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# Living Arrangement Dynamics of the Elderly in Mexico: Latent Class Analysis in an Accelerated Longitudinal Design

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# Living Arrangement Dynamics of the Elderly in Mexico: Latent Class Analysis in an Accelerated Longitudinal Design

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## Abstract

**BACKGROUND:** Household structure has been considered as a crucial determinant for the well-being of elderly and, consequently, a major factor to consider in public health planning.

**OBJECTIVE:** In this paper we propose and illustrate methods that can extract understandable data patterns for further use in longitudinal studies of household dynamics.

**METHODS:** Based on an accelerated version of the Mexican Health and Aging Study, we estimate latent classes of developmental trends in the household composition of the elderly as they grow older.

**RESULTS:** We circumvent working with a priori definitions of different household structures and estimate four typical living-arrangement trajectories of the elderly in Mexico based directly on household demographic indicators.

**CONCLUSIONS:** The elderly individual's living arrangement at 50 years old serve as important predictor of future living arrangements.

**CONTRIBUTION:** We show a new approach to the empirical analysis of living arrangement dynamics that overcomes some methodological limitations set by the relatively short time frame of most longitudinal surveys and the large number of different living arrangement transitions observed.

## Introduction

Countries described as advanced economies have developed social security, pension, and public health systems for providing care and support to the elderly. Conversely, in developing and newly industrialized countries, limited or no such government-funded institutional support is available, and well-developed old-age support systems have yet to be created. In Mexico, the elderly frequently require social, economic, and physical assistance (Montes de Oca & Hebrero 2008; Montes de Oca, *et al.,* 2014; DeGraff, Wong & Orozco-Rocha, 2018), but many are unable to provide for themselves because of poor health and a lack of private savings, relying mostly on other family members for their well-being and survival (Ham Chande 2010; Ham Chande 2014; Nava, Ham & Ramírez, 2016; Nava & Acosta, 2018).

Throughout many newly industrialized and developing countries the family epitomize the main social institution responsible for the distribution of goods and services between generations (Kuznets, 1978; Thornton, Chang & Sun, 1984; Becker, 1991). Thus, norms about respect for the elderly and the responsibility of the young to care for the old as the need arises prevail in many societies (Nydegger, 1983; Martin, 1990), including Mexico (Nydegger, 1983; Martin, 1990). Given these socially constructed and situational contexts, it is primarily the family of older adults who provide care and support. As a result, policy makers rather than introducing potentially expensive government programs, may highlight the role of familial systems of care for the elderly and prefer to maintain them (Knodel, Chayovan & Siriboon, 1992).

Issues concerning care and support for older adults are becoming increasingly important as population aging has been recognized worldwide as one of the most significant demographic transformations of the twenty-first century. Aging in Mexico is no exception and has followed a particularly remarkable decline in mortality, with life expectancy increasing from 33 years in 1920 (Partida-Bush, 2006; Parker, *et al.,* 2018) to 76 years in 2018 (González, 2015). According to population projections from the Mexican National Population Council (Conapo), the percentage of the population aged 65 and older is expected to grow from 6.7% in 2015 to 16.2% by 2050 (Regules García, 2018). This demographic trend will increase cost pressures associated with ageing such as medical and long-term care expenditures.

In most developing and newly industrialized countries providing universal health insurance coverage is a major challenge given that a great bulk of the labor force is absorbed by the informal sector (Bitran 2014; Parker, *et al.,* 2018). In Mexico, social security has provided health benefits to only a fraction of the population (Parker, Saenz & Wong, 2018), and hence the elderly without social security rely mainly on either public transfers from the Ministry of Health or familial transfers.

Mexico's inward-looking development strategy produced sustained economic growth from the 1940s until the late 1970s. However, since the early 1980s the country has been experiencing significant recessionary setbacks that have interfered with the dynamics of co-residence. Co-residence of adult children, parents and other family members has been identified as an economic survival strategy (Cortés & Rubalcava, 1991; González de la Rocha, 1994; Cortés, 2000; Singh, 2002; Chant, 2007). In a context of widening socioeconomic disparities in healthy aging and longevity (Bobadilla, *et al.*, 1993) combined with a low pension coverage and retirement income –about 13 percent, Solís (1999)–, the reliance of the elderly on family and kinship networks will likely increase, particularly on adult children, for old-age security.

Family life-cycle events, such as changes in marital status (divorce/separation, widowhood, remarriage), migration, gender differences in mortality, and precarious socioeconomic conditions may result in aging parents and adult children still living at home, grandparents raising grandchildren, and growing trends of older women living alone. These are living arrangements associated with the health and well-being of aging populations (Montes de Oca & Hebrero, 2008; Tohme, *et al.,* 2011; Manfredini & Breschi, 2013; Montes de Oca, *et al.,* 2014; Teerawichitchainan, Pothisiri & Long 2015; Gruijters 2017).

Understanding the living arrangements dynamics of the elderly is urgent to design aging public policy or improve multi-faceted interventions aimed to improve quality of life in old age. However, the empirical analysis of dynamic phenomena associated to household life-cycles requires access to information that follows individuals and households over a long period of time, information that is limitedly available, especially in developing countries.

In Mexico, the Mexican Health and Aging Study (MHAS) provides opportunities to follow households and individuals over a period of up to 15 years. Between 2001 and 2015 households were interviewed up to four times at irregular time intervals. In fact, for most households in the MHAS, the observed period is far shorter than 15 years, giving not much more than a snapshot of the dynamics surrounding their living arrangements. As a result, the use of the panel aspect of the MHAS in analyzing household dynamics has been limited (Montes de Oca & Hebrero, 2008).

