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THE PROTECTIVE ROLE OF FAMILY TIES AND THE MORTALITY OF OLDER PEOPLE: ADDRESSING THE BIAS INTRODUCED BY THE SELECTION OF THE INSTITUTIONALIZED POPULATION

Abstract: Most of the literature linking the living conditions of older people with their health outcomes refers to older populations living in private dwellings, while studies dealing with the topic from a broader perspective, including the institutionalised, are sparse. This can be ascribed to the fact that nation-wide health surveys do not generally include institutionalised populations, and to a strong selection of any institutionalised populations, which calls for specific techniques to deal with the induced bias in estimators. Our study highlights the effect of family support on the survival of older people looking at private and collective households. We examine the relationship between living conditions and mortality in a cohort of 16,263 individuals aged 55 and over, living in both private residences and institutions in France. We perform inverse probabilities of treatment weighting (IPTW) with the Cox model so as to include and adjust for confounders. We found a protective effect for marriage and childbearing in both private and collective settings. We also found a protective institutional effect for those who are disabled.

Keywords: survival, elderly, institutions, Cox analysis, IPTW.

1. Introduction

Besides health and socio-economic status, the social relationships maintained by older people play an important role in shaping living conditions. In this life phase, the family represents the major framework in which interpersonal relationships are experienced. With population ageing, the family increasingly ensures elderly care, especially where targeted public policies are lacking. It also protects, directly or indirectly, against mortality, through the physical and emotional support it provides (Rendall, 2011; Holmas, 2017). In cases of disability most older people prefer to remain in their homes; this allows them to maintain the integrity of their social network and to enjoy a higher quality of life. However, depending on several predisposing and enabling factors (Andersen, 1968), some of them enter institutions. As those people remain an integral part of the wider community, their exclusion from health-related analysis may be a source of bias. This is especially the case when the proportion of the institutionalised population is substantial and when the health indicators being studied differ substantially between the institutionalised population and those in private households.

In fact, most of the literature linking the living conditions of older people with their health outcomes concern those in private dwellings; studies with a broader perspective, including the population living in institutional settings, are sparse. This can be explained by the fact that nation-wide surveys on health conditions do not generally include institutionalised households, and also because the institutionalised population is recognised as being highly selected. Age, sex, marital status, health, income, education and

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number of children play a central role in separating those who do and those who do not enter institutions, which makes it necessary to carry out specific studies.

A general finding of the few studies comparing mortality across institutions and private homes (Grundy 2010; Shah et al. 2013; Herm et al. 2014; Giudici et al., 2018) is that higher mortality is experienced by nursing-home residents. Nonetheless, those studies do not correct for the selection bias.

The present study analyses several aspects of living conditions and their connection to mortality at home and in institutions, taking into account the bias induced by the peculiar characteristics of individuals that enter institutions. We study a cohort of 16,263 individuals aged 55 and over, living in community and in institutions in France, estimating the impact on mortality of institutional vs household settings and assessing the importance of subject-specific covariates. In order to address the selection bias we perform inverse probabilities of treatment weighting (IPTW) with the Cox model so as to include and adjust for confounders.

Our study has a twofold aim: first, we intend to compare the mortality levels of individuals in institutional settings with those in private households, taking into account the selection bias which characterise the institutionalised population. Moreover, we aim to test the protective role of different family relations within the institutional context.

2. Background

2.1. Family ties, health and mortality among the elderly

Population ageing and the growing need for care for older people in Western societies raise a series of challenging issues. In Europe, care for the older may be provided by a variety of public and private agents. Many European societies though rely, albeit to different extents, on the family for the care of their older members (Haberkern and Szydlik, 2010; Kalmijn and Saraceno, 2008; Hank, 2007).

There is a wide literature showing that elderly health and mortality are affected by family networks, mainly referred to the population living in private dwellings (Lund et al., 2002; Rasulo et al., 2005; Guilley et al., 2005; Rendall et al., 2011; Holt-Lunstad et al., 2015; Tanskanen and Anttila, 2016; Loprinzi and Ford, 2018; Hank and Steinbach, 2018).

