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**Travail de Mémoire**

**Prevalence of the Frailty Phenotype in community-dwelling  
population aged 50 and over in the Survey of Health, Ageing  
and Retirement in Europe**

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## 1. INTRODUCTION AND DEFINITIONS

Frailty is currently recognized as an important clinical syndrome in geriatrics and also public health.

This syndrome is becoming important in the European population, mainly due to the population structure. We know that currently about 16 percent of the population of the 25 countries of the European Union is aged 65 years or over. According to the baseline projection of Eurostat, the Statistical Office of the European Communities, the proportion of the population aged 65 years or over will increase substantially throughout the whole projection period from 16.5% in 2004 up to 29.4% in 2050, corresponding to an increase from 75.3 millions of individuals in 2004 to 134.5 millions in 2050 (Eurostat news release, 2005). The risk of becoming frail increases with age (Fried et al., 2001; Woods et al., 2005), and this Eurostat projection forecasts a higher absolute number of frail older people.

The main reason of the emergence of the frailty concept is the need to identify vulnerable populations with a higher risk of poor outcome, such as disability, falls, health care utilization, and mortality (Boyd et al., 2005), in order to understand its pathophysiology, develop prevention and find adequate treatments.

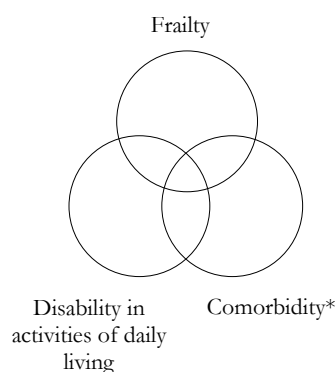
### 1.1 DEFINITION OF FRAILTY

Frailty is a term widely used in medical practice when talking about somebody who is weak, often has multiple medical problems, without a consensus for a universal definition. In fact, there are many definitions of frailty, a literature review published in 2006 identified seventeen different definitions of frailty (Levers et al., 2006; Annexe 8.3), but we can actually use an objective and standardized definition that we operationalized in this study.

Fried et al. described frailty as a “physiologic syndrome characterized by decreased reserve and resistance to stressors, resulting from cumulative decline across multiple physiologic systems, causing vulnerability to adverse outcomes”. According to this definition, a person is considered as “frail” when having at least three out of the five components of the frailty index: unintentional weight loss (ten pounds in the last year), self reported exhaustion, weakness (grip strength), slow walking speed and low physical activity. An intermediate or prefrail state corresponds to the presence of one or two attributes.

Frailty is a clinical syndrome distinct from disability or comorbidity, even though comorbidity can be an etiological risk factor and disability can be an outcome of frailty (Figure 1, Fried et al., 2001).

Figure 1. Venn diagram displaying overlap of frailty with disability in activities of daily living and comorbidity

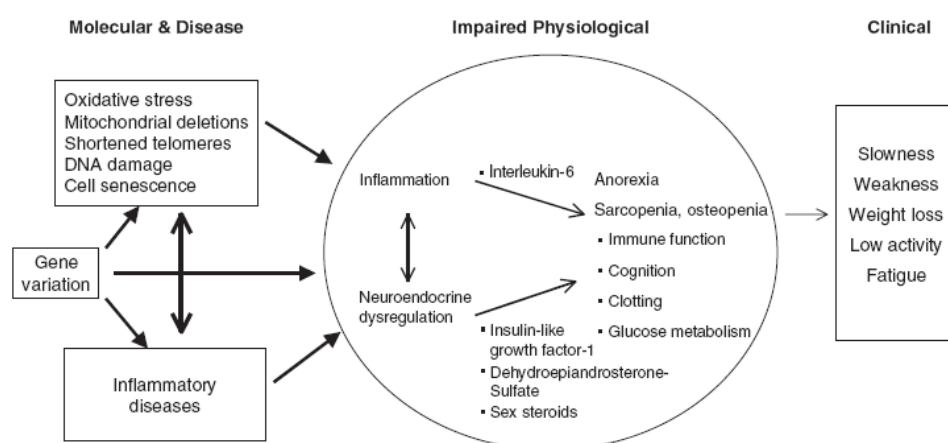


\* Comorbidity defined by L. Fried et al. as two or more out of the nine diseases: myocardial infarction, angina, congestive heart failure, claudication, arthritis, cancer, diabetes, hypertension, Chronic Obstructive Pulmonary Disease

The pathophysiology of frailty is not yet fully described but many studies have been conducted to describe relationships between frailty and biological characteristics (Walston et al., 2002; Puts et al., 2005; Leng et al., 2004; Van Tongeren et al., 2005; Cesari et al., 2006) or medical conditions (Woods et al., 2005; Blaum et al., 2005; Shlipak et al., 2004). Even though associations with laboratory findings have been described, the causal relationship remains unproven.

A hypothesized molecular, physiological and clinical pathway to frailty has been proposed at the 2004 American Geriatrics Society Conference on a Research Agenda for Frailty in Older Adults (Figure 2; Walston et al., 2006). This pathway is an interesting attempt in order to give a molecular and physiological validity to the frailty index as defined by L. Fried et al.

Figure 2. Overview of hypothesized molecular, physiological, and clinical pathway to frailty



Arrows pointing in both directions illustrate potential interactions between systems.

The frailty index as defined by Fried et al., conceptualised from this hypothesized molecular, physiological and clinical pathway (Figure 2,) allows us to apply and operationalize this definition of frailty in order to compare its prevalence within subgroups of a population and with previous studies.

Recommendations have been published on clinical trials evaluating public interventions on the frail populations also in order to understand the influence of commonly used medications on frailty (Ferrucci et al., 2004).

## 1.2 DEFINITION OF DISABILITY

The WHO Classification of Impairment, Disability & Handicap defines impairment as “Any loss or abnormality of psychological, physiological or anatomical structure or function”, handicap as “A disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents the fulfilment of a role (depending on age, sex, and social or cultural factors) for that individual” and disability as “Any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner, or within the range, considered normal for a human being”.

Disability can be dichotomised in classes, such as disability in basic activities of daily living and or disability in instrumental activities in daily living. The instrumental activities are often the first that would be impaired.

Disability in basic activities of daily living (BADLs) includes personal-care activities such as eating, bathing, dressing, transferring and using the toilet. Disability in instrumental activities in daily living (IADLs) includes household chores, shopping, managing medication, climbing stairs, public transport, finances, and walking.

## **2. OBJECTIVES**

A) The main purpose of this study was to estimate the prevalence of the frailty and intermediate states in the community-dwelling European population aged 50 and over.

B) The second objective was to compare the frailty prevalence in the European population with previous studies in other population.

C) The third aim was to determine and comment the difference of the frailty prevalence between the European countries participating in the SHARE study.

D) The last aim was to determine the proportion of the frail European population without disability in basic activities of daily living.

This was attempted by using the questionnaire and the physical tests of the SHARE study.

### 3. METHODS

#### 3.1 STUDY DESIGN

This cross-sectional study used baseline data ‘wave 1’, release 1 (2004) from The Survey of Health, Ageing and Retirement in Europe (Börsch-Supan et al. 2005).

#### 3.2 DATA SOURCE: THE SHARE PROJECT

SHARE is a multidisciplinary and cross-national data base of micro data on health, socio-economic status and social and family networks of more than 20000 European individuals living in a household that included at least one member over the age of 50.

This survey includes eleven European countries: Austria, Denmark, Sweden, France, Germany, Switzerland, the Netherlands, Spain, Italy, Greece and Belgium. Belgium was not included in our analysis due to missing data for this country (These data should be available in Release 2 of the SHARE data).

The sampling designs used in SHARE vary from simple random sampling of households to rather complicated multi-stage designs. In most countries, there were registers of individuals that permitted stratification by age. In the two Nordic countries Denmark and Sweden, the samples could be drawn from national household or population registers. In France and Spain, it became possible to get access to population registers through the cooperation with the national statistical office. In some countries, like Greece and Switzerland, telephone directories were used as sampling frames and screening was performed in the field of eligible sample participants (Börsch-Supan et al., 2005 a, b).

The interview mode adopted in SHARE was Computer Assisted Personal Interview (CAPI), supplemented by a self-administered paper and pencil questionnaire (“drop off”). The CAPI interview, which is known to be one of the most effective interview modes, represents the largest part of the SHARE interview. The self-administrated paper and pencil questionnaire was used to ask more sensitive questions, like questions on social and psychological well-being, healthcare, religiosity and political affiliation. In several countries, the sample consists of two parts: the “core sample” and the “vignette sample”. In the vignette samples, a part of the self completion questionnaire was replaced by a section with anchoring vignettes. The questionnaires and translations are all available online at [www.share-project.org](http://www.share-project.org). In addition, data on cognitive and physical abilities (walking speed, grip strength) were obtained through direct measurement.