Another factor behind the limited attention that has been paid to panel analysis is that, in studying the dynamics of living arrangements, the information regarding the changes in household's composition gives rise to a large number of different trajectories that, even with a small number of measurement occasions, cannot straightforwardly and non-arbitrarily be captured in a manageably number of categories.

In this paper we overcome these limitations set by the time frame of the survey and the large number of different living arrangement transitions observed. In fact, one goal of the present article is to propose and illustrate methods that can extract understandable data patterns for further use in longitudinal studies. In a nutshell, first we accelerate the MHAS rearranging it in a cohort-sequential design; a technique that provides a way to link adjacent segments of limited longitudinal data from different age cohorts (Duncan, Duncan & Strycker, 2013). We then use

Latent Class Analysis to estimate common developmental trends in the household composition of the elderly as they grow older. In this way, our approach allows us to explore, in a dynamic setting over a 30-year window and with a simple cursory look, the typical living arrangements trends among the Mexican elderly. As presented below, our statistical framework also allows researchers to control for cohort effects, which constitutes a major advantage over other approaches.

The results underscore, among other things, the stability of each living arrangement history; something that has not been done before. Although this may seem surprising at first, it is important to note that this does not necessarily imply that individuals hardly experience abrupt changes in the composition of their household, but that these changes are hardly correlated with age. Our results also suggest that public policies may be more effective if they are targeted towards particular individuals. For example, if they are targeted toward most-at-risk populations (both psychic and financial), where at-risk population may be different when looking at their household structure, which may change over time.

The remaining of the paper is organized as follows. Section 2 situates our methodological contribution within the study of the household dynamics and living arrangements of the elderly. Section 3 describes the data and methods; there we describe the accelerating procedure as well as the proposed Multigroup Latent Class Analysis. The results are discussed in Section 4 and Section 5 presents our conclusions.

## Empirical approaches to the living arrangements of the elderly

Surveying the literature on living arrangements of the elderly suggests that most of the studies work in a basic comparative scheme of mutually exclusive categories, usually breaking down the households according to kin relationships and cohabitation based on a couple of demographic markers typically found in household surveys. However, even with only a few demographic markers, there are quite several distinct ways to operationalize a typology of living arrangements (De Vos 1990; Varley & Blasco, 2003; United Nations Department of Economic and Social Affairs/ Population Division, 2005; Montes de Oca & Hebrero, 2008; Montes de Oca, *et al.,* 2014).

Without a doubt, the choice to be made between typologies (marital status, family type, household type) of living arrangements depend on various theoretical and practical factors, including data availability and model complexity. However, a key question remains: to what extent the preferred typology reflects the actual household structures of elderly people in the country?

Unfortunately, even with a small number of demographic markers with just a few levels each, eyeballing the answer to this question from the *n-way* contingency table can be a formidable task as the number of combinations grows geometrically with every demographic marker included.

Seeing it as dynamic process only adds further complexity to the matter. Perhaps this is why most studies on living arrangements are cross-sectional designs.

There are exceptions on the literature on living arrangements of the elderly that use longitudinal data to analyze family life-cycle transitions and changes in family size (Keilman & Prinz 1995; Brown *et al*. 2002; Dostie & Léger 2005; Martikainen *et al*. 2008). These studies, however, also rely on a priori defined types of family and household structures. It's important to note that based on these dynamic models, every judgement regarding the relative stability of the living arrangements of the elderly is predicated on the chosen typology. A choice usually made in practice as a reasonable compromise between the conflicting objectives of completeness (the complexity required to actually track the observed changes) and feasibility (the parsimony required, for a given sample size, to fit the probability models).

As a way to circumvent the restrictions in the analysis that follow from a priori postulated types of household structures, instead of using a priori definitions of household structures, it's possible to identify empirically the main types of households and their typical sequences through a Latent Class Analysis (LCA) –see Wang and Wang (2012) and Hagenaars and McCutcheon (2002). This technique profits from the correlation among observed household characteristics, both cross-sectional and longitudinally, and allows identifying household structures by empirically seeking the best way to represent the observed household demographic structures. An advantage of LCA is that it broadens the set of demographic variables as needed in order to identify household structure by including continuous, ordinal, counts or categorical variables (Oberski 2016).

Du and Kamakura (2006) follow this path identifying distinct household structures through a LCA with a Hidden Markov Model (HMM). Although the HMM paves the way for a better understanding of the relationship between age and living arrangement transitions that occur over time, it shows important limitations in describing the main developmental trends commonly observed in the living arrangements of the elderly. First, in contrasting the living arrangements at time $t$+1 to that at time $t$, it forgoes the opportunity to look at longer (or finer) set of consecutive events if using longitudinal surveys with two or more waves. Thus, the HMM does not provide enough information on the transition process itself. We still don't know how long it takes respondents to experience living arrangements transitions or how this process varies with age. This poses a problem because changes being modeled are not necessarily an accurate representation of the developmental patterns/trajectories in household compositions as individuals age, but those from measurement occasion to measurement occasion –wave to wave in the survey. Second, if pooling the data from different measurement occasions, the HMM makes it really difficult to control for cohort effects.

Unlike previous studies, this paper attempts to fill this void by presenting results from an exploratory analysis of the living arrangements dynamics of the elderly in Mexico based on an

Accelerated Longitudinal Design (ALD). With this novel approach, our work expands upon our current knowledge concerning living arrangements of older adults, allowing us to start unpacking the dynamic processes through which individuals arrive to a particular household structure as they grow old.

In order to provide a more detailed information about the living arrangement transition process, and how that process varies over the latter part of the live course, we follow Du and Kamakura (2006) in examining living arrangements from a dynamic perspective by means of LCA. Thus, we also use Structural Equation Modelling (SEM) to classify households into different categories/types according to a combination of variables usually considered to be indicators of particular household structures. In this sense we also estimate, rather than postulate, the typical dynamics behind the household structures observed in the country.