With age, the network of people with whom individuals are connected tends to change, something also true of social context, families, and health. In later life most social contacts either die or gradually fade away, bonds with non-kin decrease in importance, health problems begin impeding social interaction and bonds with children and close family members may increase. All these changes are often interrelated, and the family provides an important—perhaps the most important—context in which health and wellbeing are promoted.

According to social support theory, additional family members create additional bonds and thereby may improve health and reduce mortality (Rogers, 1996). Furthermore, different family members have an independent effect on mortality (Cornell, 1992). Notably, social scientists have generally found a protective effect of parenthood on mortality (Grundy and Tomassini, 2006; Grundy, 2010; Grundy and Kravdal, 2010). This result has been confirmed for both men and women in gender-stratified analysis (Grundy and Kravdal, 2008), suggesting the existence of biosocial pathways in which the health benefits of having several children may outweigh their costs.

The literature also highlights the positive effect of having grandchildren, possibly due to a selection effect (Christiansen, 2014 and references therein), and to emotional patterns (Carstensen et al., 1999). Nonetheless, the effect of grandparenthood on health may also depend on the characteristics of the grandparent, on the intensity of grandchild care provided and on the wider cultural context (Christiansen, 2014; Di Gessa et al., 2016, and references therein).

Concerning partners, the protective effect of marriage on survival has been widely recognised, both for women and, particularly, for men (for a review see Rendall et al., 2011; Hank and Steinbach, 2018). As pointed out by Rendall et al. (2011). This causal effect may result from the social pathway of social

integration, social support, social control, and social role attainment, as well as the material pathway of financial resources and economies of scale.

On the other hand, divorce and widowhood have been associated with negative effects on health and survival (Monden and Uunk, 2013), but there is little evidence of mortality differences between distinct non-married statuses (Hank and Steinbach, 2018).

Concerning siblings, growing up in large families seems to have a negative impact on health in low- or middle-income countries (see for example Hatton and Martin, 2010; Gagnon and Bohnert, 2012). There is, meanwhile, limited evidence on how siblings affect health in higher income developed countries (Baranowska-Rataj et al., 2017). It can be presumed that in these countries the negative impact of growing up in large families is compensated for by a number of welfare policies. Baranowska-Rataj et al. (2017) argued that a large number of siblings could be beneficial in adulthood, depending on frequency of contacts within the sibship and on whether they are a source of support or conflict. Finally, Downey et al. (2015) suggest that individuals growing up with siblings may learn and practice interpersonal skills, self-control, or conflict resolution techniques and that these may be helpful in later life.

2.2. Older people living in institutions: a selected population

The tendency of older people to stay in their home rather than entering an institution can be interpreted in the light of the behavioural model of health service use developed by Andersen (1968, 1995). Following this model, the decision to enter an institution could be seen as a function of three factors, namely predisposing, enabling and health need. The "predisposition" to use services, depends on social and demographic characteristics as well as on health beliefs. The "enabling" factors, refers to the availability of means and knowledge to access those services and exploit them, but also to the availability of health personnel and facilities. The "need" factors refers to both perceived and objective health needs. All these domains have been widely analysed in the literature (for a review see Luppa et al., 2010), and one of the most widely recognized findings is that a lower family network, associated with poor health status, has a direct impact over the choice to stay at home or enter institutions (Désesquelles and Brouard, 2003; Gaymu et al., 2006; Luppa et al. 2010). In particular, in their systematic review of predictors of nursing home placement for older members of society, Luppa et al. (2010) confirm the strong evidence of the central role played by cognitive and/or functional impairment, associated with a lack of support and assistance in daily living.

The link between income and institutionalisation has also been pointed out by a number of studies (Gaymu et al., 2006; Luppa, 2010). In the European context, Gaymu et al. (2006) observe that the higher the income, the lower the probability of living in an institution, and they suggest that a high income enables elderly people to pay for professional services and to continue living at home thus postponing institutionalisation.