For the SHARE project, the eligible subjects were all European aged 50 and over and their spouse, even if spouse was younger than 50, not living abroad and able to speak the country’s language. The relevant birth year for inclusion was 1954 or earlier.

The overall household response rate for the SHARE study was 61.8 % with a variation between the countries from 37.6 % for Switzerland to 73.6 % for France (Table 1).

Table 1. SHARE overall response rate (Börsch-Supan et al., 2005 a)

<i>Country</i>	<i>Total</i>	<i>Male</i>	<i>Female</i>	<i>Under 50</i>	<i>50 to 64</i>	<i>65 to 74</i>	<i>75+</i>	<i>Household response rate *</i>	<i>Individual response rate</i>
<b>Austria</b>	1,986	820	1,166	48	1,004	571	363	58.1	87.4 %
<b>Denmark</b>	1,732	785	947	95	929	374	334	63.2	93.0 %
<b>France</b>	1,842	794	1,048	93	928	454	366	73.6	91.7 %
<b>Germany</b>	3,020	1,385	1,635	67	1,573	888	485	63.4	86.5 %
<b>Greece</b>	2,142	901	1,241	159	1,035	554	391	61.4	91.8 %
<b>Netherlands</b>	3,000	1,337	1,623	102	1,705	713	460	55.1	87.9 %
<b>Italy</b>	2,559	1,132	1,427	53	1,339	785	382	61.3	79.7 %
<b>Spain</b>	2,419	1,004	1,415	44	1,092	702	579	53.3	73.8 %
<b>Sweden</b>	3,067	1,424	1,643	57	1,595	821	594	50.2	83.8 %
<b>Switzerland</b>	1,010	468	542	41	508	245	203	37.6	86.9 %
<b>All countries</b>	<i>22,777</i>	<i>10,088</i>	<i>12,685</i>	<i>759</i>	<i>11,708</i>	<i>6,107</i>	<i>4,157</i>	61.8	86.0 %

\* Weighted average (see Börsch-Supan & Jürges, 2005, for details).

The total SHARE sample size is 22777, including 10088 men, 12685 women and 4 unknown.

### 3.3 SUBJECTS

For our study, we only included community-dwelling European individuals aged 50 and over.

After excluding people without statistical weight (3527 due to sampling reason; vignette, incomplete interviews), institutionalized persons that were wrongly included by some countries (468 but only 389 with a statistical weight) and spouses less than 50 years old (805 but only 8 with a statistical weight), the final sample of our study was 18853 community-living European (8592 men and 10261 women).

### 3.4 MEASUREMENTS

#### 3.4.1 Components of the frailty phenotype

As mentioned in the introduction, the frailty phenotype defined by L. Fried et al. is composed of five dimensions: weight loss (ten pounds in the last year), self reported exhaustion, weakness (grip strength), slow walking speed and low physical activity. People were considered as frail when having three out of the five components of the frailty index, with an intermediate state for people with one or two attributes (Fried et al., 2001).

Each component of this index has been operationalized with the data available in the SHARE study. The five correspondent dimensions retained for the SHARE study were the following: denutrition (loss of appetite), reduced endurance (exhaustion), muscle weakness (low grip strength), low mobility (slow walking speed) and poor physical activity.

The data concerning denutrition, reduced endurance and poor physical activity were collected by self-reported questions. The data for muscle weakness were obtained with a physical test. The data concerning low mobility were collected by self-reported questions after a relationship was statistically obtained with physical measurements in a subsample. The body mass index (BMI) was calculated with the weight and height reported by the participants.

#### *3.4.1.1 Denutrition*

The denutrition criterion operationalized in our study is defined by Fried et al. as the weight loss criterion. People are considered as frail for this criterion if reporting an unintentional loss of 10 pounds or more in the previous year or if they had an unintentional weight loss of at least 5% of the previous year's body weight by direct measurement of weight at the follow-up.

In SHARE, weight loss was not available. We used instead the following questions: "What has your appetite been like?" and classified answer "diminution in desire for food" as frailty criterion fulfilled and answer "no diminution in desire for food" as frailty criterion not fulfilled. For non-specific or uncodeable response to this first question, there was a second question "so, have you been eating more or less than usual?" and we classified answer "less" as frailty criterion fulfilled and answer "more" or "neither more nor less" as frailty criterion not fulfilled.

#### *3.4.1.2 Reduced Endurance*

According to Fried et al., exhaustion criterion was obtained after reading two statements "I felt that everything I did was an effort" and "I could not get going" with the following question "How often in the last week did you feel this way?". Subjects answering "a moderate amount of the time (3-4 days)" or "most of the time" categorized as frail for the endurance criterion and subjects answering "rarely or none of the time (< 1 day)" or "some or a little of the time (1-2 days)" as unfrail for the endurance criterion.

In SHARE, these questions were not available. We used instead the following question "In the last month, have you had too little energy to do the things you wanted to do?" and classified answer "yes" as frailty criterion fulfilled and answer "no" as frailty criterion not fulfilled.

#### *3.4.1.3 Muscle Weakness*

Fried et al. considered grip strength in the lowest twenty percent at baseline, adjusted for gender and body mass index, as frail for this criterion.

In the SHARE study, grip strength was measured with a hand-grip dynamometer and defined by taking the best value out of four (two alternate measurements from right and left hand, knowing that there was no big difference of strength between left-handed and right-handed regarding the hand used to perform this test.), stratified by gender and body mass index. The cut-offs used for this criterion were exactly the same as the ones obtained by Fried et al. and subjects with grip strength values under these cut-offs were considered as frail for muscle weakness criterion.

#### 3.4.1.4 Low Mobility

Fried et al. defined the slowest twenty percent of the population at baseline, based on the time to walk fifteen feet, adjusting for gender and standing height.

In SHARE, walking time was measured only in a subsample. However, several questions regarding the mobility were asked to all participants, namely:

1) *“We need to understand difficulties people may have with various activities because of a health or physical problem. Please tell me whether you have any difficulty doing each of these everyday activities. Exclude any difficulties that you expect to last less than three months. (Because of a health problem, do you have difficulty doing any of these activities?)”*

- *Walking 100 metres*
- *Sitting for about two hours*
- *Getting up from a chair after sitting for long periods*
- *Climbing several flights of stairs without resting*
- *Climbing one flight of stairs without resting*
- *Stooping, kneeling, or crouching*
- *Reaching or extending your arms above shoulder level*
- *Pulling or pushing large objects like a living room chair*
- *Lifting or carrying weights over 10 pounds/ 5 kilos, like a heavy bag of groceries*
- *Picking up a small coin from a table*
- *None of these*

*CHECK: You cannot select ‘none of the above’ together with any other answer. Please change your answer!*

2) *“Here are a few more everyday activities. Please tell me if you have any difficulty with these because of a physical, mental, emotional or memory problem. Again exclude any difficulties you expect to last less than three months. (Because of a health or memory problem, do you have difficulty doing any of these activities?)”*

- *Dressing, including putting on shoes and socks*
- *Walking across a room*
- *Bathing or showering*
- *Eating, such as cutting up your food*
- *Getting in or out of bed*
- *Using the toilet, including getting up or down*
- *Using a map to figure out how to get around in a strange place*
- *Preparing a hot meal*
- *Shopping for groceries*
- *Making telephone calls*
- *Taking medications*
- *Doing work around the house or garden*
- *Managing money, such as paying bills and keeping track of expenses*
- *None of these*

*CHECK: You cannot select ‘none of the above’ together with any other answer. Please change your answer!*

