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ORIGINAL INVESTIGATION

Future trends in health and marital status: effects on the structure of living arrangements of older Europeans in 2030

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Abstract This article presents the results of projections of older people's living arrangements in 2030 in nine European countries. It analyses expected changes due to future trends in health and marital status. Future changes in the marital status of the older people will result in a higher proportion living in their own homes: women in each age group will more often grow old living with their partner, and this will also apply, to a lesser extent, to men aged 85 and over. Both men and women will be less likely to live alone, with people other than a partner, or in institutions. But for men aged 74–84 the likelihood of choosing one or another type of living arrangement will remain remarkably stable in the future. Further, an improvement in health will lead to older people living alone slightly more often, and they will also more often do so in good health. A comparison of two health scenarios shows that changes in marital status have a major impact on overall trends in living arrangements whereas an improvement in health—which is not certain to occur—will affect them only marginally.

Keywords Ageing · Living arrangements · Projections · Europe

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Introduction

Between now and 2030, the older population will increase sharply throughout Europe. And as we know, the risk of physical and psychological impairment increases with advancing age, often making day-to-day care indispensable. So as the European population ages, we may expect a major increase in care demand. However, this demand closely depends on the type of household in which the older person is living and their marital and family environment more broadly. Disabled people living alone more often receive professional care than those living with a partner or others (Arber et al. 1988; Breuil-Genier 1998; Grundy 2006; Martel and Legaré 2001; Pickard et al. 2000). Partner and family are the primary carers in the event of disability (Chappell 1991; Walker et al. 1993). Changes in the living arrangements of older people therefore have strong policy implications, because they change the balance between formal and informal care[1]. But equally important are their consequences for individual wellbeing. Thus for the disabled older people, day-to-day care provided by a partner makes it possible to postpone or avoid institutionalization (Carrière and Pelletier 1995; Freedman 1996), which is generally regarded as a last resort (Oldman and Quilgars 1999). Generally speaking, couples are in a better economic situation than people living alone and those living in a couple are healthier (Glaser et al. 1997). Finally, living in a couple favours social integration. Many

[1] The reverse is also true: the relative availability of formal and informal sources of care might produce changes in living arrangements. One of the essential limitations of this research is that it does not incorporate behavioural changes or possible changes in care policies for disabled persons. It turned out to be too difficult to incorporate such variables since trends in these factors are too difficult to quantify and predict.

studies have shown that older people living alone more often suffer from social isolation, loneliness and boredom than those living in a couple (Delbès and Gaymu 2003a; De Jong Gierveld et al. 1997).

In recent decades substantial changes have affected the living arrangements of older people in Europe and in most other developed countries: while the proportions of older people living alone or in a couple have risen, the proportion of those living with others[2] outside the nuclear family has decreased (Michael et al. 1980; Murphy and Grundy 1994; Ruggles 2001; United Nations 2005; Van Solinge and Esveldt 1991; Wolf 1995). Although these trends are similar in all countries, clear country group profiles emerge, based on observed levels. The proportions of older people living with persons other than a partner are in general much lower in northern than in southern and eastern Europe, while the opposite has been observed for levels of institutionalization (Pampel 1992; Tomassini et al. 2004). To explain these contrasts between the different European regions, some researchers have taken inspiration from the theory of the "three worlds of welfare capitalism" (Esping-Andersen 1990). For others, the current diversity of living arrangements of older people can be attributed to the survival of ancestral family systems (Reher 1998). More recent research attempts to combine these two approaches (Iacovou 2000; Ogg and Renaut 2005). This results in more complex classifications, in which certain European countries do not fit smoothly into the north-south gradient (Glaser et al. 2004).

Although the various socio-cultural contexts in which the older persons live influence their living arrangements differently, many studies have shown that certain individual characteristics play the same role in all countries. These analyses all show that, for older people everywhere, increasing age, being single, lack of surviving offspring, poor health and low educational level or low income all reduce the likelihood of residential independence. Differences between married, single, widowed and divorced persons are well documented: single persons more often live in institutions, married persons more rarely (Dolinsky and Rosenwaike 1988; Gaymu et al. 2006; Ricci 1991). Having poor health and having no surviving offspring also have a strong effect on living arrangements: they reduce residential independence and favour institutionalization (Angel and Himes 1992; Desesquelles and Brouard 2003; Soldo et al. 1990; Stinner et al. 1990). Lastly, research into the links between socio-economic conditions and living arrangements shows that older people who are better off financially are less likely to cohabit with other kin and more likely to live alone (Hoyert 1991; Pampel 1992; Van Solinge and Esveldt 1991).

Due to cohort and period effects, older people's socio-demographic characteristics will change, thereby affecting their likelihood of living in a couple, alone, with others or in an institution. This article presents the results of demographic projections of the living arrangements of older persons in 2030 in nine European countries and illustrates the wide range of socio-political situations among the major regions (Belgium, France, Germany and the Netherlands for Western Europe; Finland and England and Wales for Northern Europe, Italy and Portugal for Southern Europe; Czech Republic for Eastern Europe). These countries are included in a European Community funded project on Future Elderly Living Conditions in Europe (FELICIE). Some authors have used this type of demographic projection (Comas-Herrera et al. 2006; Duée et al. 2005; Keefe et al. 2005; Pickard et al. 2000) to assess trends in the cost of informal care. Here we view the issue from the older person's standpoint. After a brief analysis of their situation in 2000, we analyse how their living arrangements are likely to change in the future under the impact of changes in their marital status and health, which are among the factors with the strongest impact on living arrangements.

This study focuses on the population aged 75 and over, since the age of 75 is often a watershed in terms of risks of widowhood and disability.

Data and methods

This article presents the results of cohort component projections, mixing a pure cohort component transition model and derived projections. Projections by age, gender and marital status are made using a dynamic multi-state population projection model (Kalogirou and Murphy 2006). Disability and living arrangements are determined through derived projections.

The method employed can be summarized in three steps.

The first step is to prepare projections by age, gender and marital status. These projections are so-called multi-state population projections using a transition matrix, calculated with the LIPRO Model (Van Imhoff and Keilman 1991). The trends observed in each country over the past ten years for mortality, marriage rates and divorce rates, taken from vital records, have been prolonged. In all countries, mortality gains have been greater among married people and divorce rates have increased at these ages. Marriage rates have fallen everywhere except in Finland, France and the Netherlands. Mortality hypotheses have been adjusted to those adopted in the projections established by various national Offices of Statistics at the turn of

[2] Meaning children, other relatives or unrelated persons, except partner.