National policies on long term care may also influence the living arrangement choices of the elderly, depending on the degree of substitutability between informal and formal care (Bonsang, 2009). In the Swedish context, Ulmanen and Szebehely (2015) observe that the decline of publicly financed services in eldercare during the 2000s was not totally compensated for by the increase in purchased home services, but it was associated with an increase in informal family care. Analogously, in the United States, Mommaerts (2018) finds that living in a state with a Medicaid income "spend-down" provision decreases the prevalence of co-residence with adult children for single elderly individuals, and increases the use of nursing-homes residence[1]. The author observes that whether the financial burden of formal long-term care

[1] "Medicaid is a medical assistance program jointly funded by state and federal governments in the United States for low income individuals who are elderly (65 years and older), disabled, blind, or who meet some other category of eligibility. People with low income automatically qualify for Medicaid. However, seniors and people with disabilities, whose incomes exceed the income limit, may qualify for Medicaid only if they have medical bills that equal or are greater than their "excess" income. The process of subtracting those medical bills from the individual's income over a six-month period is called a Medicaid spend-down. For example, a person over 65 is denied Medicaid because her monthly income is $50 more than the limit for Medicaid eligibility. If

affects living arrangements depends crucially on the strength of preferences, opportunity costs, and individual care needs. The responsiveness of living arrangements to changes in policies is, thus, more effective in aged, low-income and unhealthy sub-populations (Mommaerts, 2018).

Finally, one can argue that the tendency of older people to live in their home rather than in an institution depends on the country, and associated attitudes towards family (Geert et al., 2012; Fernandez-Carro, 2016).

2.3. Mortality risk in institutional settings

Since an older institutionalized population is characterized by a higher burden of chronic diseases, cognitive impairment and disability, this kind of population is recognized as having higher mortality compared to the population living at home (Grundy, 2010; Shah et al., 2013; Herm et al., 2014, Giudici et al., 2018).

However, the majority of studies that investigate mortality risks in institutional settings focuses on specific health determinants and a comparison of mortality levels among institutions and private households is lacking (see Thomas et al., 2013 for a review). This can be ascribed to the fact that: first, nation-wide surveys on health conditions do not generally include the population living in collective households; and, second, that the unusual characteristics of institutionalised populations make it necessary to carry out *ad hoc* studies.

According to the literature, the most relevant mortality risk factors in institutions include older age, male gender, the absence of a social support network, the presence of certain medical conditions (e.g., neoplasms, and musculoskeletal or respiratory diseases) and high levels of cognitive and physical dependence (Jakobsson and Hallberg, 2006; Vetrano et al., 2018).

Indeed, even though diminished survival is mainly associated with health factors, some authors argue convincingly that social ties are also significant predictors of mortality (Seeman, 1987; Holt-Lunstad, 2010, Vetrano, 2018). In his study based on the European Services and Health for Elderly in Long TERm care (SHELTER) database, Vetrano (2018) underlines that health determinants in older nursing home residents depart from those usually accounted for in younger and fitter populations. The social aspects of life and engagement in physical activity assume a pivotal positive role to prolong survival.

Using French data collected in 2007 from a sample of about 2,000 older people living in nursing homes, Wolff (2013) hypothesizes that the benefits of social interactions especially with friends should be strong among institutionalized older people.

In a previous study using French data Giudici et al. (2018) found evidence of a protective role of the family network on survival. The authors argued that in the absence of family support, institutional settings may play a surrogate role, especially when the person is not independent due to a severe disability. However, they observed that the strong selection process affecting the population living in institutional settings may hinder a correct estimation of the effect of covariates on mortality.

she spends, or incurs $50 per month of medical bills, the rest of her medical bills will be covered by Medicaid. The spend-down in this case is the $50 she spends" (https://definitions.uslegal.com/m/medicaid-spend-down/).

3. Data

Our study is based on the French national survey on Disability, Functional Limitations, Dependency (Handicaps-Incapacités-Dépendance, or HID for short). This survey was carried out by INSEE, between 1998 and 2001, both in medico-social institutions and private dwellings, in collaboration with several research institutes including the Institut National d'Etudes Démographiques (INED) and the Institut National de Recherches Médicales (INSERM).