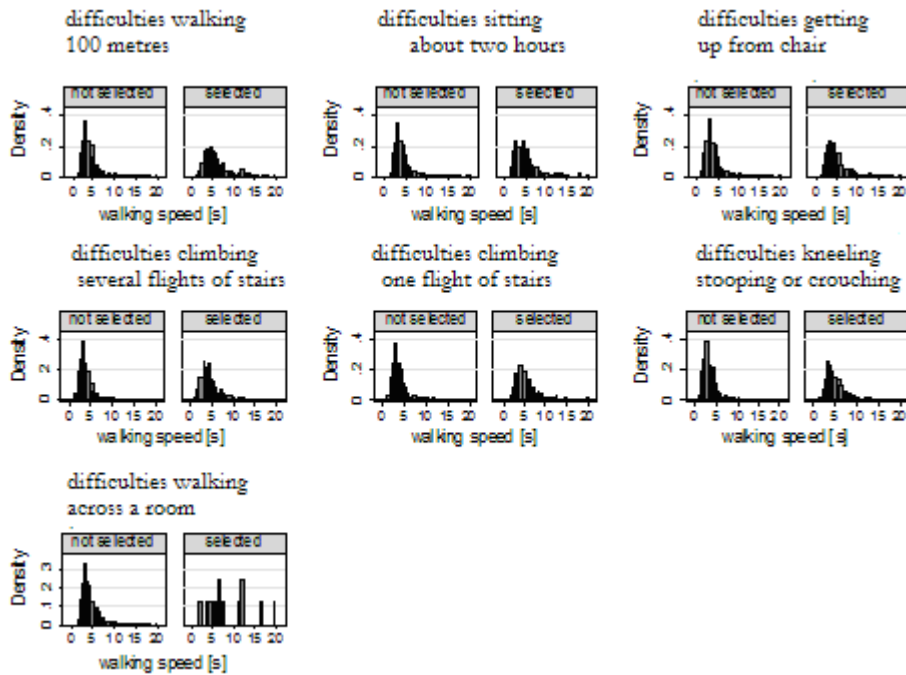
Participants indicated all items for which they had difficulties. We analysed the relationship between these items and the performance at the walking test in subjects for whom the two types of measurements were available. Variables found associated with the walking time were then combined into a score in order to classify individuals as slow or normal walkers. At the end of this analysis we retained the following question: “Please tell me whether you have any difficulty doing each of the everyday activities” and the low mobility criterion was fulfilled for the people that selected “Walking 100 metres” and/or “Climbing one flight of stairs without resting”.

### 3.4.1.5 Assessment of Low Mobility

The sample of subjects aged 75 and older had an objective measurement of the time necessary to walk 250cm and a statistical model allowed us to choose the two questions related to lower limb that could be applied to the entire sample in order to have a simple method.

First we took the subsample of 75 or older ( $n = 3201$ ) and compared the walking speed with each variable that seemed to have a relationship with this item.

Figure 3. Relationship between various answers concerning difficulties and walking time, subsample of 75 or older



With these graphs we could not find one question directly related with walking speed.

We then investigated the relationship between walking speed and these seven questions through a multivariate regression on the subpopulation of those who had performed the walking test.

Table 2. Multivariate regression between various answers concerning difficulties and walking time, subsample of 75 or older

ws difficulties	Robust Coef.	Std. Err.	z	P>  z	[95% Conf. Interval]	
walking 100 metres	-.0315245	.0092299	-3.42	0.001	-.0496147	-.0134343
sitting two hours	-.00589	.0106972	-0.55	0.582	-.0268561	.0150762
getting up from chair	-.0020455	.0093583	-0.22	0.827	-.0203874	.0162965
several flights of stairs	.0132275	.0147968	0.89	0.371	-.0157737	.0422287
one flight of stairs	-.0422551	.009227	-4.58	0.000	-.0603397	-.0241706
kneeling	-.0280356	.017399	-1.61	0.107	-.062137	.006066
walking across room	.0110925	.0206032	0.54	0.590	-.029289	.05147
_cons	.228929	.0268502	8.53	0.000	.1763037	.28155

At the end two variables were significant for the low mobility criterion.

Table 3. The two variables related to the low mobility criterion

ws difficulties	Robust		z	P> z	[95% Conf. Interval]	
	Coef.	Std. Err.				
walking 100 metres	-.0346564	.0117275	-2.96	0.003	-.0576418	-.011671
one flight of stairs	-.0459678	.0135751	-3.39	0.001	-.0725745	-.0193612
_cons	.2231623	.0162404	13.74	0.000	.1913317	.2549929

The construction of our final score for low mobility was obtained with these two variables.

In order to confirm this score we observed its distribution in the 75 and older subsample.

Table 4. Score distribution of the variables retained for low mobility criterion for the 75 and older subsample:

Score	Freq.	Percent	Cum.
0	2,036	63.61	63.61
1	641	20.02	83.63
2	524	16.37	100.00
Total	3,201	100.00	

In conclusion, this analysis allowed us to use a simple method for the low mobility criterion and this criterion was considered as fulfilled if either one or both of these two variables (“Walking 100 metres” and/or “Climbing one flight of stairs without resting”) were selected.

#### *3.4.1.6 Poor Physical Activity*

Fried et al. defined this frailty criterion by using the short version of the Minnesota Leisure Time Activity questionnaire, asking about “walking, chores (moderately strenuous), mowing the lawn, raking, gardening, hiking, jogging, biking, exercise cycling, dancing, aerobics, bowling, golf, singles tennis, double tennis, racquetball, callisthenics and swimming” and then by calculating the Kcals per week expended using standardized algorithm. The lowest quintile of physical activity was identified for each gender, “men with less than 383 Kcals of physical activities per week” and “women with less than 270 Kcals of physical activities per week” categorized as frail for the physical activity criterion.

In SHARE, we used instead the following question “How often do you engage in activities that require a low or moderate level of energy such as gardening, cleaning the car, or doing a walk?” and classified answers “one to three times a month” and “hardly ever, or never” as frailty criterion fulfilled and answers “more than once a week” and “once a week” as frailty criterion not fulfilled.

### 3.4.2 Disability

For disability, depending upon presence of one criterion of the following list the person was considered with disability in basic activities of daily living and/or instrumental activities of daily living. The subject should only include difficulties that have been lasting for more than three months.

*Disability in basic activities of daily living :*

- Dressing, including putting on shoes and socks
- Bathing or showering
- Eating, such as cutting up your food
- Getting in or out of bed
- Using the toilet, including getting up or down

*Disability in instrumental activities of daily living :*

- Using a map to figure out how to get around in an unknown place
- Preparing a hot meal
- Shopping for groceries
- Making telephone calls
- Taking medications
- Doing work around the house or garden
- Managing money, such as paying bills and keeping track of expenses

These questions were all available in the SHARE questionnaire.

In our analysis we only considered disability in basic activities of daily living.

### 3.5 STATISTICAL ANALYSIS

A descriptive statistical analysis was performed with STATA 9 software in order to estimate frailty prevalence with 95 % confidence intervals. The same software was used to compute chi-square tests and conduct multivariate regression analysis (survey special routines taking into account the study sampling design).

Due to the lack of complete information about the sampling design in the SHARE study (stratum and primary sampling unit indicators), variables were missing and only the sampling weights could be taken into account, using so called 'survey' procedures. While estimations were unbiased, variances and their confidence intervals may be underestimated.

The analysis used weighted value for all data except for the class age related values.

We only retained persons with complete information concerning the five frailty criteria, meaning that people with even only one or two data missing were not kept in our analysis.

#### 4. RESULTS

For each criterion used for the construction of the frailty index, the response rate was equal or higher than 90 %, body mass index 98% (18534 / 18853), denutrition 100 % (18853/18853), reduced endurance 99 % (18673 / 18853), poor physical activity 100 % (18851 / 18853), muscle weakness 90 % (17043 / 18853), low mobility 100% (18853 / 18853), and frailty 90 % (17022 / 18853).

For the body mass index, after excluding person with missing data for height or weight (303) and with weight less than 30 kg (16), the response rate was 98 % (18534 / 18853).

##### 4.1 PREVALENCE OF THE FIVE COMPONENTS OF THE FRAILTY INDEX

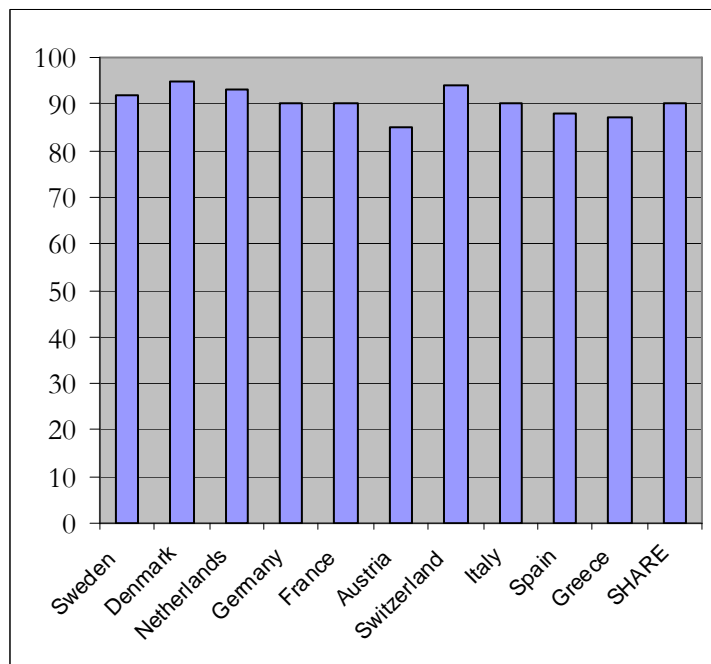
Table 5. Weighted prevalence of the frailty phenotype components in the SHARE study, by gender

	Men (%)	Women (%)	Total (%)
denutrition	6.4	11.5	9.2
reduced endurance	25.3	38.8	32.7
poor physical activity	18.2	22.2	20.4
muscle weakness	13.7	17.1	15.5
low mobility	12.4	19.8	16.4

The prevalence of each component of the frailty index is higher for women in the SHARE study.