However, unlike Du and Kamakura, we do not estimate a HMM. Instead, we use LCA to estimate the typical conjoint developmental trends of demographic markers, which allows us to recognize the main types of living arrangements dynamics. In this way we make full use of the longitudinal design of our data, exploiting the correlation through time of our socio-demographic variables, not just between time $t$ and $t$+1, but through all measurement occasions as a function of age while controlling for cohort effects. This provides us with a more complete analysis of the living arrangement dynamics of the population age 50 and over.

## Data, Measures and Methods

For our analysis, we use data collected by the Mexican Health and Aging Study (MHAS). The MHAS gathers detailed longitudinal information about the aging process of people aged 50 and over. The Study also collects sociodemographic data for all spouses (regardless of age), household and family members and life histories for each age-eligible (≥ 50 years old) person. The first wave of the survey was conducted in 2001, and follow-up waves were conducted in 2003, 2012 and 2015. Our analysis is based on 18,845 individuals aged 50 and over.

The structure of households has traditionally been analyzed by the relationship of individuals to the head of household or in terms of their size. However, for longitudinal analyses the household will often not have a well-defined starting or finishing point (Murphy 1991). In this article, we adopt an unconventional approach to analyze the living arrangements dynamics of the elderly. First, we examine the relationship of all individuals living in the household to the age-eligible (≥ 50 years old) person. Second, we perform a Latent Class Analysis (LCA) based on an Accelerated Longitudinal Design (ALD) to analyze the typical trajectories of living arrangements as the older adult population grow older.

## Accelerated Longitudinal Design (ALD)

Longitudinal survey designs have many advantages in comparison with cross-sectional ones, most notably in providing information about within-individual change (Duncan, *et al.*, 2013). However, longitudinal surveys also pose major potential problems like confounding aging and period effects, delayed results, achieving continuity in funding and research direction, cumulative attrition (Farrington 1991), and the amount of time required to collect enough data about each individual to analyze social and demographic phenomena. Particularly for the time span required to study changes in family and household structures.

As a means of overcoming longitudinal survey problems one strategy refers to an Accelerated Longitudinal Design (ALD), which was first proposed by Bell (1953),[1] and consisted of collecting limited repeated measurements of independent age cohorts and temporally overlapping the cohort data (see Appendix Figure A-1). In this way researchers can approximate a long-term longitudinal study by conducting numerous concurrent short-term longitudinal studies of different age cohorts (Duncan, *et al.*, 1996). An obvious advantage of the ALD is that it allows achieving the benefits of the longitudinal methods while minimizing time, continuity, attrition and budget constraints.

In this article we explore for the first time the potential benefits of using an ALD to study the living arrangements dynamics of the elderly. The MHAS baseline survey was conducted in 2001, and follow-up interviews were conducted in 2003, 2012 and 2015. In 2012 panel data sets were supplemented by an additional refreshment sample to deal with attrition due to death, decline in the health of participants or study drop-out across the follow-up waves. To minimize the number of time periods under analysis while keeping track of the different waves of the Study, we divide the index older adult population into nine age groups. Table 1 shows the number of observations by wave and index older adult mean age.

**Table 1: Number of observations by wave and index older adult's mean age**

| | Age (sd) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wave | 52 (1.1) | 55 (1.4) | 59 (1.4) | 63 (1.4) | 67 (1.3) | 71 (2.1) | 75 (2.3) | 81 (4.0) | 86 (4.4) | $n$ |
| 2001 | 2,804 | 2,447 | 2,023 | 1,674 | 1,348 | 1,339 | 688 | 696 | 11 | 13,030 |
| 2003 | 0 | 2,598 | 2,288 | 1,891 | 1,584 | 1,283 | 1,305 | 640 | 667 | 12,256 |
| 2012 | 1,663 | 2,008 | 1,508 | 2,473 | 1,987 | 1,536 | 1,216 | 1,556 | 393 | 14,340 |
| 2015 | 0 | 1,460 | 1,803 | 1,344 | 2,345 | 1,921 | 1,407 | 1,077 | 1,468 | 12,825 |
| Total | 4,467 | 8,513 | 7,622 | 7,382 | 7,264 | 6,079 | 4,616 | 3,969 | 2,539 | 52,451 |

Source: MHAS I-IV.

1 Also known as mixed longitudinal, cross-sequential or cohort-sequential design (Baltes and Nesselroade 1979).

Because overlapping age across measurement occasions occurs, Table 2 displays intersecting cohorts.[2] Cohort 1 [1909-1919], ages 82-92; Cohort 2 [1920-1923], ages 78-107; Cohort 3 [1924-1927], ages 74-81; Cohort 4 [1928-1931], ages 70-113; Cohort 5 [1932-1935], ages 66-91; Cohort 6 [1936-1939], ages 62-81; Cohort 7 [1940-1943], ages 58-77; Cohort 8 [1944-1947], ages 54-73; Cohort 9 [1948-1951], ages 50-69; Cohort 10 [1951-1954], ages 58-65; Cohort 11 [1955-1958], ages 54-61 and Cohort 12 [1959-1962], ages 50-57.