Table 1 Distribution of older persons by marital status, gender and age in 2000 and 2030 (all FELICIE countries, weighted by country population)

	Males					Females				
	Single	Married	Widowed	Divorced	All	Single	Married	Widowed	Divorced	All
75–84										
2000	6	73	19	2	100	8	29	59	4	100
2030	8	70	12	10	100	7	46	34	13	100
85+										
2000	6	50	43	2	100	9	9	80	2	100
2030	4	63	28	5	100	6	27	59	8	100
75+										
2000	6	68	24	2	100	9	24	64	3	100
2030	7	68	16	9	100	6	40	43	11	100

Kalogirou and Murphy, Eur J Ageing, 2006

the twenty first century. In all cases it is assumed that the life expectancy of women will increase less than that of men. Table 1 summarizes the results of a publication by Kalogirou and Murphy (2006) detailing these hypotheses. It shows that, except for men aged 75–84, the proportion of older persons with a spouse will rise despite the increasing proportion of divorcees.

The second step is to extend these projections by marital status with indicators on health, applying a prevalence ratio model to the marital status projection results. The prevalence ratio method is commonly known as the participation ratio method and also known as the incidence rate method (George et al. 2004; Siegel 2002). The outcome is a projection by age, gender, marital status and health status. Superimposing a health distribution on the projected population by marital status makes strong assumptions on causality between health and mortality. It is clear that health and mortality are interrelated. However, this interrelationship is too complex to be implemented in a macro level two stage projection as applied here. As dealing with this problem creates many technical problems two scenarios were developed (see below) in order to at least perceive what the consequences of health status improvements are, given the mortality assumptions from Kalogirou and Murphy (2006). To assess health status, three different data sources were used: the European Community Household Panel (ECHP), national health surveys, and national statistics on the populations living in institutions. The prevalence of health and disease observed in a specific population depends largely on the health question that is asked. We therefore opted for an international data source—the ECHP—that asks the same questions in all countries. The ECHP question we used was: *Are you hampered in daily activities by any physical or mental health problem, illness or disability? (severely/to some extent/no)*. Those who answer "severely" are assumed to be in need of care. But the ECHP is restricted to private households, and living in institutions is related to health and marital status. On the basis of the ECHP alone the prevalence of disability would be seriously underestimated, and differently so, depending on the country.

Since the sample sizes in the ECHP are generally small, particularly at older ages, it does not give reliable age-specific prevalence of disability for the unmarried population. The analysis was therefore restricted to the married population only and calculates age-specific profiles of disability for the married. Then, using the proportion of married people living in institutions from national statistics, the age-profile was adjusted in order to reflect the prevalence in the total married population. Finally, national health surveys were used to estimate odds ratios of disability for widowed, single and divorced persons compared to married persons, and to apply these odds ratios to the age-specific prevalence of married persons observed in the ECHP.

For the future two scenarios were developed (Table 2):

- In the *Constant Disability Share (C)* scenario the proportions of disabled by age and gender remain constant (= as observed over the time period 1995–1999).
- In the *Healthy Life Gain (H) scenario* it is assumed that the additional years gained in life expectancy will be healthy years. In other words the total number of years lived in disability will remain constant. In this scenario, it is assumed that the proportions of disabled[3] by gender and marital status decrease at the same speed (by about 20%, see Table 2).

The various sub-populations obtained in this way (by age, gender, marital status and health status) are then broken down according to whether or not surviving offspring are

[3] In this article, the terms disabled and in poor health are considered as synonyms.

Table 2 Percentage of people in poor health, by age, gender and marital status in 2000 and 2030, under two health trend scenarios (all FELICIE countries, weighted by country population)

	Males					Females					All
	Single	Married	Widowed	Divorced	All	Single	Married	Widowed	Divorced	All	
75+											
2000	41	28	35	39	30	46	30	42	43	39	36
2030c	40	30	36	39	32	44	33	44	42	39	37
2030h	31	23	28	31	25	37	28	37	36	33	30
75–84											
2000	38	27	31	37	29	40	28	35	39	34	32
2030c	38	28	32	38	30	39	29	35	38	33	32
2030h	30	22	25	29	23	32	24	30	32	27	26
85+											
2000	51	37	42	49	40	59	47	53	59	53	50
2030c	49	37	42	49	39	60	46	52	58	52	47
2030h	39	29	32	38	30	50	39	44	49	43	39

Constant Disability Share (2030C), Healthy Life Gain (2030H)

available. In accordance with other studies (Murphy et al. 2006), the results (not shown here) show that in 2030, a higher proportion of older people will have surviving offspring than is the case today.

The third step is to combine the previous set of projections (by age, gender, marital status and health) with estimations on the relationship between health and living arrangement—living alone, with partner, with other people or in an institution.

Definitions of the four categories of living arrangements

- Living alone: living in a one-person household.
- Living in a couple: living with a spouse or a cohabitee and possibly with others.
- Living with others: combines all other categories of private households (one-parent family or other forms of co-residence).
- Living in a collective household: all persons not living in a private household, mainly in an "institution". This category is not fully comparable across countries. Persons living in sheltered housing units are sometimes included in this category and sometimes counted in the population of private households. This bias could not be eliminated in this study.

The distribution by living arrangement is available only for the base year. This distribution is assumed to remain constant for the entire projection period. By multiplying the estimated data matrix "age by gender by marital status" with the (fixed base year) distribution by age by gender by marital status by living arrangement we get to the living arrangement projection.

Next the living arrangement projection has to be integrated with the previous set of projections by age, gender, marital status and health. The key technique used in this integrated projection is the entropy maximization technique (Willekens 1999). This technique involves using iterative proportional fitting to estimate missing data from available data. The Expectation–Maximization (EM) algorithm is a common method for solving log-likelihood equations when closed-form solutions are not readily available, as is the case when data are incomplete (in the ECHP for example). The basic principle is to specify a probability model, the parameters of which are estimated from the available data, and to apply the model to estimate the missing data (Willekens 1999). The method is applied to both the base year and the out-year projections.

The projection by age, gender, marital status and health status (in two scenarios) and the projection by age, gender, marital status and living arrangement are considered to be fixed. If these projections are combined the relationship between health status and living arrangement (given age, gender and marital status) is unknown. To estimate the full matrix "age by gender by marital status by health status by living arrangement" for the entire projection period with the entropy maximization technique an initial guess of this matrix (and thus the relationship) is needed.