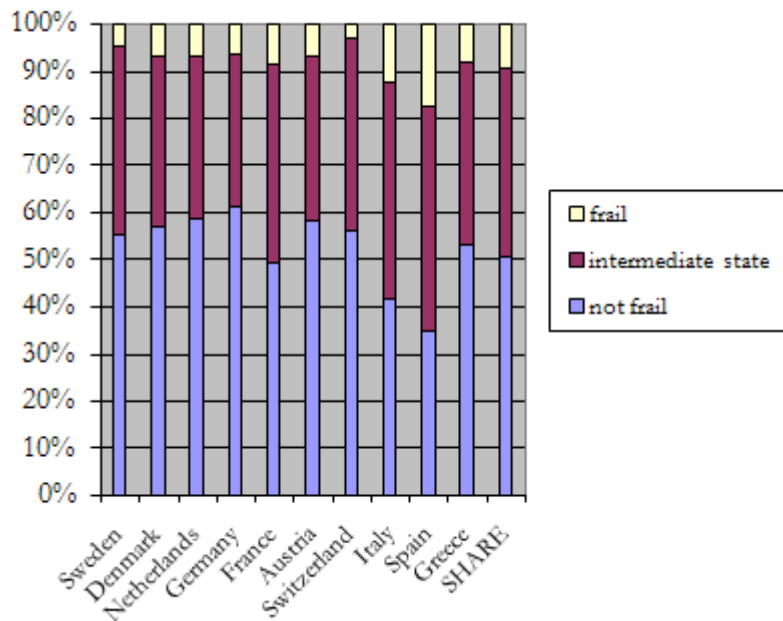
##### 4.2 PREVALENCE OF THE FRAILTY PHENOTYPE

Figure 4. Country response rate of participants for the frailty index (%)



The overall country response rate of participants for the frailty index is 90 % (17022/18853) with values from 85 % (1608/1899) for Austria to 95 % (1498/1574) for Denmark.

Figure 5. Prevalence of frail (3-5 criteria), intermediate (1-2 criteria) and not frail states (0 criterion) in SHARE study participants by country



The overall prevalence of frailty (3-5 criteria) for the SHARE study is 9.7 %, and is about twice higher for women (men 6.6 % and women 12.4 %).

Table 6. Prevalence of frailty (3-5 criteria) with confidence intervals in the countries of SHARE

	Frailty Prevalence	Confidence Intervals (95 %)	
Sweden	4.95%	3.94%	5.97%
Denmark	7.04%	5.69%	8.40%
Netherlands	7.18%	5.95%	8.42%
Germany	7.06%	5.72%	8.40%
France	8.71%	7.24%	10.19%
Austria	7.06%	5.79%	8.34%
Switzerland	3.29%	2.12%	4.46%
Italy	12.72%	10.51%	14.94%
Spain	17.42%	15.38%	19.45%
Greece	8.48%	7.14%	9.82%

The comparison of the prevalence of frailty in the different European countries reveals a higher percentage of frail people in Spain (17.4%) and Italy (12.7%) in comparison to Sweden (5 %) and Switzerland (3.3%).

Figure 6. Prevalence of frailty (3-5 criteria) with confidence intervals for each country of SHARE

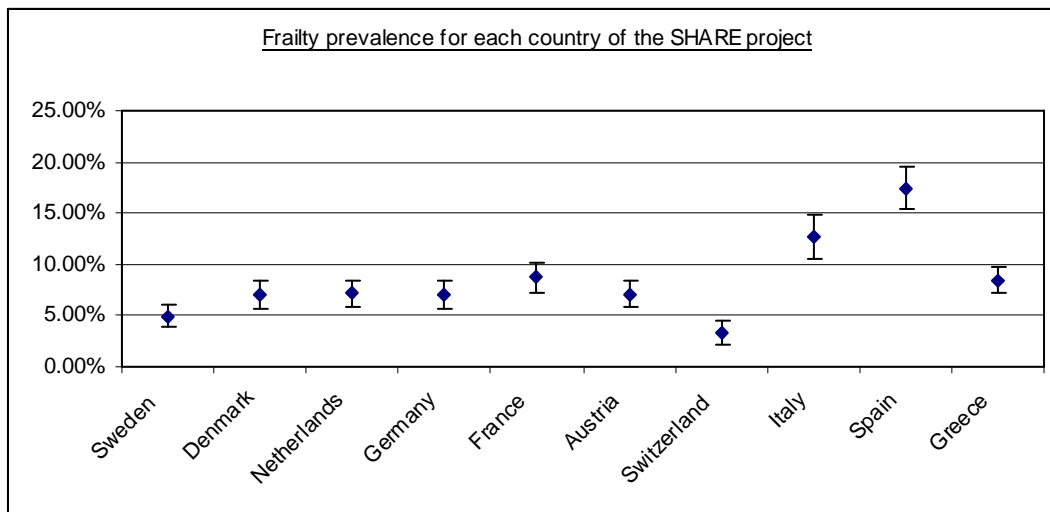
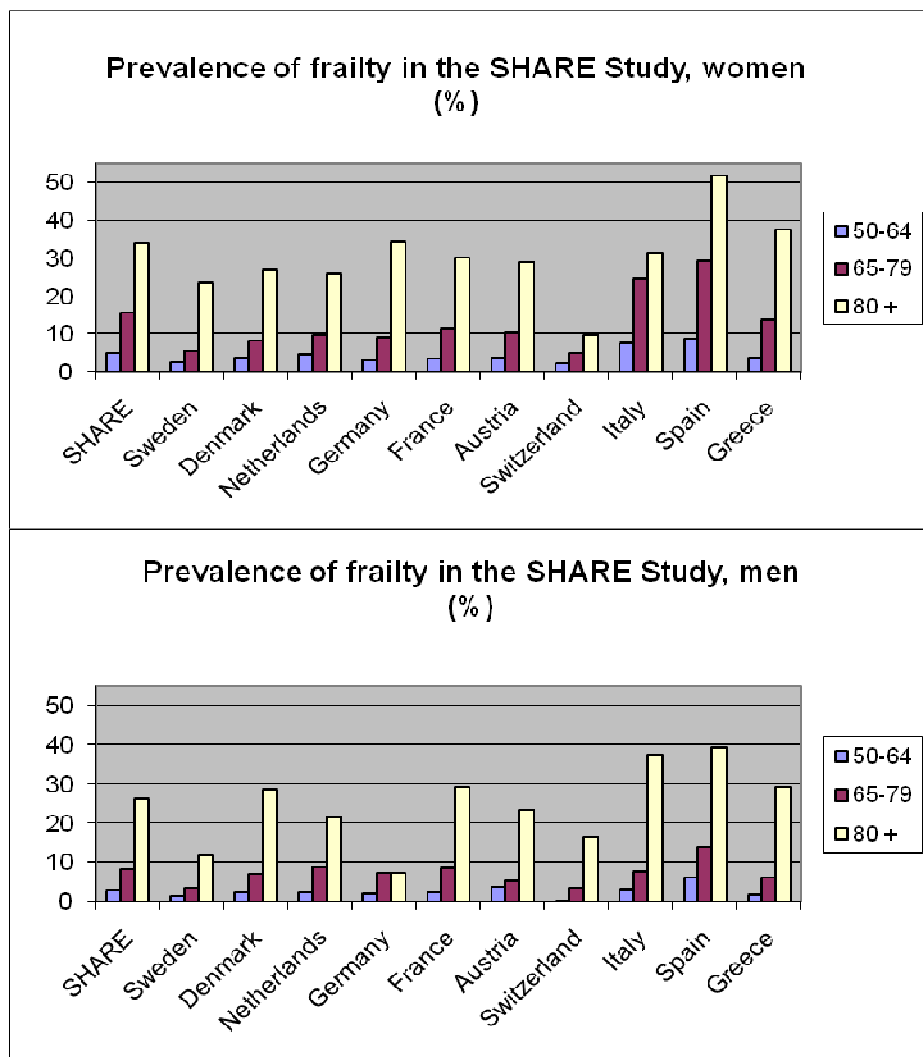


Figure 7. Prevalence of frailty (3-5 criteria) in the SHARE countries by age groups (50-64; 65-79; 80 and older) and gender



As we could expect, the classification by age groups and countries confirms that the prevalence of frailty increases with age for all the countries of this study.