**Table 2: Number of observations by age groups and cohorts in the MHAS-ALD**

| | Age (sd) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 52 (1.1) | 55 (1.4) | 59 (1.4) | 63 (1.4) | 67 (1.3) | 71 (2.1) | 75 (2.3) | 81 (4.0) | 86 (4.4) | *n* |
| **Age Groups** | **[50-53]** | **[54-57]** | **[58-61]** | **[62-65]** | **[66-69]** | **[70-73]** | **[74-77]** | **[78-81]** | **[82-]** | |
| Cohort | | | | | | | | | | |
| 12 | 1,663 | 1,460 | - | - | - | - | - | - | - | 3,123 |
| 11 | - | 2,008 | 1,803 | - | - | - | - | - | - | 3,811 |
| 10 | - | - | 1,508 | 1,344 | - | - | - | - | - | 2,852 |
| 9 | 2,804 | 2,598 | - | 2,473 | 2,345 | - | - | - | - | 10,220 |
| 8 | - | 2,447 | 2,288 | - | 1,987 | 1,921 | - | - | - | 8,643 |
| 7 | - | - | 2,023 | 1,891 | - | 1,536 | 1,407 | - | - | 6,857 |
| 6 | - | - | - | 1,674 | 1,584 | - | 1,216 | 1,077 | - | 5,551 |
| 5 | - | - | - | - | 1,348 | 1,283 | - | 1,556 | 1,468 | 5,655 |
| 4 | - | - | - | - | - | 1,339 | 1,305 | - | 393 | 3,037 |
| 3 | - | - | - | - | - | - | 688 | 640 | - | 1,328 |
| 2 | - | - | - | - | - | - | - | 696 | 667 | 1,363 |
| 1 | - | - | - | - | - | - | - | - | 11 | 11 |
| Total | 4,467 | 8,513 | 7,622 | 7,382 | 7,264 | 6,079 | 4,616 | 3,969 | 2,539 | 52,451 |

Source: MHAS I-IV.

The mean overlap between consecutive waves is 57%, meaning that more than half of the observations reappear in the first follow-up survey conducted in 2003, half of them in second one in 2012, and one third in the last follow-up survey in 2015. That is 15 years after the baseline survey (2001) was completed. Our analytical sample includes 18,845 participants sparse throughout 12 cohorts. Each cohort sample size range from n=11 for Cohort 1 to n= 10,220 for Cohort 9 (see Table 2). Overall, 46% of the sample were men and almost half of them (48%) have between 51 and 58 years old when responding the baseline survey.

Table 3 presents changes across time-period (index older adult mean age) in descriptive statistics for selected household demographic variables using data from the ALD.

2 Note that cohorts 10, 11 and 12 belong to the 2012 sample refreshment.

**Table 3: Changes in household structure characteristics by time-period (index older adult mean age) in the accelerated longitudinal design**

| Time-period | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| ***Demographic variables*** | | | | | | | | | |
| Index older adult average age | 51.6 | 54.8 | 58.6 | 62.7 | 66.7 | 70.9 | 75.0 | 80.5 | 84.7 |
| Index older adult sex (0-Man, 1-Women) | 56% | 57% | 57% | 54% | 52% | 53% | 54% | 54% | 56% |
| Household average size | 4.4 | 4.2 | 4.0 | 3.8 | 3.6 | 3.5 | 3.4 | 3.3 | 3.2 |
| ***Household dichotomous demographic variables (1-Yes, 0-No)*** | | | | | | | | | |
| Children living in the household | 82.2% | 78.0% | 70.7% | 64.8% | 59.6% | 55.9% | 54.2% | 54.3% | 55.1% |
| Children < 6 years old | 3.0% | 1.6% | 1.1% | 0.7% | 0.4% | 0.3% | 0.1% | 0.2% | 0.1% |
| Children ≥ 6 and ≤ 11 years old | 12.4% | 6.8% | 3.6% | 2.0% | 1.3% | 0.9% | 0.6% | 0.3% | 0.1% |
| Children ≥ 12 and ≤ 14 years old | 16.6% | 10.3% | 5.4% | 2.9% | 1.5% | 0.9% | 0.6% | 0.6% | 0.2% |
| Children ≥ 15 and ≤ 17 years old | 25.5% | 18.1% | 10.7% | 5.0% | 2.7% | 1.3% | 1.0% | 0.6% | 0.4% |
| Children ≥ 12 and ≤ 17 years old | 35.1% | 24.1% | 14.1% | 7.1% | 3.7% | 1.9% | 1.5% | 1.1% | 0.5% |
| Children ≥ 18 years old | 69.5% | 70.1% | 65.7% | 62.0% | 58.0% | 54.9% | 53.4% | 53.7% | 54.8% |
| Student children ≥ 18 years old | 12.9% | 10.5% | 6.7% | 4.2% | 2.4% | 1.4% | 0.7% | 0.5% | 0.3% |
| Working children (aged ≥ 13) | 50.4% | 52.4% | 51.1% | 50.2% | 47.4% | 43.8% | 41.3% | 40.0% | 38.0% |
| Working children ≥ 18 years old | 48.2% | 50.9% | 50.3% | 49.7% | 47.1% | 43.6% | 41.2% | 39.9% | 37.9% |
| Children's partners | 11.6% | 12.6% | 13.5% | 13.3% | 14.1% | 14.5% | 14.6% | 15.8% | 17.2% |
| Other household members' death | 0.3% | 1.5% | 1.9% | 3.2% | 3.0% | 3.1% | 2.6% | 3.3% | 2.8% |
| Index older adult's partner or spouse | 77.8% | 77.1% | 74.1% | 72.3% | 69.0% | 62.0% | 54.6% | 44.3% | 35.2% |
| Nonrelatives | 0.8% | 0.9% | 0.7% | 1.0% | 0.9% | 1.0% | 1.4% | 1.6% | 2.4% |
| Other relatives | 31.6% | 34.1% | 37.3% | 36.7% | 37.4% | 38.0% | 38.5% | 40.0% | 40.8% |
| Index older adult's parents and/or in-laws | 6.3% | 5.6% | 4.7% | 3.4% | 1.8% | 1.2% | 0.6% | 0.5% | 0.6% |
| Grandchildren and/or greatgrandchildren | 20.8% | 24.3% | 28.4% | 29.5% | 31.7% | 32.9% | 33.7% | 34.4% | 34.3% |
| Index older adult's partners aged 40 or less | 3.5% | 2.0% | 1.3% | 0.7% | 0.4% | 0.4% | 0.2% | 0.2% | 0.2% |
| Index older adult partner's death | 0.7% | 1.3% | 1.8% | 3.2% | 4.9% | 5.9% | 7.0% | 10.9% | 7.7% |

Source: MHAS I-IV.