The initial full matrix for the base year is derived from several sources. In Belgium, France, Germany and England and Wales the national sources (Handicap Incapacité, Dépendance survey in France (1999); Individual Samples of Anonymised Records in England and Wales (2001);

Micro census in Germany (1999); census in Belgium (2001)) make it possible to use the distribution of living arrangement by all the other variables. For the remaining countries (Czech Republic, Finland, Italy, Portugal and the Netherlands) the ECHP distribution of living arrangements (living alone or not) by age, gender, marital status (married or not) and health was used. Persons living in institutions were added on the basis of census information concerning their number, age, gender and marital status; their health status is assumed to be similar to that observed in the French data[4].

The final result is a single integrated projection by age, gender, marital status, health status and living arrangement. The marginal totals of the final projection are exactly in line with the projections from steps 1 and 2.

Results

Effects of marital status and health on the structure of living arrangements in 2000

Older people in good health are more likely to be living in a couple than are those in poor health (taking all the FELICIE countries together, weighted by country population, among persons aged 75 and over, these figures are 70 and 60% respectively for men and 29 and 19% for women (Fig. 1)). Among the married, living in a couple is scarcely at all linked to health status: they almost always live with their partner[5] (97% for those in good health against 93% for those in poor health). The same remark applies to unmarried people but, regardless of health, they almost never have this living arrangement (except divorced men). On the other hand, good health favours residential independence among people not living in a couple. Widowed and divorced persons—whose living arrangements are very similar for a given health status—generally live alone (about 80%) if they are in good health. If they are in poor health, the proportion living at home is virtually halved, in favour of living with others or living in an institution (each of these situations accounting for about 25% of individuals). Lastly, never married people are always distinguished by a higher propensity to live in institutions and this living arrangement becomes preponderant (40%) for single people in poor health.

The greater residential independence of married and/or healthy people is observed in all countries, and the Europe-wide uniformity of living arrangements of the married population with no health problems is striking. But while poor health and/or unmarried status limit residential independence throughout Europe, there is more geographical variation on this point and living arrangements vary widely from country to country. It is mainly the relative frequency of intergenerational co-residence versus institutionalization that creates a distinction between countries. An explicit example is that of disabled unmarried women aged 75 and over (Fig. 2). It appears that in some countries their situation is determined more by family solidarity than social solidarity, while in others it is the reverse. Co-residence is favoured in Portugal (56%), the Czech Republic (42%) and Italy (44%), whereas institutionalization is favoured in the Netherlands (41%), Belgium (40%) and, to a lesser extent, in Germany (32%) and France (28%). In England and Wales and in Finland, unmarried dependent persons opt for both types of living arrangement with equal frequency (about 25% in each case), while half of them are (still) living alone.

Effects of trends in marital status on the future structure of living arrangement

These results, which are in perfect agreement with many other studies, combined with the expected growth in the proportion of married older people (Kalogirou and Murphy 2006) and the likely improvement in health, suggest that older people in the future will more often enjoy residential independence. The projections made under the FELICIE project distinguish between the effects of trends in marital status and those of health status on the structure of living arrangements for future cohorts of older adults. From the scenario in which the health status at a given age does not change, we can learn that it is only changes in marital status that determine the future living arrangements. In this regard, the basic trends expected over the coming decades are a decline in widowhood and, as a result of the generation effect, a higher proportion of divorced people and a constant proportion of single people. Except in the case of men in certain countries such as Finland, Germany and the Netherlands where the proportion of being single will (almost) double, while nevertheless remaining below 12%. But the extent of these changes varies by gender and by age (Table 1).

For women, widowhood will decline sharply because of the drop in male mortality and the reduction in mortality differential between the sexes. This mortality trend is more than compensating for the increase in divorce. Consequently, throughout Europe, in the future, women will more often grow old in the company of a partner. Today, between 21% (Czech Republic) and 37% (Italy) of women

[4] The prevalence of disability in institutions certainly differs between countries. However it was not possible to integrate these differences due to lack of data.

[5] Even if in certain countries (Belgium, France, Netherlands), at oldest-old ages, a non-negligible proportion of married people live in institutions.

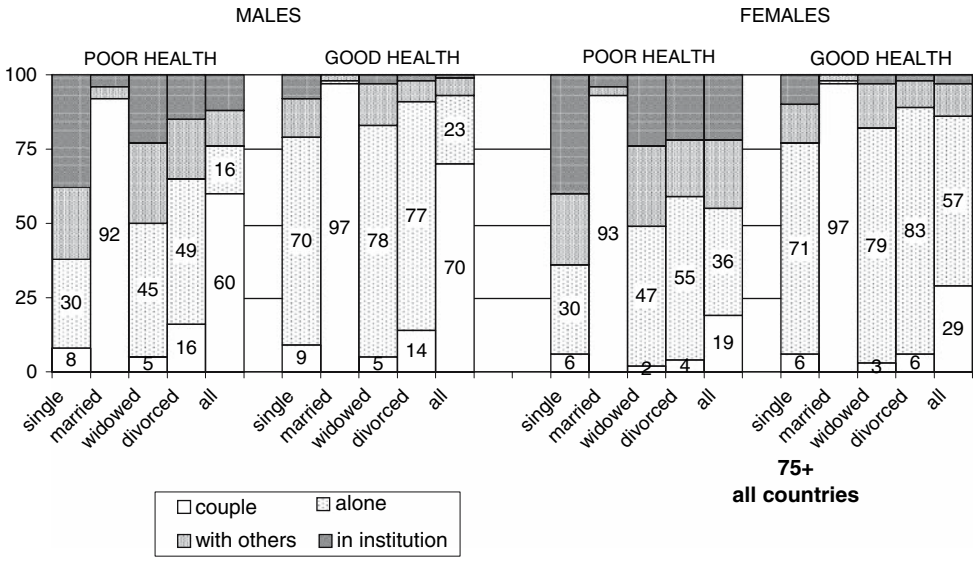

Fig. 1 Structure of living arrangements of older persons aged 75 and over in 2000, by health status and marital status (all FELICIE countries, weighted by country population)