Women are at higher risk of being frail and this is observed for nearly all age groups. This difference regarding the gender has been observed in most of the studies on the frailty phenotype. Fried and al. have an interesting hypothesis that could explain this observation: “female gender could confer intrinsic risk of frailty due to women starting with lower lean mass and strength than age-matched men; thereafter women losing lean body mass with aging might be more likely to cross a threshold necessary for frailty. Women could also have greater vulnerability to frailty via extrinsic effects on sarcopenia” (Fried et al., 2001).

#### 4.3 PREVALENCE OF DISABILITY IN BASIC ACTIVITIES OF DAILY LIVING

The weighted values gave us the prevalence of disability in activities of daily living in order to do an international comparison. As mentioned in the Methods, in our analysis we only considered disability in basic activities of daily living.

Table 7. Prevalence of disability in basic activities of daily living with confidence intervals in the countries of SHARE

	Prevalence	Confidence Intervals (95%)	
Sweden	9.53%	8.21%	10.84%
Denmark	9.00%	7.52%	10.49%
Netherlands	6.85%	5.68%	8.01%
Germany	9.88%	8.44%	11.33%
France	12.33%	10.70%	13.95%
Austria	9.33%	8.00%	10.66%
Switzerland	6.90%	5.26%	8.55%
Italy	11.54%	9.02%	14.06%
Spain	13.08%	11.40%	14.75%
Greece	9.09%	7.78%	10.40%

Figure 8. Prevalence of disability in basic activities of daily living with confidence intervals for each country of SHARE

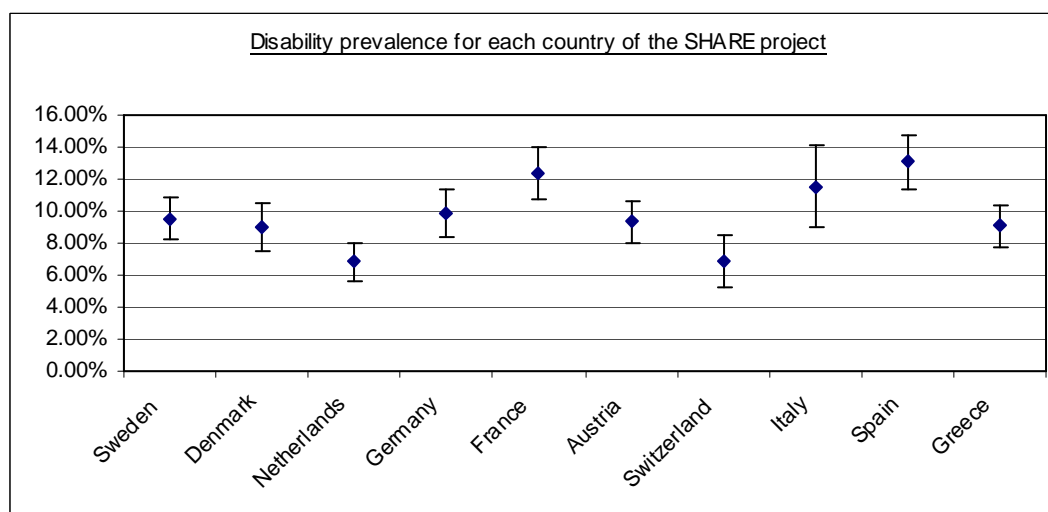
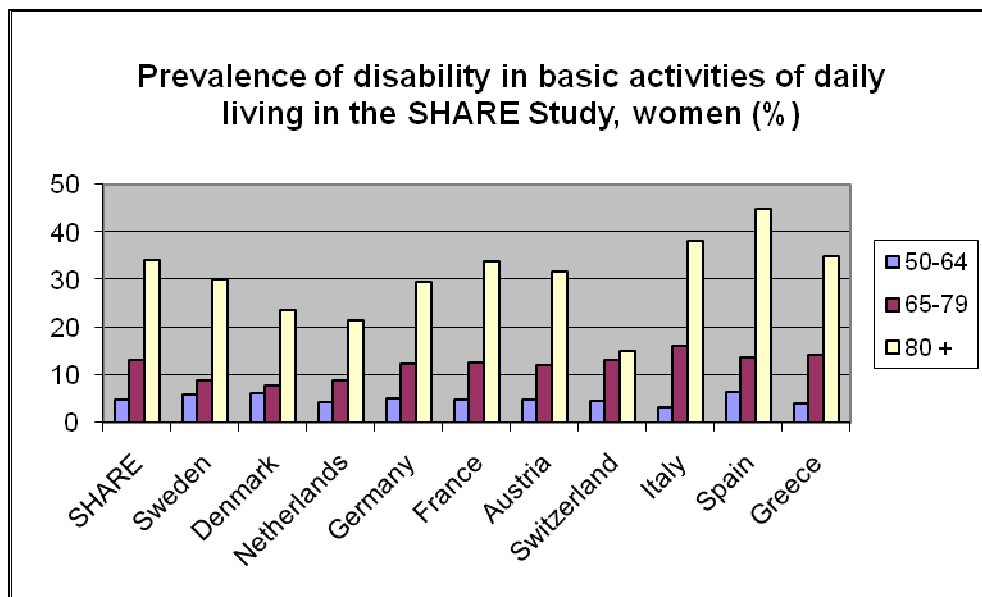
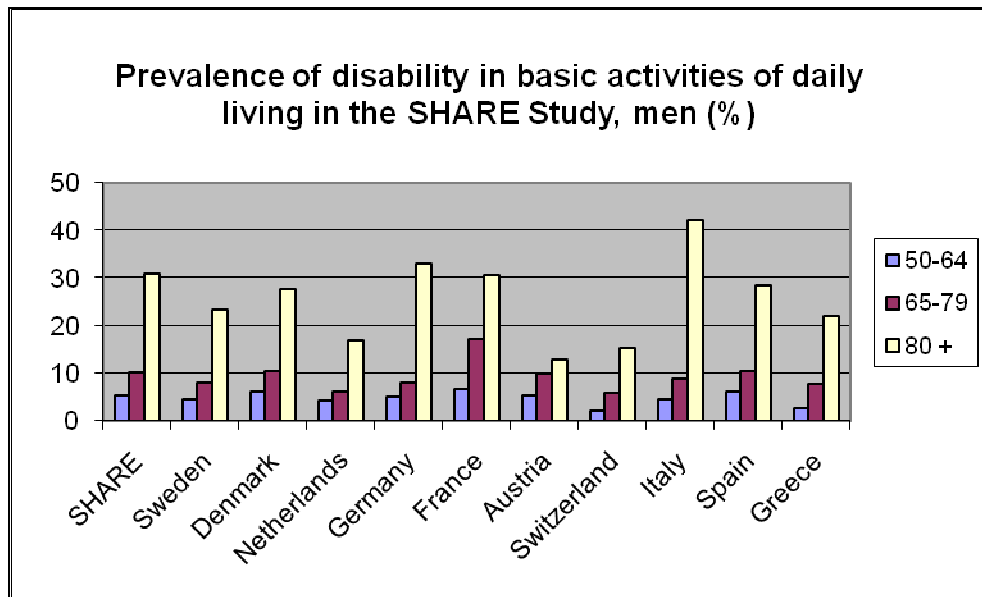
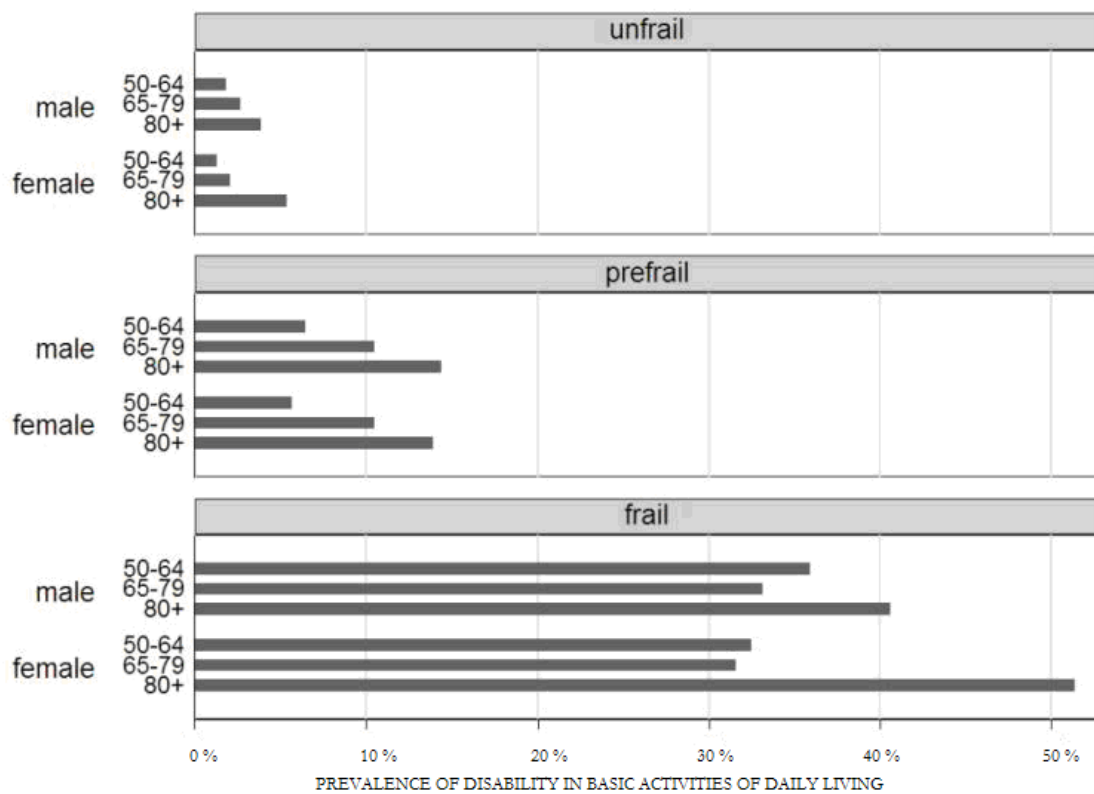