Regardless of overlapping cohorts and relatively large sample sizes, it is important to note that each cohort displays a unique pattern of missingness (see Table 2). In this context, questions immediately arise of whether cohorts are comparable enough to provide reliable information to characterize the living arrangements dynamics of the elderly between 50 and 90 years of age in México,[3] and if the ALD allows us to differentiate between age and cohort effects. Relating to the

3 Although there is no general formulae for assessing the validity of a particular ALD, recovering information concerning the full longitudinal effect from different cohort segments depend on the number of subjects and cohorts, the degree of overlap among cohorts, and the frequency of observations (Moerbeek, 2011).

latter, an advantage of the ALD is that, since different cohorts of the same ages in different periods can be linked together to represent a longitudinal trend, aging may be analyzed independently of period and cohort effects.[4]

Regarding to comparability, subjects in the same overlapping time span, belonging to different in the cohorts, should be as similar as possible to strengthen our confidence in our estimated longitudinal trends (Duncan, Duncan, *et al.*, 1996). If the cross-sectional measures of the ALD exhibit different patterns across cohorts, they can lead to misleading conclusions about aging effects on the living arrangements of the elderly.[5]

Given that our analytical approach uses several household demographic variables, it poses reasonable doubts on the naïve assumption that cohort effects are none or small enough to be dismissed. Thus, in this article we assume that age and cohort interact confounding the living arrangements dynamics of the elderly, therefore controlling for these effects in our models.

Particularly, inferences regarding correlates of change are adjusted for cohort membership exploiting the flexibility of structural equation modelling (SEM) viewing cohorts as subpopulations. In the next Section we address the validity of our methodology to characterize the evolution of household dynamics (living arrangements) controlling directly by Age X Cohort effects in our probability models.

## Latent Class Analysis (LCA)

Our approach to estimate the typical trajectories of household structures of the Mexican elderly involves the investigation of the MHAS-ALD for the presence of subpopulations, or classes of elderly individuals, associated with differential patterns of household demographic indicators as they gain age.

To characterize the trajectories of household structures, a part from the sex of the respondent –still a major factor behind the possible living arrangements for the elderly in Mexico–, we used 9 household level socio-demographic markers to profile the dynamics of the respondent's living arrangements in terms of cohabitation, kin and economic-dependence relationships within the household.

For each time point (age bracket of the respondent) in the ALD, we use the following variables: (1) Children living in the household; (2) Children ≥ 18 years old; (3) Studying children ≥ 18 years

4 Note that in single-cohort longitudinal designs age and history are perfectly confounded. Time dependent deflections may represent historical effects as well as age effects (Miyazaki and Raudenbush, 2000).

5 When age-outcome trajectories do not vary by cohort, they may be said to converge (Miyazaki and Raudenbush, 2000).

old; (3) Working children ≥ 18 years old; (4) Children's partners; (5) Index older adult's partner or spouse; (6) Nonrelative; (7) Other relatives; and (8) Grandchildren and/or greatgrandchildren.

Latent Class analysis (LCA) offers a valuable approach for the task at hand. This technique allows us to identify classes or typologies of trajectories of household structures from the relationships among this set of socio-demographic variables. Loosely speaking, LCA partitionates the original ALD into subsets with alike developmental trends in their socio-demographic markers. This has the added value of further exploit the utility of the ALD as it links segments consisting of limited longitudinal data on a specific age cohort with similar segments from other temporally related age cohort in determining classes of common household structure developmental trend –much as a matching procedure would. In other words, LCA groups observations in line with what one would expect from an ALD that provides an accurate picture of the age related change.

In this sense, LCA helps deflate the importance of Age x Cohort interaction effects within classes, thus hampering the potential cohort differences in developmental trajectories. However, given the different missing patterns of individuals in an ALD, as cohorts differ from one another, LCA may end up classifying the bulk of one cohort in a single class, with marginal contributions to the others. Being the downside of this eventuality the entanglement of age effects with cohort effects.

To circumvent the issue of confounding age with cohort effects, rather than examining a posteriori potential cohort differences in the estimated developmental trajectories – Miyazaki and Raudenbush (2000) referred to this type of examination as the *test of convergence* –, we impose several restrictions in a multiple-group[6] approach to enforce measurement invariance and equal transition probabilities across cohorts, thus controlling for age-cohort effects directly in our model structure.

In other words, by viewing cohorts as subpopulations, we adapted the multiple group approach to estimate classes of trajectories of household structures imposing a common classification scheme. That is, we restricted the model to be fitted to make the probability of belonging to a particular class the same across cohorts –thus making it impossible to predict class from cohort.