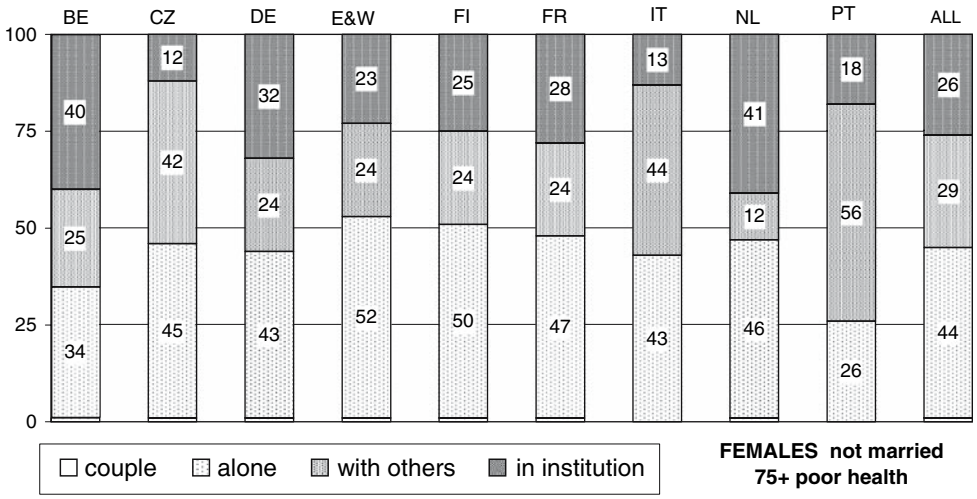

Fig. 2 Structure of living arrangements of unmarried women aged 75 and over, in poor health in 2000, in the separate FELICIE countries

aged 75–84 live in a couple. In thirty years' time this current maximum will be the minimum (in the Czech Republic, Finland and Portugal) whereas 58% of Italian women will be living their old age in a couple[6] (Table 3). The trend is even stronger for women aged 85 and over: the proportions of those living in a couple will triple almost everywhere. In 2030, women in this age group will more often be living in a couple than women aged 75 and over today.

While men of 85 and over like their female counterparts, will less often be widowed and hence more often be living in a couple (60% in 2030 compared to 48% in 2000, on average), this will not be the case for men aged 75–84. In this age bracket, few men are widowed (19% on average) and the decline in the risk of widowhood (to only 12% in 2030) will scarcely or not at all compensate for the rise in the proportion of divorced men (increasing from 2 to 10% between now and 2030). These trends concur with those observed in recent decades for the youngest old (Delbès and Gaymu 2003b). The proportion of men aged 75–84 living in a couple will fall everywhere in the next 30 years except in England and Wales and in Italy, where it will remain unchanged.

The composition of the unmarried population will undergo profound changes in the future. Today, for example, 4% of unmarried women aged 75 and over are divorced and 84% are widows (for men, these figures are 6 and 75% respectively); these proportions will reach 18 and 72% for women in 2030 (22 and 50% for men). But as widows and divorced people have very similar living arrangements this redistribution has almost no effect on the

[6] These proportions should be viewed as minimums, since the projections do not take account of the likely increase in the number of widows, divorcees or single persons living with a partner. These trends are difficult to quantify, notably due to the lack of data on dissolution of these non-marital unions at these ages.

Table 3 Structure of older people's living arrangements in 2000 and 2030, by age and gender, in the separate FELICIE countries

	Year	Males					Female				
		Couple	Alone	With others	In institution	All	Couple	Alone	With others	In institution	All
75–84											
All countries	2000	72	18	7	3	100	31	49	14	6	100
	2030	70	20	7	3	100	47	38	11	4	100
Belgium	2000	70	19	8	4	100	30	48	14	8	100
	2030	67	22	8	4	100	43	39	11	7	100
Czech Republic	2000	71	20	8	2	100	21	52	24	3	100
	2030	68	22	8	2	100	39	39	19	3	100
England and Wales	2000	66	24	7	3	100	31	51	13	5	100
	2030	65	25	7	3	100	46	40	10	4	100
Finland	2000	67	23	6	4	100	24	57	13	6	100
	2030	62	27	7	5	100	39	46	10	5	100
France	2000	74	18	5	4	100	32	50	12	6	100
	2030	71	20	6	4	100	44	41	10	5	100
Germany	2000	72	17	7	4	100	27	50	14	9	100
	2030	68	20	8	5	100	47	36	11	6	100
Italy	2000	77	16	5	1	100	37	47	14	2	100
	2030	77	16	5	1	100	58	32	9	1	100
Portugal	2000	69	12	16	3	100	32	32	31	5	100
	2030	67	13	17	3	100	36	30	30	4	100
The Netherlands	2000	71	21	3	4	100	30	56	6	8	100
	2030	69	23	3	5	100	43	45	5	7	100
85+											
All countries	2000	48	30	11	11	100	10	49	20	21	100
	2030	60	22	9	9	100	27	40	17	16	100
Belgium	2000	42	32	12	14	100	8	49	18	25	100
	2030	56	24	10	11	100	24	40	15	21	100
Czech Republic	2000	50	28	16	6	100	6	50	33	11	100
	2030	55	25	15	5	100	17	44	30	9	100
England and Wales	2000	43	35	11	12	100	9	54	16	21	100
	2030	51	29	9	11	100	25	44	14	17	100
Finland	2000	41	34	11	13	100	6	54	17	23	100
	2030	54	25	9	12	100	21	46	14	19	100
France	2000	50	27	9	14	100	9	50	18	23	100
	2030	62	20	7	11	100	23	42	15	20	100
Germany	2000	41	33	12	15	100	6	47	18	29	100
	2030	57	22	9	12	100	25	38	15	22	100
Italy	2000	61	25	10	5	100	20	47	23	10	100
	2030	71	19	7	4	100	36	39	18	7	100
Portugal	2000	44	18	28	10	100	11	28	47	14	100
	2030	49	16	26	9	100	12	28	47	13	100
The Netherlands	2000	43	33	5	19	100	7	56	7	30	100
	2030	55	25	4	16	100	22	47	7	24	100
75+											
All countries	2000	67	21	8	5	100	25	49	16	10	100
	2030	67	21	7	5	100	40	38	13	8	100
Belgium	2000	64	22	8	6	100	24	48	15	13	100
	2030	64	22	8	6	100	38	39	12	11	100