Figure 9. Prevalence of disability in basic activities of daily living in the SHARE countries by age groups (50-64; 65-79; 80 and older) and gender



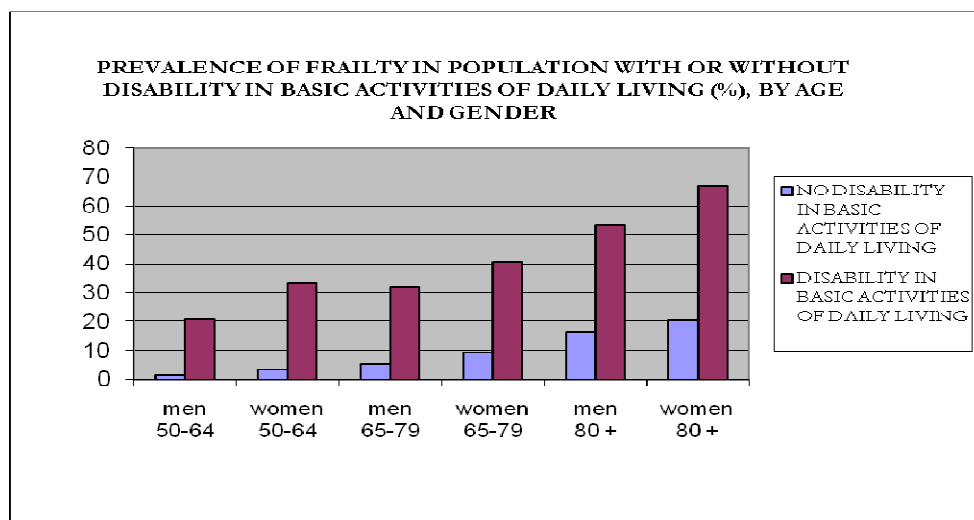
As for the frailty prevalence, the classification by age group and country confirms that the prevalence of disability in basic activities of daily living increases with age for all the countries of this study.

Figure 10. Relationship between not frail (0 criterion), intermediate (1-2 criteria), frail (3-5 criteria) states and the prevalence of disability in activities of daily living classified by age groups and gender



We can notice that the prevalence of disability in basic activities of daily living is higher in the frail population than in the unfrail population. This observation is valid for men and women. More than 30 % of the frail persons and less than 10 % of not frail people have a disability in basic activities of daily living.

Figure 11. Prevalence of frailty (3-5 criteria) in population with or without disability in basic activities of daily living (%), classified by age groups and gender



The prevalence of frailty is higher for people with disability in basic activities of daily living. This observation is valid for both gender and age groups.

## 5. DISCUSSION AND CONCLUSIONS

As mentioned in the chapter 3, the attributes concerning frailty (denutrition, reduced endurance, poor physical activity, muscle weakness, low mobility) were not operationalized in the same manner as the definition of Fried et al. even if they concern the same five dimensions.

Concerning the grip strength, we used the score defined by Fried et al. and the same cut-off, and it would be interesting to do a comparison of the BMI distribution between our population and the Cardiovascular Health Study to confirm that the distribution is similar between both populations. If it's not the case, this criterion could be corrected by stratifying it by gender and BMI quartiles, dividing the participants into 8 groups, and considering low hand grip strength if hand grip strength corresponding to the \_20th percentile for the sex and BMI groups.

Regarding the criteria belonging to the frailty index, it's also important to notice that the cognitive status is one element that is not part of the score as defined by Fried et al. and it would be also interesting to do a comparison using this criterion in order to determine its prevalence in the concerned population and its possible impact on the frailty status.

In order to be certain not to underestimate the overall prevalence of frailty in the elderly population, we should also take into account the prevalence of frailty in the institutionalized populations, this doesn't figure in the data we collected that concern only the community-dwelling European population.

The SHARE overall response rate (61.8%) is low (Table 1) and a response-bias is not excluded. For example we don't know if economical criteria could have also impacted the composition of the sample, as wealthy people could have been less inclined to participate in this study, especially for Switzerland (rate response of 37.6 %) that has the lower participation rate. Switzerland is well known for its low participation rate in previous studies.

We can also consider that the use of self-reported data could result in informational and recall biases, and residual or unmeasured confounding cannot be excluded.

### 5.1 COMPARISON OF THE PREVALENCE OF FRAILITY WITH PREVIOUS STUDIES

Table 8. Prevalence of frailty in various studies

		1) SHARE study		2) CHS Fried			3) EPESE	4) WHIOS
		1a) original cohort	1b) 65 and older		original cohort	minority cohort		
Frailty prevalence (%)								
	total	9.7	16.3	6.9			20	16.3
	men	6.6	11.3		4.9	7.4	17	
	women	12.4	20.3		7.3	14.4	22	16.3

1a) SHARE Study subsample (n= 17022) data wave 1, 2004, men and woman aged 50 and over

1b) SHARE Study subsample (n= 7772) data wave 1, 2004, men and woman aged 65 and over

2) Cardiovascular Health Study (CHS), men and woman aged 65 and over, original cohort 1989-1990 (n= 5201) and minority cohort 1992-1993 (n= 687) (Fried et al., 2001).

3) subsample from the Hispanic Established populations for Epidemiologic Study of the Elderly (EPESE), n = 621, female 369, male 252, Mexican Americans aged 65 and older, wave 1, 2000 (Ottinbacher et al., 2005)

4) Women's health initiative observational study (WHIOS), woman aged 65 to 79 (n= 40657), excluding Parkinson or medication for Parkinson, 1993-1998 (Woods et al., 2005)

This study provides information on prevalence of frailty in Europeans aged 50 and over and allows us to compare it with results from other similar studies (Table 8). First of all, we can notice that the prevalence of frailty in the SHARE study is in the same range as the values of the previous studies (Fried et al., 2001; Ottenbacher et al., 2005; Woods et al., 2005).

In order to compare the frailty prevalence of our European community-based population with the results obtain by Fried et al. in the Cardiovascular Health Study, a cohort of 5317 community-dwelling men and women 65 years or older (Fried et al., 2001), with a prevalence of frailty of 6.9 % (and for the original cohort: men 4.9 % and women 7.3 %), we selected in our sample the men and women aged 65 or older. The weighted prevalence of frailty in the subsample of 65 years or older (n = 7772) of the SHARE study was 11.3 % for men and 20.3 % for women. The higher frailty prevalence obtained in our Study compared to the Cardiovascular Health Study could be connected to different exclusion criteria. In fact, in the SHARE study we did not apply the exclusion criteria concerning people with Parkinson or taking antidepressants medications of the CHS, meaning that these items are certainly related with a more important frailty state.

In The Cardiovascular Health Study, Fried et al. considered all persons with a missing data as non frail for the related criterion. In SHARE we only selected the people with data concerning each of the five criteria. It would be interesting to apply the same method as Fried et al. to our analysis in order to obtain a higher rate response and compare this new value of frailty prevalence with the other studies.

## 5.2 FRAILTY PREVALENCE IN THE EUROPEAN COUNTRIES

This study provides information on prevalence of frailty in Europeans aged 50 and over and allows us to do an international comparison (Table 6).

“There is a clear North–South gradient in health and income: Older persons in the North are better off financially and are in better health, but this does not translate into corresponding mortality differences.” says Professor Axel Börsch-Supan, the coordinator of the Survey of Health, Ageing and Retirement in Europe. We classified the European countries from to South in order to see if we could also observe a North-South gradient for frailty. As we can observe on the Figure 6 the North-South gradient obtained in the SHARE Study for health and income is less obvious concerning frailty.