### *Multi-group Approach to LCA*

Standard LCA models are characterized by two parameters: the probability of randomly selected individual in the population being in a particular latent class, and the probability of a member of a particular latent class (LC) yielding a particular set of response the observed variables. As an

6 This multi-group analysis is an extension of the standard LCA used to compare the latent structure derived from a set of discrete item responses between multiple groups (Kankaraš, Moors y Vermunt, 2010).

extension to this traditional approach, multi-group LC models assume the presence of three types of categorical variables: observed (indicator) variables, in our case the household demographic markers ($\boldsymbol{M}$), at each of the 9 time points (age bracket of the individual) with two levels ($l$=1,2); an unobserved (latent) variable that accounts for the relationships between the observed variables, this is the class of household structure development $X$ with $S$ classes ($s$=1,2,…,S); and a grouping variable $G$, in our case the cohort to which individuals belong, which is a categorically scored, manifest variable, indexed by $c$=1,..,$C$, that can be associated with both the demographic markers $M_{it}$ and the latent class to which it belongs. The 10 demographic markers $\boldsymbol{M}$ are observed indexed by $i$=1,..,10; and by time point ($t$=1,…,9) with different patterns of missing values in each cohort G. Note that, even though, in principle, we have a set of 12 ninety-way ($M_{1,1}\times\ldots\times M_{10,1}\times M_{1,2}\times\ldots\times M_{10,2}\times\ldots$ $\ldots\times M_{1,9}\times\ldots\times M_{10,9}$) observed contingency tables, no single observation has data on all $\boldsymbol{M}_t$, leaving a lot empty cells in said contingency tables. The multigroup LC model is presented in equation (1):

$$\pi^{\boldsymbol{M}X|G}_{\boldsymbol{l}sc} = \pi^{X|G}_{sc} \; \Pi_i \, \Pi_t \, \pi^{\boldsymbol{M}_{it}|XG}_{lsc} \tag{1}$$

Here $\pi^{\boldsymbol{M}X|G}_{\boldsymbol{l}sc}$ denotes the conditional probability that an individual who belongs to cohort $c$, will be at levels ($l_{1,1}$,…,$l_{10,9}$,$s$) with respect to variables $\boldsymbol{M}$ and $X$. The conditional probability of $X$, taking on the level s for a member of cohort $c$ is denoted with $\pi^{X|G}_{sc}$. Which determines the LC proportion for the cohort $c$. $\pi^{\boldsymbol{M}_{it}|XG}_{lsc}$ is the conditional probability of an individual taking the level $l$ in demographic marker $M_{it}$ for a given class and cohort membership. Note that in the model presented above, all the parameters differ across cohorts, which makes it difficult to compare the results across groups.

In order to make as comparable as possible the data coming from different cohorts, we have restricted equal class specific conditional response probabilities across cohorts. That is, we have imposed equality restrictions on these conditional probabilities. Thus imposing a homogeneous measurement structure across cohorts.

Specifically, all parameters are restricted to be equal across cohorts; that is, the conditional probabilities of items $\pi^{\boldsymbol{M}_{it}X|G}_{ls1} = \pi^{\boldsymbol{M}_{it}X|G}_{ls2} = \ldots = \pi^{\boldsymbol{M}_{it}X|G}_{lsC}$, making the indicator variables independent of the cohort variable when controlled for the latent variable, and the conditional probabilities of the latent variable $\pi^{X|G}_{s1} = \pi^{X|G}_{s2} = \ldots = \pi^{X|G}_{sC}$ .

In other words, we have estimated the case of a completely equivalent model.[7] Note that explicitly imposing these restrictions on the analytical model, cohort differences in age-related

7 We estimate three LCA models in parallel, holding all thresholds equal to obtain a LCA model with measurement invariance and equal transition probabilities.

change in the trajectories of household composition would, in principle, be null. This is not the same as disregard the cohort to which each observation belongs in our models. On the contrary, we have imposed a homogenous model on every cohort, in a probability model in which it's impossible to predict class from cohort. Avoiding the case in which a latent class concentrates the bulk of a particular cohort[8].

Even with these restrictions, the parametric model can be computationally intense and take a nontrivial amount of time to run, because a threshold parameter must be estimated for each of the 90 indicator variables. This model complexity can lead to non-convergence problems or improper solutions in some instances.

To ease the computational burden and convergence of our LCA models, in order to balance the number of observations across cohorts and reduce the number of parameters, data were aggregated for the MHAS-ALD in three different groups according to the decade of birth: G1, cohorts 1-6, basically all respondents born before 1940; G2, cohorts 7-9, roughly all respondents born in the 1940s; and G3, cohorts 10-12, born in the 1950s.

## Results

Since the number of latent classes of living arrangement trajectories is unobserved, it cannot be estimated directly from the MHAS-ALD. Thus, the first step in our analysis is to determine the optimal number of classes of trajectories to analyze. In determining the optimal number of latent trajectories, following a common practice, we have fitted a series of LCA models, with increasing number of latent classes, comparing $k$-class model with ($k$-1)-class model iteratively.

Following Lo, Mendell et al. (2001) and Cortés and Vargas-Chanes (2016), we have used two model fit indices and statistics to determine the number of trajectories to analyze: (2) log-likelihood and (3) Bayes Information Criterion (Schwarz 1978). We haven't used the Lo–Mendell–Rubin likelihood ratio given the complexities of its interpretation under the multigroup approach.

Also, we have examined the quality of latent class membership classification in each of the seven models looking at: (4) A relative entropy criterion (Wedel and Kamakura 2000), which is a rescaled version of Celeux and Soromenho (1996); (5) The relative class size or the percentage of individuals in each class and (6) The range of the probabilities to be assigned to a specific latent class individuals exhibit. In addition, our choice was taken considering also the theoretical meaning and interpretability of the classes estimated in each model in the light of the country's demographics.

8 It is important to note that, even though we use the multigroup LCA to force a latent structure derived from different cohorts, this approach allows researchers to qualify in detail the differences observed across cohorts. Something left for future research and out of the scope of this article.