Table 3 continued

	Year	Males					Female				
		Couple	Alone	With others	In institution	All	Couple	Alone	With others	In institution	All
Czech Republic	2000	67	21	9	3	100	18	51	26	5	100
	2030	66	22	9	3	100	34	40	22	4	100
England and Wales	2000	61	26	8	5	100	25	52	14	9	100
	2030	61	26	7	5	100	39	42	11	8	100
Finland	2000	62	25	7	6	100	19	56	14	11	100
	2030	60	26	7	7	100	34	46	12	9	100
France	2000	68	20	6	6	100	25	50	14	11	100
	2030	69	20	6	6	100	38	41	12	9	100
Germany	2000	66	20	8	6	100	21	49	16	14	100
	2030	65	20	8	7	100	40	36	12	12	100
Italy	2000	74	18	6	2	100	32	47	16	4	100
	2030	75	17	6	2	100	49	34	13	4	100
Portugal	2000	64	13	18	5	100	27	31	35	8	100
	2030	63	14	19	5	100	28	30	36	7	100
The Netherlands	2000	66	23	3	8	100	24	56	7	14	100
	2030	66	23	4	7	100	38	45	6	12	100

trend for the total population in the proportions of persons living alone, with other people or in institutions. These groups will all shrink to a comparable degree, because of the lower risk of being unmarried. In 2000, taking all the countries together, nearly half of all women aged 75 and over lived alone, but in 30 years time only 38% will do so (Table 3). A lower percentage of them will be living with other people or in institutions (13 and 8% respectively compared to 16 and 10% in 2000). The same trends can be seen for men aged 85 and over; but the structure of living arrangements for men aged 75–84 will remain remarkably stable.

These trends can be seen among persons in good and poor health alike, and in all countries (Fig. 3). Everywhere, disabled persons, especially women and the oldest age groups, will more likely have the benefit of living in a couple. In 2000, 25% of disabled women aged 75–84 and 9% of disabled women aged 85 and over live in a couple. In 2030, these proportions will reach 40 and 23% respectively—higher than the proportions for women in good health today (34 and 12% respectively, on average). The same observation is valid, to a lesser extent, for men aged 85 and over: in 2000, 52% of those in good health live in a couple (43% of those in poor health); in 2030 an equivalent proportion (54%) will be found for the disabled male group.

The structure of living arrangements for older Europeans will thus change considerably in the future, owing to changes in marital status. The hypotheses on which these evaluations of future marital structures are based have been shown to be robust. They are shown to depend primarily on the current proportion of married persons and changes in mortality, with trends in marriage and divorce rates and migration playing only marginal roles. Different mortality hypotheses have been tested successively but they produce only minor variations in the estimations of future marital structures (Kalogirou and Murphy 2006).

Effects of trends in health status on future living arrangement structures

While the future of marital status and its consequences for the future structure of living arrangements is to a large extent predictable, trends in health status remain uncertain, as no clear trend emerges from the past. However, in overviewing health trends in low-mortality countries over a 25-year period, Robine et al. (2003) support the dynamic equilibrium scenario. The authors conclude that "disability-free life expectancy has evolved very differently depending on the severity level of disability: a decrease for the most severe levels of disability (institutionalisation and/or bed confinement) and an increase for the less severe levels of disability (no ADL dependency)". The conclusion from past studies is that "at worst the increase in life expectancy is accompanied by a pandemic of light and moderate but not severe disability". Although suggesting that loss of health scenarios should

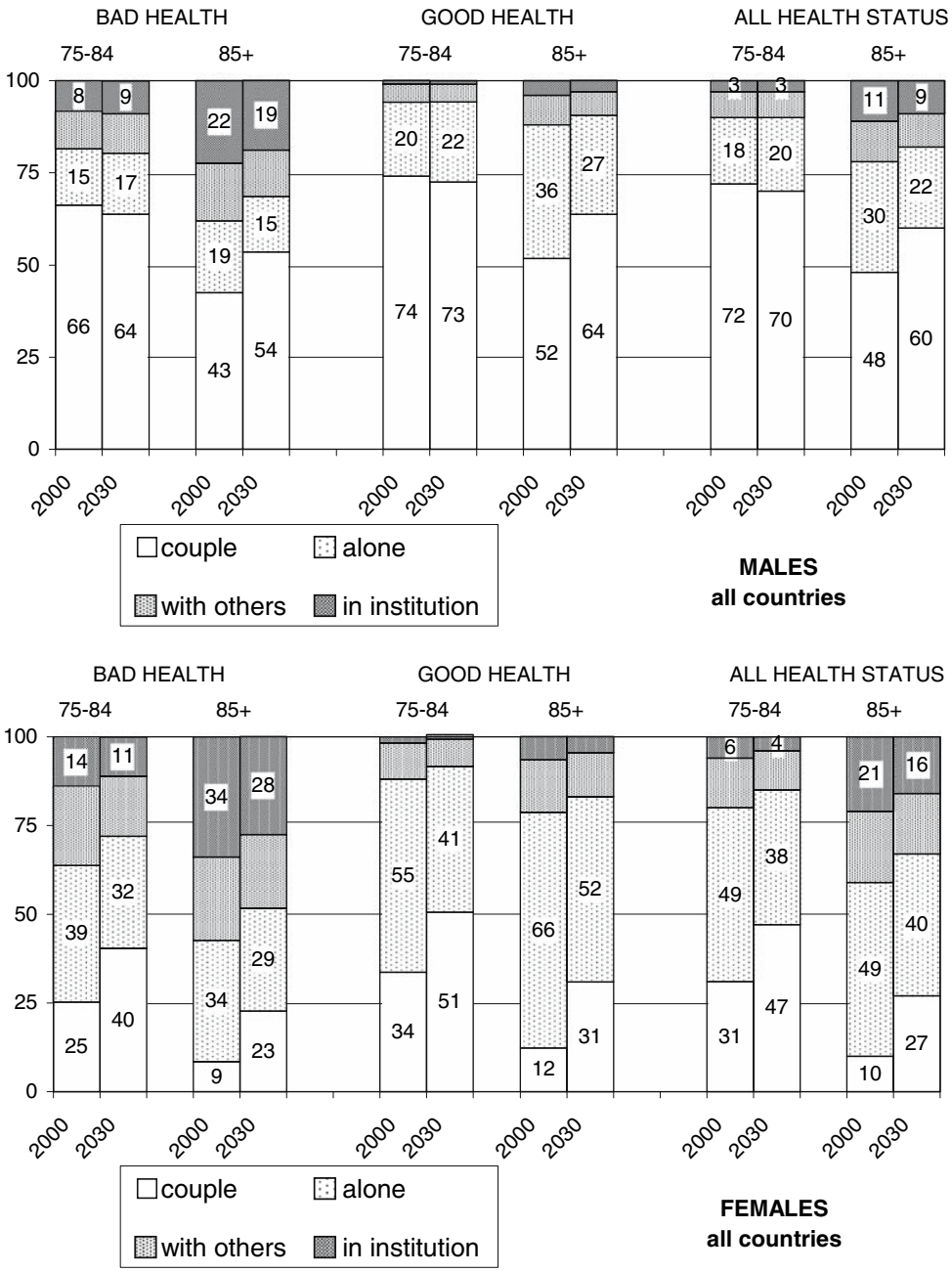

Fig. 3 Structure of older people's living arrangements in 2000 and 2030, by age and health status (all FELICIE countries, weighted by country population)

also be examined, even Parker et al. (2005) conclude: "whether these findings are indicative of a new trend, and emergence of a frail population or a minor fluctuation in an otherwise positive development of compression remains to be seen in future studies". Furthermore, some changes in the structure of the older population (higher level of education, lower paid workload) or behavioural changes (for example, attitudes to prevention) suggest that the older people of tomorrow will enjoy a better health status than those of today. Pursuing this logic, we have drawn up an "improvement in health status" scenario in which we assume that all additional years of life expectancy will be years spent in good health and a loss of health scenario has not been considered[7].