A first wave was carried out in late 1998; 14,611 people living in institutions were interviewed. The same persons were surveyed again in late 2000. In addition, between 300,000 and 400,000 people living in private dwellings filled out a brief questionnaire on "daily life and health" during the 1999 population census. After this filtering operation, 16,924 respondents were interviewed, once in late 1999 and again in late 2001. The survey is the first data source that combines information on health status and death for a nationally representative sample of the population in France. For more detailed documentation on the survey design, see Mormiche 2003.

Thanks to the record linkage with vital statistics it had been possible to monitor the mortality of HID individuals both in institutions and in households: among individuals aged 55 and over, 9,235 deaths were recorded between 1998 and 2011, or 54.4% of the initial sample; 6,031 individuals (35.6%) were still alive in 2011, mainly residing in ordinary households, while 1,701 individuals (14%) could not be linked. This loss of follow up is partly corrected using information on mortality coming from the survey. After correction, the linkage failure stood at 1% of the sample in ordinary households and 10% in institutions, mainly elderly and widowed women.

We limited the analysis to the population aged 55 and over that, in the first wave was living at home, in institutions for elderly people (retirement homes, hospices etc.) or in long-stay care facilities attached to hospitals (16,236 individuals, 6,426 living in institutional settings and 9,807 living at home, representative of the French population aged 55 and over).

Table 1 – HID Survey characteristics

Year of the first wave	Living environment of the interviewed	Sample size	55+ sub-sample size
1998	Institutional setting	14611	9807
1999	Ordinary setting	16924	6426

In our work disability refers to the activities needed for independent living and personal care, and has been operationalized as the difficulty or inability to perform one of the five activities of daily living (ADL): bathing, dressing, eating, getting in/out of a bed or chair and using the toilet. An individual is considered moderately disabled when he/she is able to perform one or more ADLs with difficulties, and is considered as severely disabled when he/she needs help for at least one ADL. Besides the date of institutionalization, the survey provides information about the reason of entry in institution (health or other reasons) and on the age at the first occurrence of each functional problem. This information let us identify disability status before institutionalisation. *Ex-ante* disability status is a dummy variable, taking the value of 1 when the youngest age at the onset of a disability was before the age of institutionalisation or if the individual entered an institution for health reasons. For people living at home the variable corresponds to the declared disability status.

As to the family network, only the respondent's partner, children, grand-children and siblings are considered as family members. Respondents who reported having a family were also asked about the existence of contacts with their relatives.

If the close family network provides a key context for the well-being of the aged, the role of external context is also important and individuals were asked too about social contacts with friends or colleagues.

In a separate covariate we also take into account contacts with a partner, that includes non-marital or even non cohabiting relationships: this condition, as expected, is much more frequent among non-institutionalized individuals.

Finally, people living in an institution and those living alone or at most with their partner are asked about any person that could give a financial support in case of need, assuming that people living in larger households can always rely on a help.

4. Methods

Empirical studies in the social sciences are typically based on observational data that may be unrepresentative of the population of interest, as the result of a selection effect. Indeed, several selection mechanisms may occur, that produce non-random samples. Some of them are the result of sample design, others depend on self-selection of the sample units. Selection holds when non-random treatment assignment leads to correlation between the treatment (selection) variable and the error term in the outcome of interest. The consequence of this kind of selection bias is often an inferential bias, occurring because unit's characteristics may confound the effect of treatment/covariates on the outcome.

In such circumstances, inferences only hold for a specific subset of the target population rather than for the whole population. Several methods that account for endogenous selection have been proposed in the literature.

Heckman (1979) introduced a useful framework for handling estimation when the sample is subject to a selection mechanism. The original Heckman model, proposed for the linear regression model, was extended in many directions and a survey would be beyond the scope of this paper; see Vella (1998) and Lee (2003). For more general regression models, Miranda and Rabe-Hesketh (2006) allow for binary, ordinal, or count dependent variables of interest. Furthermore, Carlin and Solid (2014) propose a selection survival model extending the previous work to a Weibull hazard model with a multiplicative frailty term. In practice, adjusting for selection in survival models has been performed through propensity scores, in a wide variety of formats. In the proposal by Rosenbaum and Rubin (1983), three methods of using propensity scores are presented: (1) propensity score matching, (2) stratification of the population by propensity score, and (3) inclusion of the propensity score as a regression adjustment. The inferences rely on the crucial assumption of strong ignorability, i.e. that the response variable is uncorrelated with the treatment assignment, once one has conditioned on the predictor variables. In the context of time to event data, as discussed in Austin (2008), propensity score matching (1) violates the requirement that proportional hazard models are based on independent samples.