The chi-square test indicates that the proportion of frail individuals is not uniform across countries ( $p < 0.0001$ ). The Figure 6 shows that this finding is mostly explained by a higher prevalence in Italy (12.7%) and Spain (17.4%). This difference could be due to the fact that less people are institutionalized in Italy and Spain meaning that there would be a population bias. This hypothesis should be verified by a comparison of the percentage of institutionalized population in each European country.

The prevalence of frailty is the lowest in Switzerland (3.3%). This finding could be the result of various biases mentioned earlier such as response-bias (low overall household response rate) or population bias (higher national rate of institutionalization?).

### 5.3 PREVALENCE OF DISABILITY IN BASIC ACTIVITIES OF DAILY LIVING

As mentioned earlier, there is a significant difference of frailty prevalence in the European countries and this observation is also valid for the prevalence of disability in activities of daily living.

The countries differ in their proportion of disabled individuals (chi-square test:  $p= 0.0017$ ), but this result is more difficult to interpretate on the basis of a graphical representation (Figure 8). There is no clear North-South gradient. However, Spain (13.1%) and Italy (11.5%) are here again in the highest ranges, together with France (12.3%).

### 5.4 PREVALENCE OF DISABILITY IN ACTIVITIES OF DAILY LIVING IN THE FRAIL POPULATION

As represented in Figure 1, disability and frailty are two distinct concepts even if there is an overlap. In other terms an important proportion of frail people have no disability in basic activities of daily living (Figure 10) and many people with disability in basic activities of daily living are not considered as frail (Figure 11).

We can also observe that the prevalence of disability in basic activities of daily living is the lowest for the unfrail population and the highest for the frail population (3-5 criteria), regardless of gender.

### 5.5 CONCLUSION

One of the strengths of this study is that it is the first one that has operationalized Fried's frailty definition to a large European community-dwelling sample.

The frailty index as defined by Fried et al. is an inexpensive tool, easy to use in clinical practice that we adapted to the European population. This score will certainly become important in the future, attending to a universal definition of frailty.

Knowing the frailty prevalence in Europe, allow us now to study further the relationship with numerous components (lifestyle, socioeconomic level, cognitive status, poor outcomes) in the European population.

Concerning the natural course of frailty, it has also been demonstrated to be a dynamic process, characterised by frequent transitions between frailty states over time, with a likelihood of transitioning between frailty states highly dependent on one's preceding frailty state (Gill et al., 2006).

With these data we can try to understand the meanings of the difference of prevalence in the European countries of the SHARE study and with the further wave, permitting us to calculate the incidence of frailty and disability, we will then be able to detect the population at risk in order to aim prevention.

## 6. ACKNOWLEDGEMENTS

The Master in Health Economics and Management has proven to be a very challenging but worthwhile effort towards my professional goals and I could not have accomplished this part of this curriculum without the help and support of the following persons.

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## 8. ANNEXES

### 8.1 SPONSOR'S ROLE

The SHARE data collection has been mainly funded by the [European Commission through the 5th framework programme](#) (project QLK6-CT-2001). Additional funding was received from the U.S. [National Institute on Aging](#) (U01AG09740-13S2, P01 AG005842, P01 AG08293, P30 AG12815, Y1-AG- 4553-01 and OGHA 04-064), the Austrian Science Fund, the Belgian Science Policy Office and the Swiss Federal Office of Education and Science.



### 8.3 FRAILTY: THEORETICAL AND RESEARCH LITERATURE DEFINITION

Table 1 Theoretical literature definitions

Author	Theoretical definition	Operational definition
Bales and Ritchie (2002)	Nutritional frailty is 'an acute, dramatic reduction in appetite as well as food consumption' (p. 312)	
Bortz (1993)	Diminished energy flow (interaction) between the individual and their environment	
Bortz (2002)	'A state of muscular weakness and other secondary widely distributed losses in function and structure' (p. M284)	
Brown <i>et al.</i> (1995)	'A diminished ability to carry out the important practical and social activities of daily living' (p. 95)	
Raphael <i>et al.</i> (1995)		
Buchner & Wagner (1992)	'A state of reduced physiological reserve associated with increased susceptibility to disability' (p. 2)	Deficits in the neurological, musculo-skeletal and energy metabolism systems
Fried & Walston (1999)	'A state of age-related physiologic vulnerability resulting from impaired homeostatic reserve and a reduced capacity of the organism to withstand stress' (p. 1389)	Chronic under nutrition Sarcopenia ↓Resting metabolic rate ↓Walking speed ↓Activity ↓Total energy expenditure ↓Strength and power ↓VO <sub>2max</sub>
	Sarcopenia Neuroendocrine dysregulation Immune dysfunction	
Hamerman (1999)	Is a mid-point between independence and pre-death (p. 945)	
Lipsitz (2002)	Loss of adaptive capacity due to a loss of complexity	
Morley <i>et al.</i> (2002)	'A commonly used term indicating older persons at risk for morbidity and mortality' (p. M698)	
Rockwood <i>et al.</i> (1994)	'Those in whom the assets maintaining health and the deficits threatening it are in precarious balance' (p. 492)	

Table 2 Research literature definitions

Author	Theoretical definition	Operational definition
Strawbridge <i>et al.</i> (1998)	'A syndrome involving deficiencies in two or more domains involving physical, nutritive, cognitive and sensory capabilities' (p. 59)	Classified as frail if problems/difficulties were reported in two of the following domains: physical functioning <ul style="list-style-type: none"> <li>• Sudden loss of balance</li> <li>• Weakness in arms</li> <li>• Weakness in legs</li> <li>• Get dizzy or faint when stand up quickly</li> </ul> Nutritive Status <ul style="list-style-type: none"> <li>• Loss of appetite</li> <li>• Unexplained weight loss</li> </ul> Cognitive Functioning <ul style="list-style-type: none"> <li>• Difficulty paying attention</li> <li>• Trouble finding the right words</li> <li>• Difficulty remembering things</li> <li>• Forgetting where put something</li> </ul> Sensory Functioning <ul style="list-style-type: none"> <li>• Vision – difficulty reading a newspaper, recognizing a friend across the street, reading signs at night</li> <li>• Hearing – hearing over the phone, hearing a normal conversation, hearing a conversation in a noisy room.</li> </ul> Scores for physical, nutritive and cognitive were <ol style="list-style-type: none"> <li>1. rarely or never have a problem in the last 12 months</li> <li>2. have a little difficulty</li> <li>3. have some difficulty</li> <li>4. have a great deal of difficulty</li> </ol> Sensory items were scored: <ol style="list-style-type: none"> <li>1. have no difficulty</li> <li>2. have a little difficulty</li> <li>3. have some difficulty</li> <li>4. have great difficulty</li> </ol>

Table 2 Research literature definitions

Author	Theoretical definition	Operational definition
Brown <i>et al.</i> (2000)	Difficulty with functional tasks (p. M350)	Based on Modified Physical Performance Test score: book lift, put on and take off a coat, pick up a penny, chair rise, turn 360°, walk 50-ft, one flight of stairs, four flights of stairs, progressive Romberg test (maximum score 36) (1) 32–36 – not frail (2) 25–32 – mild frailty (3) 17–24 – moderate frailty (4) <17 – excluded
Chin A Paw <i>et al.</i> (1999)	'Physical inactivity combined with either low energy intake, 5-year weight loss, or low BMI' (p. 1015)	Physical inactivity – <210 min/week Low energy intake – <7.6 MJ per day 5 year weight-loss – >4 kg Low BMI – <23.5 kg/m <sup>2</sup>
Dayhoff <i>et al.</i> (1998)	Frailty is diminished functioning combined with diminished self-rated health (p. 19)	Scoring 21 or more on the World Health Organization Assessment of Functional Capacity combined with a self-report of health as fair or poor <ul style="list-style-type: none"> <li>• Walking between rooms</li> <li>• Moving around outdoors</li> <li>• Using stairs</li> <li>• Walking at least 1/4 mi</li> <li>• Using the lavatory</li> <li>• Washing and bathing</li> <li>• Dressing and undressing</li> <li>• Getting in and out of bed</li> <li>• Feeding oneself</li> <li>• Cutting toenails</li> <li>• Doing one's own cooking</li> <li>• Doing light housework</li> <li>• Doing heavy housework</li> <li>• Carrying heavy objects</li> <li>• In comparison with other people your age, how would you judge your state of health?</li> </ul>
Fried <i>et al.</i> (2001)		Prefrail is the presence of 1 or 2 and Frail is the presence of three or more of the following: Shrinking – > 10 lbs lost unintentionally in prior year Weakness – grip strength: lowest 20% (by gender, BMI) Poor endurance and energy – self-reported exhaustion Slowness – walking time/15 feet: slowest 20% (by gender and height) Low physical activity level – kcals/week: lowest 20% (males < 383 kcals/week, females < 270 kcals/week) (Same as above)
Leng <i>et al.</i> (2002) (using the Fried/Walston definition)	'A wasting syndrome of older adults, characterized by weakness, fatigue, weight loss and extreme vulnerability to stressors, that predicts increased morbidity and mortality' (p. 1268)	1. Unintentional weight loss of >10 pounds in the past year 2. Low grip strength by gender and BMI 3. Slow walking speed 4. Subjective exhaustion 5. Low levels of physical activity
Nourhashemi <i>et al.</i> (2001)	'A combination of deficits or conditions that arise with increasing age and contribute to making the elderly person more vulnerable to changes in the surroundings and to stress (p. M228)	Disability with one or more IADLs measured by the Instrumental Activities of Daily Living scale