Over the next 30 years, we can expect an increase in the proportion of people living in couples but, as we have seen, health status has no impact on this living arrangement: whatever their state of health, the married older people almost always live in a couple and the unmarried ones almost never do. So an improvement in health will not

[7] Under a loss of health scenario the demand for formal care would be much higher and the impact would be reversed with respect to that of the constant disability towards healthy life gain scenario.

Table 4 Structure of older people's living arrangements by age, gender and health status in 2000 and 2030, under two health trend scenarios (all FELICIE countries, weighted by country population)

	In a couple			Alone			Not alone			All					
	(%)			(%)			(%)			(%)			Absolute numbers (in th)		
	2000	2030 C	2030 H	2000	2030 C	2030 H	2000	2030 C	2030 H	2000	2030 C	2030 H	2000	2030 C	2030 H
Males aged 75–84															
Good health	53	51	55	14	15	17	4	4	5	71	70	77	4307	7851	8581
Poor health	19	19	15	5	5	4	5	6	4	29	30	23	1703	3371	2641
All	72	70	70	19	20	21	9	10	9	100	100	100	6010	11222	11222
Males aged 85+															
Good health	31	39	44	22	16	19	7	6	7	60	61	70	933	2521	2869
Poor health	17	21	16	8	6	5	15	12	9	40	39	30	628	1610	1262
All	48	60	60	30	22	24	22	18	16	100	100	100	1561	4131	4131
Males aged 75+															
Good health	49	48	52	16	16	18	5	5	5	70	69	75	5240	10372	11450
Poor health	18	20	15	5	5	4	7	7	6	30	32	25	2331	4981	3903
All	67	67	67	21	21	22	12	12	11	100	100	100	7571	15353	15353
Females aged 75–84															
Good health	22	34	36	36	27	30	8	6	7	66	67	73	6832	10098	10875
Poor health	9	13	11	13	11	8	12	9	8	34	33	27	3458	5002	4225
All	31	47	47	49	38	38	20	15	15	100	100	100	10290	15100	15100
Females aged 85+															
Good health	6	15	17	31	25	30	10	8	10	47	48	57	1956	3580	4181
Poor health	4	12	10	18	15	12	31	25	21	53	52	43	2250	3809	3208
All	10	27	27	49	40	42	41	33	31	100	100	100	4206	7389	7389
Females aged 75+															
Good health	18	28	30	34	26	29	9	7	8	61	61	67	8788	13678	15056
Poor health	7	13	11	15	12	10	17	14	12	39	39	33	5709	8811	7433
All	25	41	41	49	38	39	26	21	20	100	100	100	14497	22489	22489

Constant Disability Share (2030C), Healthy Life Gain (2030H)

affect the future proportion of older people living in a couple (Table 4). And the result would be similar under the hypothesis of much faster progress will be made in health. On the other hand, as a natural consequence of an improvement in health, a higher proportion of people will both have good health and be living in a couple. The main beneficiaries of this trend are those aged 85 and over: in 2000, 31% of men in this age group were both in good health and living in a couple. By 2030 this figure will reach 39% solely due to changes in marital structures, and 44% if health status improves as well.

Further, although an improvement in health has no impact on the proportion of older persons living in a couple, there is a slight redistribution among those not living in a couple: they are slightly more likely to live alone (proportions increase by one or two percentage points) and a little less likely to live with other people or in an institution. Furthermore, of the increased proportion of people living independently, fewer will be in poor health. Thus today, for example, 18% of women aged 85 and over live alone and are in poor health. But taking into account a lower rate of widowhood, they will represent no more than 15% in 2030 and only 12% assuming health improvement. In this case, the effect of the improvement in health is as strong as that of changes in marital status. This similarity of effect applies to other population groups in poor health: women aged 75–84 living alone and men aged 85 and over living "not alone" (i.e. with others or in an institution). An improvement in health will further reduce the proportion of these particularly vulnerable sub-populations.

Comparing these two scenarios shows the strong influence of marital status on overall trends in living arrangement structure. By comparison, an improvement in health status, which in fact is not certain to occur, plays only a marginal role. But it has more impact, indeed as much impact as marital structures, on reducing the size of some population categories in poor health. Further, the

effect of an improvement in health will be crucial for trends in total numbers: if health status remains unchanged, the population aged 75 and over in poor health will increase by 71% between now and 2030 (and by nearly 90% for those aged 85 and over); but this growth rate is only 41% (55%) under the "improvement in health" scenario considered here. The difference made by improvement versus stability in health is most important for certain population groups, for example those living in institutions. If health does not improve, demand for institutional care will increase by 70–80% in the Czech Republic, Finland and the Netherlands, by 40–50% in Belgium, France and Italy and by 35–40% in Germany, the United Kingdom and Portugal. Improvement in health would divide the above growth rates in the institutionalised populations by 2 or 2.5 in all countries under research (Gaymu et al. 2007).

Discussion

Future changes in marital status among older people will enable a larger proportion of those among them who are disabled enjoy residential independence: a higher proportion of women in all age groups will grow old living in a couple, and to a lesser extent this will also be true for men aged 85 and over. Both men and women will be less likely to live with other persons or in an institution. On the other hand, for men aged 75–84, the probability of opting for a specific living arrangement will remain remarkably stable. So these trends will result everywhere in men and women having rather more similar situations in their old age. Further, an improvement in health status will lead to a slightly higher proportion of older persons living alone, and those enjoying such residential independence will more often be in good health.

