of myocardial infarction among men and women: Results from the Stockholm Heart Epidemiology Program (SHEEP). *J. Epidemiol. Community Health* **2006**, *60*, 1080–1084. [CrossRef]
10. Ben-Shlomo, Y.; Kuh, D. A life course approach to chronic disease epidemiology: Conceptual models, empirical challenges and interdisciplinary perspectives. *Int. J. Epidemiol.* **2002**, *31*, 285–293. [CrossRef]
11. Evans, G.W.; Kim, P. Childhood poverty and health: Cumulative risk exposure and stress dysregulation. *Psychol. Sci.* **2007**, *18*, 953–957. [CrossRef]
12. McDonough, P.; Sacker, A.; Wiggins, R.D. Time on my side? Life course trajectories of poverty and health. *Soc. Sci. Med.* **2005**, *61*, 1795–1808. [CrossRef]
13. Kahn, J.R.; Pearlin, L.I. Financial strain over the life course and health among older adults. *J. Health Soc. Behav.* **2006**, *47*, 17–31. [CrossRef]
14. Clarke, P.; Morenoff, J.; Debbink, M.; Golberstein, E.; Elliott, M.R.; Lantz, P.M. Cumulative Exposure to Neighborhood Context: Consequences for Health Transitions over the Adult Life Course. *Res. Aging* **2014**, *36*, 115–142. [CrossRef]
15. Janlert, U.; Winefield, A.H.; Hammarström, A. Length of unemployment and health-related outcomes: A life-course analysis. *Eur. J. Public Health* **2015**, *25*, 662–667. [CrossRef]
16. Korpi, T.; Nelson, K.; Stenberg, S.Å. The accumulation of social problems 1974–2000 (Chapter 4). *Int. J. Soc. Welf.* **2007**, *16*, 91–103. [CrossRef]
17. Fors, S.; Almquist, Y.B.; Brännström, L. Coexisting Social, Economic, and Health-Related Disadvantages in More than 2.4 Million Swedes: Combining Variable-Centred and Person-Centred Approaches. *Soc. Indic. Res.* **2019**, *143*, 115–132. [CrossRef]
18. Heap, J.; Lennartsson, C.; Thorslund, M. Coexisting disadvantages across the adult age span: A comparison of older and younger age groups in the Swedish welfare state. *Int. J. Soc. Welf.* **2013**, *22*, 130–140. [CrossRef]
19. Heap, J.; Fors, S. Duration and Accumulation of Disadvantages in Old Age. *Soc. Indic. Res.* **2015**, *123*, 411–429. [CrossRef]
20. Romero-Ortuno, R.; Kenny, R.A. The frailty index in Europeans: Association with age and mortality. *Age Ageing* **2012**, *41*, 684–689. [CrossRef]
21. Hanlon., P.; Nicholl, B.I.; Jani, B.D.; Lee, D.; McQueenie, R.; Mair, F.S. Frailty and pre-frailty in middle-aged and older adults and its association with multimorbidity and mortality: A prospective analysis of 493 737 UK Biobank participants. *Lancet Public Health* **2018**, *3*, e323–e332. [CrossRef]
22. Palermo, S. COVID-19 Pandemic: Maximizing Future Vaccination Treatments Considering Aging and Frailty. *Front. Med* **2020**, *7*, 558835. [CrossRef] [PubMed]
23. Börsch-Supan, A.; Brandt, M.; Hunkler, C.; Kneip, T.; Korbmacher, J.; Malter, F.; Schaan, B.; Stuck, S.; Zuber, S. Data Resource Profile: The Survey of Health, Ageing and Retirement in Europe (SHARE). *Int. J. Epidemiol.* **2013**, *42*, 992–1001. [CrossRef] [PubMed]
24. Havari, E.; Mazzonna, F. Can We Trust Older People's Statements on Their Childhood Circumstances? Evidence from SHARELIFE. *Eur. J. Popul.* **2015**, *31*, 233–257. [CrossRef]
25. Rehnberg, J. What Levels the Association between Income and Mortality in Later Life: Age or Health Decline? *J. Gerontol.-Ser. B Psychol. Sci. Soc. Sci.* **2020**, *75*, 426–435. [CrossRef] [PubMed]
26. Mitnitski, A.B.; Graham, J.E.; Mogilner, A.J.; Rockwood, K. Frailty, fitness and late-life mortality in relation to chronological and biological age. *BMC Geriatr.* **2002**, *2*, 1. [CrossRef] [PubMed]
27. World Health Organization. WHO Clinical Consortium on Healthy Ageing 2019. In Proceedings of the Consortium Meeting, Geneva, Switzerland, 21–22 November 2019.

28. Stolz, E.; Mayerl, H.; Waxenegger, A.; Rásky, É.; Freidl, W. Impact of socioeconomic position on frailty trajectories in 10 European countries: Evidence from the Survey of Health, Ageing and Retirement in Europe (2004–2013). *J. Epidemiol. Community Health* **2016**, *71*, 73–80. [CrossRef]
29. Eikemo, T.A.; Bambra, C.; Joyce, K.; Dahl, E. Welfare state regimes and income-related health inequalities: A comparison of 23 European countries. *Eur. J. Public Health* **2008**, *18*, 593–599. [CrossRef]
30. European Commission. *Green Paper on Ageing. Fostering Solidarity and Responsability between Generations*; European Commission: Brussels, Belgium, 2021.