We have specified up to 5 latent classes.[9] Table 4 reports model fit indices and statistics that suggest the model with 4 classes as a good candidate, given that smaller values of information criterion indices (BIC) indicate a better model fit than that with 3 classes, as well as higher entropy and rate of classification than that achieved with a 5 class model.

**Table 4: Determinants of the optimal number of latent classes of living arrangements trajectories**

| (1)<br>Class | (2)<br>-2xlog-L | (3)<br>BIC | (4)<br>Entropy | (5)<br>Relative Class Size (%) | | | (6)<br>Range of Probabilities | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 581,815 | 582,428 | - | - | - | - | - | - | - |
| 2 | 504,621 | 505,841 | 0.965 | 41% | - | 59% | 0.974 | - | 0.976 |
| 3 | 469,394 | 471,220 | 0.978 | 31% | - | 36% | 0.971 | - | 0.986 |
| 4 | 446,711 | 449,144 | 0.973 | 20% | - | 28% | 0.956 | - | 0.980 |
| 5 | 433,407 | 436,446 | 0.967 | 17% | - | 22% | 0.954 | - | 0.974 |

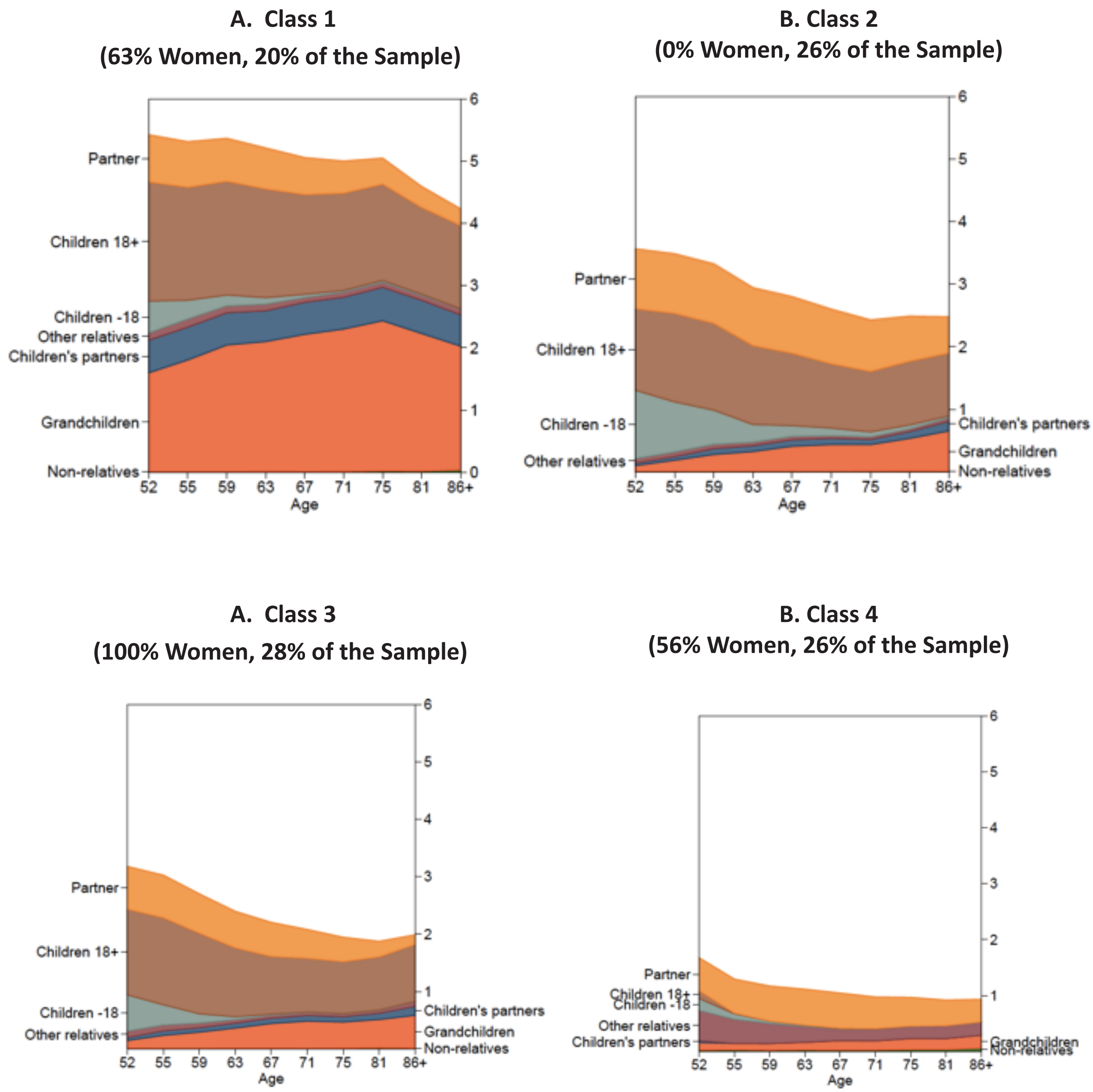
Source: MHAS I-IV.

Even though the 3 class model also seems like a good candidate for analysis, we will discuss the results of the 4 class model since the extra class allows us to look closely at the trends followed by larger households (Class 1 below) separately. As already noted, in the selection of the number of classes is equally important to consider no only the statistical indicators but also de substantive meaning of each class, including the nature and ultimate objective of subsequent analyses.

Figure 1, depict the different developmental trends of the household composition of the Mexican elderly according to Tables 6-9 in Appendix B. There we can see the average composition of the respondent’s household as they grow older –but not the respondents themselves.

9 Due to non-convergence on the global maximum of the likelihood, we show no results for more than 5 latent classes. Note that the eventual non-convergence of these kind of models is something bound to happen as the number of parameters to be estimated grows arithmetically with the number of classes. In this case, a 5 class model already estimates 183 parameters. In this way, every additional class keeps adding computational burden straining the data to the point of non-convergence.