The down-side of the decline in widowhood will be that increasing proportions of older persons will have to cope with their partner's disability, even with the improvement in health status envisaged here. At these advanced ages, there is a high risk that the care-giving partners will themselves have disability problems[8] and many studies have shown that the carer role is itself damaging to health. In particular, the work-load and stress involved increase the risk of psychological disorders, particularly depression (Schulz et al. 1995). And whichever scenario we take for health trends, the proportion of men having to cope with a dependent partner will increase sharply in the future, whereas for women this proportion may remain stable. In 2000, 17% of women compared to only 4% of men had a partner aged 85 or over in poor health. As couples survive longer, these percentages will be 21 and 12% in 2030 or, if health status improves, 16 and 10%. Today, men find it more difficult to cope with their partner's dependency than women do: they more often rely on professional carers (Martel and Legaré 2001) and more often put their partners in an institution (Delbès et al. 2006). The decreased risk for women of living alone will therefore only be combined with better care when their health fails if the men of tomorrow provide this better care. This probably means a fundamental change in men's attitudes and behaviour. The same applies to all tomorrow's potential carers. In 2030, a higher proportion of older persons than today will have surviving offspring (Murphy et al. 2006), but we cannot tell to what extent these children will be available to provide care. Today, throughout Europe, families and essentially female relatives provide most of the solidarity for the frailest older people (Mestheneos and Triantafillou 2005). Those of tomorrow, having found their identity in areas of life other than their family roles, mainly in their working careers, may be less willing to accept the constraints imposed by the health problems of their partners, parents or parents-in-law. One of the limitations of this research is that it does not attempt to take account of behavioural changes (in the nature of parents' and children's obligations, different generations' desires for residential independence, social norms etc.) or possible changes in policies regarding care of the disabled, whereas trends in these factors could transform the structure of living arrangements for older people not living in a couple far more radically than the changes described here.

The same applies to the economic situation of the older adults, which is another fundamental determinant of their living arrangements. In recent decades, throughout Europe, older persons have turned away from intergenerational co-residence in favour of staying on in their own home, and improvements in their economic situation have greatly contributed to this change (Michael et al. 1980; Mickus et al. 1997; McGarry and Schoeni 2000). Future trends in older people's purchasing power will therefore be an important factor in any continuation of this trend. And everywhere in Europe there is uncertainty as to the future financing of old-age pensions and the financial capacity of tomorrow's older people to call in professional carers for day-to-day support. Furthermore, although many countries in recent years have introduced specific policies to provide support in this area, might not this collective solidarity gradually decline in the face of ever increasing expenditure on social protection? Future policy orientations may also affect other areas that have not been included in this study, such as

[8] In Belgium, according to the census data, it can be estimated at 50%.

residential accommodation, house prices, and migration. Each of these could influence the price of formal care and could completely change the quality of life for older people still living at home.

Although the changes in the socio-demographic characteristics of the older population analysed here will not substantially alter the contrasts in older people's living arrangements in Europe, some other contextual factors might have a much greater impact. Today, older people's living arrangements differ radically between southern and northern Europe; co-residence of generations and family care are favoured in the south, while collective care and institutionalization are favoured in the north. However, family behaviour patterns and government policy (particularly policies on the funding of care for the dependent) are inseparable and interdependent. For example, is the continued preponderance of intergenerational co-residence in southern Europe not partly due to the fact that there are no alternatives? And will the trend towards reducing institutional care—as is now the case in some countries like the Netherlands (Jacobzone et al. 2000)—not in the long run shape new forms of family solidarity? The extent to which families will be involved in future informal care and next to that the (changing) economic resources of older persons and possibly changing future policy orientations within each country, will play important roles in directing the trends towards greater uniformity in living arrangements for the older Europeans of tomorrow. In all countries, these trends will have a major impact on the balance between formal and informal care. Today, even in countries with an extensive formal care structure, the majority of care is provided by family members. Nevertheless informal care cannot provide all the answers and in anticipation of foreseeable changes in older people's living arrangements the expansion of formal support for family carers has also to be considered in the future.

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References

Angel RJ, Himes CL (1992) Minority group status, health transitions, and community living arrangements among the elderly. Res Aging 14:496–521

Arber S, Gilber GN, Evandrou M (1988) Gender, household composition and receipt of domiciliary services by elderly disabled people. J Soc Policy 17:153–175

Breuil-Genier P (1998) La dépendance des personnes âgées: recours aux proches et aux aides professionnelles in France (Disabled people in France: formal and informal care): Portrait Social, INSEE 91–107

Carrière Y, Pelletier L (1995) Factors underlying the institutionalization of elderly persons in Canada. J Gerontol Soc Sci 50B(3):164–172

Chappell NL (1991) Living arrangements and sources of care giving. J Gerontol 46:S1–S8

Comas-Herrera A, Wittenberg R, Costa-Font J, Gori C, Di Maio A, Patxot C, Pickard L, Pozzi A, Rothgang H (2006) Future long-term care expenditure in Germany, Spain, Italy and the United Kingdom. Ageing Soc 26:285–302

De Jong Gierveld J, Van Tilburg T, Lecchini L (1997) Socio-economic resources, household composition and social network as determinants of well-being among Dutch and Tuscan older adults. Genus III(3–4):75–100

Delbès C, Gaymu J (2003a) La retraite, 15 ans après (Fifteen years after the retirement), Les Cahiers de l'INED, n 154, p 223

Delbès C, Gaymu J (2003b) More unions surviving after 60? Population and societies, 389, p 4

Delbès C, Gaymu J, Springer S (2006) Women grow old alone but men grow old with a partner. A European overview. Population and societies, 419, p 4

Desesquelles A, Brouard N (2003) The family networks of people aged 60 and over living at home or in an institution. Population 58(2):181–206

Dolinsky AL, Rosenwaike I (1988) The role of demographic factors in the institutionalization of the elderly. Res Aging 10(2):235–257

Duée M, Rebillard C, Pennec S (2005) Les personnes dépendantes en France : évolution et prise en charge (Disabled people in France: changes and caring), XXV International Population Conference, IUSSP, Tours July 18–23

Esping-Andersen G. (1990). The three worlds of welfare capitalism. Polity Press, Cambridge

Freedman VA (1996) Family structure and the risk of nursing home admission. J Gerontol Soc Sci 51B(2):S61–69

Gaymu J, Delbès C, Springer S, Binet A, Desesquelles A, Kalogirou S, Ziegler U (2006) Determinants of the living arrangements of older people in Europe. Eur J Popol 22(3):241–262