In addition, weights that adjust for different selection probabilities in biased samples (2) are analysed e.g. in Pan and Schaubel (2008), Austin (2014), Austin (2016). Use of survey weights in survival analysis has already been analysed in the literature (Lin 2000, Hadley et al. 2010); in particular, Austin et al (2018) analyse the issue of propensity score matching in complex surveys and compare different uses of sampling weights at various stages of the procedure.

Following Austin (2016 and 2018) and Hadley et al. (2010) we adopt option (3) and perform inverse probabilities of treatment weighting (IPTW) with the Cox model so as to include and adjust for confounders while dealing with the issue of selection. We implement a two-stage procedure where we first fit a selection probability model based on a logistic regression with covariates representing *ex-ante* characteristics that determine the probability of individuals entering an institution versus staying at home. In particular, having defined $W_i=1$ if the individual lives in an institution and $W_i=0$ if the individual lives in a household at a time t_0 prior to the survey time, we regress $\pi_i=Pr(W_i=1)$ onto a set of *ex-ante* characteristics hypothesized to affect the decision to live in institution rather than in household, using a logit link:

$$\log\left(\frac{\pi_i}{1-\pi_i}\right) = z_i'\gamma \tag{1}$$

In the application, the fitted logistic regression model includes, as explanatory variables, covariates for sex, age, education, employment, marital status, having children, having a daughter, or siblings and *ex ante*

health status. These variables represent *ex-ante* characteristics assumed to influence both a subject's propensity to enter an institution and to survive.

The logistic regression model was estimated using the sampling design weights of the survey. The fitted values from model defined above were exploited to define inverse probability of treatment weights, as follows:

$$\omega_i = \frac{1}{\hat{\pi}_i} \text{ if } W_i=1 \text{ and } \omega_i = \frac{1}{1-\hat{\pi}_i} \text{ if } W_i=0. \quad (2)$$

Finally, the above weights were trimmed, excluding the upper 15% of the distribution to avoid inclusion of extreme weights.

The working hypothesis is that poor health status and lack of support implied by the absence of a network, besides the effect on mortality, tend to increase the probability of moving to an institute. A selection effect is expected, then, to affect the subpopulation of individuals in this living arrangement. We try to allow for this effect by incorporating, in the survival analysis, inverse selection weights (2), estimated from logistic regression. At a second stage of the procedure, we therefore estimate a weighted Cox regression model

$$h_i(t) = h_0(t)\exp(x_i'\beta) \quad (3)$$

whose weights take into account the inverse probability of treatment, estimated as described above.

The covariates included in the proportional hazards model encompass a set of demographic and socio economic characteristics, known to affect mortality: age, sex, marital status, education, occupation, the disability status, plus a set of variables describing the family and the social network of the individual (having siblings, children, grandchildren, contacts with partner or friends, possibly relying on others for financial support). The working hypothesis is that, besides the first two sets of factors that are expected to affect survival, the support provided by the social network, primarily family members, may reduce the risk of mortality even after correcting for selection effects. On the other hand, a protective effect from living in an institutionalised setting may occur, and this effect may be stronger for more fragile individuals (those who lack the support of a social network and have poor health conditions); this protective effect might emerge more clearly after having corrected for selection bias.

Following the literature, the analysis is restricted to the first five years of follow up. This allows for us to ensure the validity of the analysis and compare results with similar studies (Giudici et al. 2018).

5. Results

At the age of 60, people living in institutions live on average ten years less that those living in private households, and the gap decreases with age (Figure 1).

Table 2 shows the proportion of dead and censored individuals after 153 months of follow up for selected variables within the two living spheres. Those living in institutions are older than those living at home. Institutional settings are characterised by a higher proportion of women, widowed and severely disabled individuals. Furthermore, the proportion of people having no children, grandchildren or siblings is higher in institutions, where the least represented categories show higher mortality. The mortality gap between households and institutions is particularly large at younger ages and for married and healthier individuals.