(Levers *et al.*, 2006)

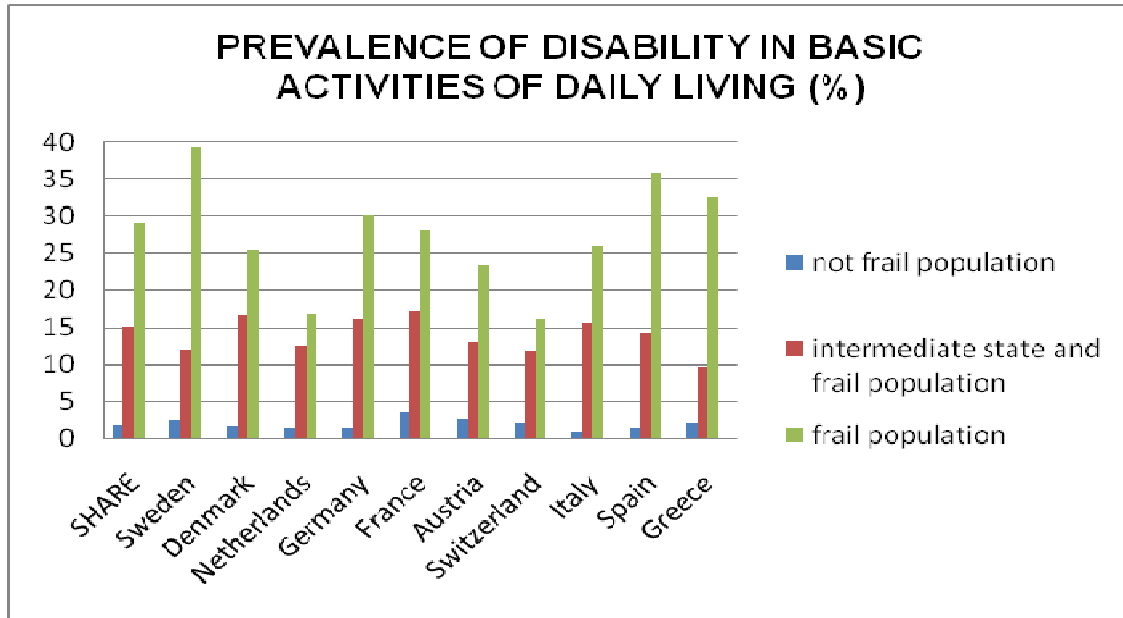
8.4 PREVALENCE OF THE STATES OF FRAILTY AMONG THE EUROPEAN COUNTRIES BY AGE GROUPS AND GENDER; WEIGHTED VALUES (TABLE 9)

	Unfrail (%)	Intermediate state (%)	Frail (%)	Frail and intermediate (%)
<b>Austria</b>	58.09	34.96	6.95	
Male				
50-64	68.42	27.89	3.70	31.58
65-79	60.47	34.15	5.38	39.53
80 +	41.31	35.41	23.28	58.69
Female				
50-64	63.12	33.01	3.86	36.88
65-79	43.96	45.68	10.36	56.04
80 +	23.19	47.83	28.99	76.81
<b>Denmark</b>	56.77	36.29	6.94	
Male				
50-64	64.05	33.61	2.33	35.95
65-79	59.50	33.32	7.18	40.50
80 +	35.35	36.06	28.59	64.65
Female				
50-64	60.35	35.94	3.72	39.65
65-79	54.79	36.89	8.31	45.21
80 +	17.56	55.46	26.99	82.44
<b>France</b>	49.21	42.02	8.76	
Male				
50-64	63.95	33.60	2.46	36.05
65-79	52.07	39.29	8.64	47.93
80 +	27.08	43.75	29.17	72.92
Female				
50-64	49.94	46.41	3.65	50.06
65-79	42.70	45.68	11.62	57.30
80 +	21.11	48.89	30.00	78.89
<b>Germany</b>	60.87	32.44	6.69	
Male				
50-64	70.90	27.21	1.89	29.10
65-79	60.34	32.44	7.22	39.66
80 +	33.92	58.68	7.40	66.08
Female				
50-64	62.72	34.09	3.18	37.28
65-79	58.63	32.32	9.05	41.37
80 +	28.47	37.26	34.27	71.53
<b>Greece</b>	52.95	38.80	8.26	
Male				
50-64	69.36	28.93	1.71	30.64
65-79	51.29	42.58	6.12	48.71
80 +	29.88	41.00	29.12	70.12
Female				
50-64	58.84	37.22	3.94	41.16
65-79	39.30	46.84	13.86	60.70
80 +	12.07	50.52	37.41	87.93
<b>Italy</b>	41.45	45.89	12.66	
Male				
50-64	53.52	43.37	3.10	46.48
65-79	43.09	49.17	7.74	56.91
80 +	1.68	60.85	37.48	98.32
Female				
50-64	46.35	45.87	7.77	53.65
65-79	37.12	38.37	24.51	62.88
80 +	6.68	61.99	31.33	93.32
<b>Netherlands</b>	58.57	34.19	7.23	
Male				
50-64	69.44	28.10	2.47	30.56
65-79	64.77	26.26	8.97	35.23
80 +	33.75	44.66	21.60	66.25
Female				
50-64	61.86	33.53	4.61	38.14
65-79	45.83	44.49	9.69	54.17
80 +	18.92	55.11	25.97	81.08

	Unfrail (%)	Intermediate state (%)	Frail (%)	Frail and intermediate (%)
<b>Spain</b>	34.79	47.75	17.46	
Male				
50-64	55.92	37.97	6.12	44.08
65-79	33.79	52.37	13.84	66.21
80 +	7.47	53.34	39.19	92.53
Female				
50-64	39.34	51.71	8.95	60.66
65-79	18.44	52.46	29.11	81.56
80 +	8.75	39.39	51.87	91.25
<b>Sweden</b>	55.20	39.97	4.83	
Male				
50-64	69.20	29.50	1.30	30.80
65-79	62.95	33.53	3.52	37.05
80 +	30.74	57.56	11.70	69.26
Female				
50-64	54.44	43.07	2.49	45.56
65-79	49.62	44.92	5.46	50.38
80 +	17.93	58.55	23.51	82.07
<b>Switzerland</b>	56.14	40.55	3.30	
Male				
50-64	68.88	30.88	0.25	31.12
65-79	66.30	30.27	3.43	33.70
80 +	30.48	54.86	14.67	68.52
Female				
50-64	56.93	40.75	2.32	43.07
65-79	42.27	52.71	5.02	57.73
80 +	26.98	63.25	9.78	73.02
<b>SHARE</b>	50.33	39.95	9.72	
Male				
50-64	56.11	37.30	6.59	
65-79	63.83	33.36	2.81	36.17
80 +	51.50	40.15	8.35	48.50
Female				
50-64	21.12	52.69	26.19	78.88
65-79	45.28	42.27	12.45	
80 +	53.38	41.60	5.02	46.62
65-79	43.18	41.23	15.59	56.82
80 +	17.90	48.26	33.84	82.10

8.5 PREVALENCE OF DISABILITY IN BASIC ACTIVITIES OF DAILY LIVING IN FRAIL, INTERMEDIATE STATE AND NOT FRAIL EUROPEAN POPULATION (FIGURE 12)

The prevalence of disability in basic activities of daily living increases regarding the state of frailty in all the European countries of the SHARE Study



8.6 PREVALENCE OF DISABILITY IN BASIC ACTIVITIES OF DAILY LIVING IN SHARE PARTICIPANTS WITH NO FRAILTY CRITERION (0 CRITERION) OR AT LEAST ONE FRAILTY CRITERION FULFILLED (1 TO 5 CRITERIA) BY AGE AND GENDER (FIGURE 13)