Gaymu J, Ekamper P, Beets G (2007) Qui prendra en charge les Européens âgés dépendants en 2030? (Who will care for the disabled older Europeans in 2030?) Population 62(4) (in press)

George MV, Smith SK, Swanson DA, Tayman J (2004) Population projections. In: Siegel JS, Swanson DA (eds) The methods and materials of demography, 2nd edn. Elsevier, Amsterdam, pp 561–601

Glaser K, Murphy M, Grundy E (1997) Limiting long-term illness and household structure among people aged 45 and over, Great Britain 1991. Ageing Soc 17:3–19

Glaser K, Tomassini C, Grundy E (2004) Revisiting convergence and divergence: support for older people in Europe. Eur J Ageing 1:64–75

Grundy E (2006) Ageing and vulnerable people: European perspectives. Ageing Soc 26:105–134

Hoyert DL (1991) Financial and household exchanges between generations. Res Aging 13:205–225

Iacovou M (2000). Health, wealth and progeny: explaining the living arrangements of older European women. Retrieved December 20, 2004, from http://www.iser.essex.ac.uk/pubs/workpaps/pdf/2000-08.pdf

Jacobzone S, Cambois E, Robine JM (2000) Is the health of older persons in OECD countries improving fast enough to compensate for the population aging? OECD Econ Stud 30(1):149–178

Kalogirou S, Murphy M (2006) Marital status of people aged 75 and over in nine EU countries in the period 2000–2030. Eur J Ageing 3:74–81

Keefe J, Legaré J, Carrière Y (2005) Developing new strategies to support future caregivers of the aged in Canada: projections of need and their policy implications, XXV International Population Conference, IUSSP, Tours 18–23 July

Martel L, Légaré J (2001) Avec ou sans famille proche à la vieillesse: une description du réseau de soutien informel des personnes âgées selon la présence du conjoint et des enfants. (With or without the support of close family members in old age: a description of the older person's informal support networks based on the presence or absence of a spouse and/or children). Cah Qué Démogr 30(1):89–114

McGarry K, Schoeni RF (2000) Social security, economic growth, and the rise of the elderly widow's independence in the twentieth century. Demography 137(2):221–236

Mestheneos E, Triantafillou J (2005) Supporting family carers of older people in Europe. In: Döhner H, Kofahl C (eds) The Pan-European Background Report. University of Hamburg, vol 1, p 155

Michael R, Fuchs V, Scott S (1980) Changes in the propensity to live alone: 1950–1976. Demography 17:39–56

Mickus M, Stommel M, Given CW (1997) Changes in living arrangements of functionally dependent older adults and their adult children. J Ageing Health 9(1):126–143

Murphy M, Grundy E (1994) Co-residence of generations and household structure n Britain: aspects of change in the 1980s. In: Becker H, Hermkens PLJ (eds) Solidarity of Generations: Demographic, economic and social change and its consequences. Thesis Publishers, Amsterdam, pp 551–582

Murphy M, Martikainen P, Pennec S (2006) Demographic change and supply of potential family supporters in Britain, Finland and France in the period 1911–2050. Eur J Popul 22(3):219–240

Ogg J, Renaut S (2005) Le soutien familial intergénérationnel dans l'Europe élargie (Intergenerational family support in the enlarged European Union). Retraite et Société 46:30–57

Oldman C, Quilgars D (1999) The last resort? Revisiting ideas about older people's living arrangements. Ageing Soc 19:363–384

Pampel FC (1992) Trends in living alone among the elderly in Europe. In: Rogers A (ed) Elderly migration and population redistribution, Belhaven Press, London, pp 97–117

Parker MG, Ahacic K, Thorslund M (2005) Health changes among Swedish oldest old : prevalence rates from 1992 and 2002 show increasing health problems. J Gerontol Med Sci 60A(10):1351–1355

Pickard L, Wittenberg R, Comas-Herrera A, Davies B, Darton R (2000) Relying on informal care in the new century? Informal care for elderly people in England to 2031. Ageing Soc 20:745–772

Reher DS (1998) Family Ties in Western Europe: Persistent contrasts. Popul Dev Rev 2:203–234

Ricci M (1991) Residential care for the elderly in Italy: recent trends and regional differences. Paper presented at the European Population Conference, Session "Living arrangements of the elderly", Paris

Robine JM, Romieu I, Michel JP (2003) Trends in health expectancies. In: Robine JM, Jagger C, Mathers CD, Crimmins EM, Suzman RM (eds) Determining health expectancies. Wiley, Chichester, pp 75–101

Ruggles S (2001) Living arrangements and well-being of older persons in the past. In: United Nations (eds) Living arrangements of older persons: critical issues and policy responses, population bulletin of the United Nations, Special issue 42/43, United Nations, New York, pp 111–161

Schulz R, O'Brien AT, Bookwala J, Fleissner K (1995) Psychiatric and physical morbidity effects of dementia caregiving: prevalence, correlates and causes. Gerontologist 35(6):771–791

Siegel JS (2002) Applied demography; applications to business, government, law and public policy, 2nd edn. Academic Press, San Diego

Soldo BJ, Wolf DA, Agree EM (1990) Family, households, and care arrangements of frail older women: a structural analysis. J Gerontol 45: S238–S249

Stinner WF, Byun Y, Paita L (1990) Disability and living arrangements among elderly American men. Res Aging 12:339–363

Tomassini C, Glaser K, Wolf DA, van Broese Groenou MI, Grundy E (2004) Living arrangements among older people: an overview of trends in Europe and the U.S.A. Popul Trends 115:24–34

United Nations (2005) Living arrangements of older persons around the world. Department of Economic and Social Affairs, Population division, United Nations, New York, p 138

Van Imhoff E, Keilman NW (1991) *LIPRO 2.0:* An application of a dynamic demographic projection model to household structure in The Netherlands, NIDI CBGS Publications #23. Amsterdam/Lisse: Swets & Zeitlinger

Van Solinge H, Esveldt I (1991) Living arrangements of the Dutch elderly (1956–1986), with a focus on elderly living in with their children. European Population Conference, session 18 "Living arrangements for the Elderly", Paris

Walker A, Alber J, Guillemard AM, (1993) Older people in Europe, Social and Economic Policies. The 1993 Report of the European Observatory, Commission of the European Communities, Directorate General V, Employment, Social Affairs, Industrial Relations

Willekens F (1999) Modelling approaches to the indirect estimation of migration flows: from entropy to EM. Math Popul Stud 7(3):239–278

Wolf DA (1995) Changes in the living arrangements of older women: an international study. Gerontologist 35(6):724–731