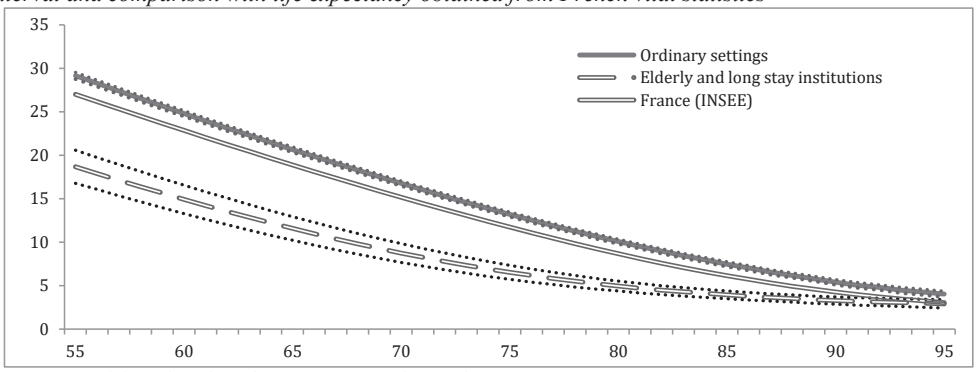
Concerning social contacts, almost 80% of those living in private households have contacts, according to their own declaration, with friends or relatives, but this proportion decreases to 43% among the institutionalized.

Globally, almost 40% of the sample does not have someone to whom he/she can eventually count for financial support, in both private and collective households.

The observed selection of institutionalised individuals with respect to family and relational ties, age and health status is a major issue when estimating the impact on mortality of institutional vs household settings and in assessing the importance of subject-specific covariates. For this reason, we use selection models to correct for the resulting bias.

At a first stage of the multivariate analysis we fit a selection probability model based on a logistic regression whose results are shown in Table 2. *Ex-ante* disability status is by far the most important variable in predicting institutionalization. As expected, married individuals are less likely to be institutionalized than those who are single, widowed or divorced and the presence of a close family is lowers the probability of moving to an institution. Those results confirm the existing literature on institutionalisation of older people and its determinants (Gaymu et al, 2006; Himes et al. 2000; Désesquelles and Brouard 2003; Luppa et al. 2010). In order to correct for selection bias, inverse selection probability weights were estimated and included in the Cox proportional hazards models (Cox, 1972), as explained in Section 4. The estimated effect of selected indicators on mortality risk over the first five years of follow up is presented in figure 4.

Figure 1 – Life expectancy at different ages in private dwellings and institutions with 95% confidence interval and comparison with life expectancy obtained from French vital statistics



Source: Our elaborations based on HID survey data and INSEE

Table 2 - Descriptive statistics – proportion of dead and censored individuals after 153 months of follow up for selected variables, private households and institutions for elderly people and long-stay care facilities attached to hospitals

	Private Households			Collective Households			Total
	Total	Censored %	Dead %	Total	Censored %	Dead %	
Gender							
Men	4217	50.0	50.0	1655	14.3	85.7	5872
Women	5590	59.3	40.7	4774	23.6	76.4	10364
Age							
55-70	3611	76.4	23.6	603	44.3	55.7	4214
71-85	5061	50.2	49.8	2320	22.8	77.2	7381
85+	1135	11.2	88.8	3506	16.9	83.7	4641
Marital status							
Single	689	55.9	44.1	1505	25.0	75.0	2194
Married	5717	60.9	39.1	549	17.5	82.5	6266
Widowed	2797	41.7	58.3	4013	20.2	79.8	6810
Separed or divorced	598	64.9	35.1	331	20.5	79.5	929
Missing	6	50.0	50.0	31	51.6	48.4	37
ADL Disability							
No disability	6361	62.0	38.0	1610	28.1	71.9	7971
Moderate disability	2347	50.7	49.3	951	21.8	78.2	3298
Severe disability	1094	26.1	73.9	3867	18.2	81.8	4961
Missing	5	80.0	20.0	1	100.0	0.0	6
Self rated health							
Good or very good	3794	63.4	36.6	1590	26.0	74.0	5384
Fair	3494	55.2	44.8	1585	20.4	79.6	5079
Bad or very bad	1673	43.6	56.4	925	17.3	82.7	2598
Missing	846	43.0	57.0	2329	20.1	79.9	3175
Children							
0	1418	78.2	21.8	2527	45.7	54.3	3945
1+	8374	81.9	18.1	3728	38.8	61.2	12102
Missing	15	66.7	33.3	174	31.4	68.6	189
Siblings							
0	2761	74.9	25.1	2879	37.1	62.9	5640
1+	6985	83.9	16.1	2359	49.5	50.5	9864
Missing	61	81.9	18.1	1191	35.3	64.7	1252
Grandchildren							
0	2211	80.6	19.4	2642	46.6	53.4	4853
1+	7534	81.6	18.4	2754	39.8	60.2	10288
Missing	62	69.4	30.1	1033	32.5	67.5	1095
Contacts with a partner (even non married or							
Yes	1405	64.3	35.7	20	20.0	80.	1425
No	8396	53.8	46.2	6404	21.0	79.0	14800
Missing	6	50.0	50.0	5	20.0	80.0	11
Contacts with distant relatives, friends,							
Yes	7918	55.8	44.2	2781	20.2	79.8	10699
No	1883	53.3	46.7	3646	21.9	78.1	5529
Missing	6	50.0	50.0	5	80.0	20.0	11
Trust on the network in case of financial need							
Yes	5682	55.5	44.5	3480	19.9	80.1	9162
No	3906	54.8	45.2	2555	22.7	77.3	6461
Missing	219	59.8	40.2	394	23.1	76.9	613
Total	**9807**	**55.3**	**44.7**	**6429**	**21.2**	**78.8**	**16236**

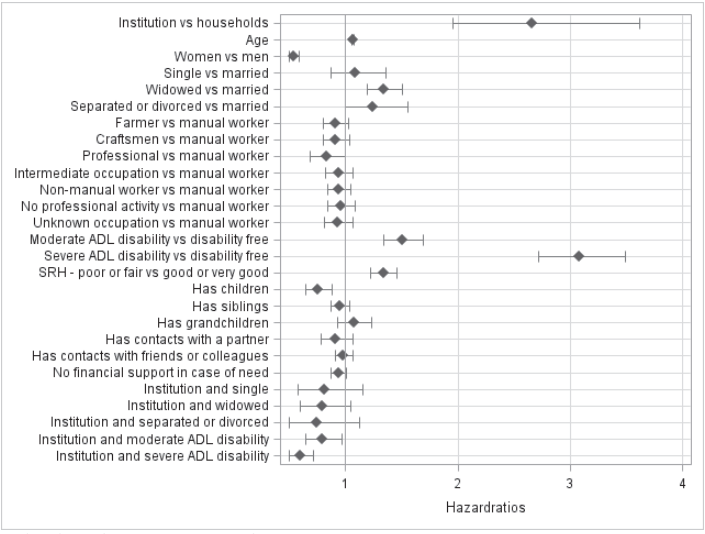
Source: our elaboration based on HID survey data

Table 3 – Logistic analysis of entering institution – main results

Independent variables		Estimate	Standard error	Odds Ratio
Gender	Men		ref	
	Women	-0.53***	0.0049	0.59
Age		0.08***	0.0002	1.09
Education	Lower or any		ref	
	Higher	0.29***	0.0103	1.34
Occupation	Farmer		ref	
	Craftsmen	-0.03**	0.0082	0.97
	Professional	-0.52***	0.0119	0.59
	Intermediate occupation	0.09***	0.0087	1.10
	non manual worker	0.11***	0.0072	1.11
	Manual worker	0.06***	0.0066	1.81
	No professional activity	2.18***	0.0093	8.83
Marital status	Single		ref	
	Married	-2.65***	0.0081	0.07
	Widowed	-0.59***	0.0067	0.56
	Separated or divorced	-0.65***	0.0099	0.52
Have children		-0.60***	0.0064	0.55
Have daughters		-0.37***	0.0054	0.69
Have siblings		-0.30***	0.0042	0.74
Have ex ante adl disability		2.42***	0.0048	11.23

Levels of significance: ***$p < 0.001$; **p<0.01
Source: our elaboration based on HID survey data

Figure 2 - Hazard ratios estimated from the adjusted Cox regression model



Source: our elaboration based on HID survey data

6. Discussion and final remarks

For the first time, we extend the analysis of family-health nexus to an institutionalised population. We highlight on the protective effect of living in institution for those who are severely disabled. The analysis also confirms that the protective role of children goes beyond the care activities.

The results from the Cox model confirm that there is higher mortality in institutions compared to private households. This may suggest that the inclusion of weights has not fully addressed the issue of selection; nonetheless, excess mortality in institutions may be the result of a funnelling of public resources towards the frailest individuals, as pointed out by Grundy (2010) in her study on changes in older people's living arrangements and subsequent mortality over 30 years in England and Wales.

Catherine-Quivet (2005) confirms this hypothesis in the French context, using data from a survey carried out on 1,557 people entering geriatric institutions in France from 1966 to 2004. Her main findings are the links between the evolution of public policies in the field of elderly care and the aging upon entry into the institution, the decrease of the average presence period and the rise in mortality, especially for women. More specifically, the author stresses the shift from a social to a medical care approach during the analysed period and on the consequent rise of the share of dependent elderly entering French institutions. This evolution was facilitated by a greater efficiency in home-care services which has allowed an increasing number of people to defer institutionalisation until disability becomes severe. Nonetheless, the author emphasizes that the costs of accommodation may deter institutionalization, especially for women, whose pensions were on average about 30 percent lower than that of men (Catherine-Quivet, 2005).

Our analysis also confirms that higher risk of death is associated with poor health and lower socio economic status. Being married is associated with lower mortality risk in comparison with the widowed, separated or divorced, and the analysis also shows a protective effect from children on survival. The test on the interaction between the living arrangement and the presence of children produced non-significant results. This confirms that the protective role of children on mortality is not limited to their role of care, and supports the notion of biosocial and psychological pathways playing an important role in shaping the fertility-health nexus even after entering an institution.

This result is in line with the existing literature (Grundy, Kravdal, 2008) and at the same time brings an important added value in extending the field of analysis to nursing institutions. To the best of our knowledge, in fact, there is no study at national level that investigates the relationship between the presence of children and mortality in institutional settings. As mentioned in section 2, Giudici et al. (2018) recently found an increase in the risk of mortality for those having rare or no contact with their children compared to those declaring frequent contacts. Authors noted a slightly significant interaction effect with living arrangement suggesting that this risk factor was reduced for individuals living in institutions, other conditions being equal. Care in interpreting these results, due to the selection bias in institution, was suggested. The present work tries to address this issue and confirms the protective role of children, in both households and institutions.

Furthermore, if those who live in private households tend to have a lower probability of dying with respect to those living in institutions under the same conditions, it is interesting to note that there is a significant interaction effects between living arrangement and ADL (figure 2). This suggests a protective effect from institutional settings especially for the severely disabled. As pointed out by several authors, the decision to institutionalise an older individual represents a substantial substitution of formal care for informal care (Bonsang 2009), and is affected by the price of institutionalization as far as by the strength of preferences, opportunity costs, and individual care needs (Moammaerts, 2018). Our work suggests the importance of supporting individuals in entering institutions in cases of disability, especially when they belong to the lower income groups.

The main limitation of the study can be ascribed to the observational nature of the HID survey, involving heterogeneous and time-varying exposures, many years of follow-up, and confounding by numerous measured and unmeasured risk factors. Individual characteristics are captured at the baseline and only mortality has been followed. Changes in living arrangement during the follow up cannot be considered.

Despite these limitations, our results offer material for debate on both the protective role of family ties and the beneficial/detrimental role played by institutional settings at an older age. European societies actually rely, to different extents, on the family for the care of their older members (Haberkern, Szydlik, 2010; Kalmijn, Saraceno, 2008; Hank, 2007). This work suggests that, public policies are though a key instrument for survival in cases of disability among older men and women.

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