**Figure 1: Living arrangements Trajectories**




Source: MHAS I-IV.

The different panels in Figure 1 present the elderly individual's age along the x-axis, and along the y-axis the average number of other household members, according to their familial relation with the respondent: the number of children, elderly's partners in the household, children, children's partners or spouses, grandchildren, other relatives and non-relatives.

In looking at these results, we can see that Class 1 trajectories include elderly individuals, slightly more women than men, living in the largest households with and average size of 6 persons;

however, the average household size fell from 6.4 at age 52 to 5.2 at ages around 86 (see Figure 1, panel A). Here it is important note that, even though we made no effort to control for locality size, all Classes end up with a distribution that closely follows the national average. That is to say, it is not the case that Class 1 concentrates a relatively larger number of rural households (see Table 5 in Appendix B).

When compared with Classes 2, 3 and 4, it is noteworthy that average household size in Class 1 declines sharply only after 75 years old, whereas among the other Classes a noticeable decline in household size begins quite earlier, around 52 for Class 4 or after 60 years old, as in Classes 2 y 3. Note that Class 1 has the highest average household size, while the size of the average household declines as we move from Class 2 to 4 going from 4.6 to 2.7, respectively.

Households in Class 1 register the highest number of grownup children (aged 18 and over), as well as the highest number of children's partners or spouses, and grandchildren. In 8 out of 10 households in Class 1 we can find three generations living together, and this does not change as the respondents grow older, even though these households tend to get smaller as the respondent turns 75.

While it is true that Classes 2 and 3 also register high numbers of grownup children, unlike those in Class 1, they start mostly single and with hardly any children of their own living with them, although, by the age of 86, we can find a children's partner in 15% of these households and grandchildren in a quarter of them. It is noteworthy that, contrary to Class 1, the presence of grandchildren in these household increases after turning 75 years old.

Class 2, comprised mainly of elderly men, exhibit the highest frequency of underage children, mostly young adolescents. Unlike any of the other Classes, it is still possible to find underage children in 1 out of 10 households by the time respondents turn 67. Households in Class 3 in turn, comprised mainly by women, are slightly smaller and children under 15 are harder to find. The fact that, in these Classes, the average number of underage children living in the household falls more rapidly than the number of grownup children increases, speaks us of the pace at which children, as they grow up, leave the household to go to college or form their own households.

In all 4 Classes we observe common trends: household size, the percentage of households where the elderly's spouse is present, as well as the presence of underage children; all decline as respondents grow older. The case of cohabitation is most notably for elderly women in Class 3. It's important to note that changes in the presences of a partner in the household could mean a combination of either the death of said partner or spouse, or, in some cases, divorce or separation, and the formation of new partnerships. In this sense, the peculiarity of Class 3 may be partially due to the characteristic supermortality of women (women often outlive their spouse) in combination with a higher reluctance to repartner.

In addition, Class 4 stands out as the one with the smallest average household size, but the highest number of other relatives living in the household, growing steadily in proportion from 1.1 to 3.8%. The combination of a growing presence of grandchildren and the decreasing number of children in the household reminds us that U.S. migration is an age-specific phenomenon in many areas of Mexico, which may disrupt traditional living arrangements and increase the likelihood that the elderly live alone and/or with their grandchildren and other relatives.

Also important to note is that, in all 4 trajectories, the percentage of households with grandchildren increases as respondents grow older, and that in ¾ of our sample (except in Class 4) it's possible to find the Mexican elderly living with at least one of their children along the whole period. This might reflect high levels of family caregiving for the elderly and a high degree of continuity in parent-child co-residence trends, such that a parent is likely to live with one or more children (Kanaiaupuni 2000), their children's partner or spouse, and their grandchildren. Although this pattern appears consistent in 3 of the 4 Classes, is most visible in Class 1 which has the largest average household size.

In terms of public and social policy, the results are relevant because parent-child co-residence in Mexico is common due both to structural constraints, fed by economic instability and limited services or institutional coverage for the poor and elderly, and to social norms that emphasize the importance of the family (Kanaiaupuni, 2000; Varley and Blasco, 2003).

At a minimum, these results provide us with additional information to feed the discussions of the dynamics of the Mexican elderly's living arrangements. According to the ultimate research questions researchers might want to address, in combination with goodness-of-fit- indices, it's possible to look into other models, with different number of Classes, to better inform public policy[10].

## Conclusions

In this paper we approach the study of household dynamics and living arrangements of the elderly in Mexico in a novel way in several fronts both methodological and empirical. First, we have shown how, by means of an Accelerated Longitudinal Design, it's possible to further exploit the Mexican Health and Aging Study (MHAS), and surveys like it, in looking at household structures as a crucial determinant of the well-being of older adults. Second, we have also shown how, falling back on Latent Class Analysis (LCA), it's possible to overcome some methodological limitation previously encounter in the empirical literature on household dynamics. Third, we have proposed a way to

10 The estimated 3 Class model, for example, roughly distributes Class 1 into Classes 2 and 3 in the 4 Class model discussed above.

control for cohort effects in an ADL framework by means of a multigroup approach to LCA. Lastly, we have contributed to the empirical literature on household dynamics of the elderly in Mexico estimating typical developmental trajectories of their living arrangements in a 30-year time span; that is, we have estimated the typical full living arrangement histories of the Mexican elderly.

These methodological innovations allow researchers to provide answers to questions concerning the typical living arrangement trajectories that, until this point, have not been addressed. More specifically, the ADL-LCA approach allows us to address questions such as: How likely is it that an elderly person, in a particular living arrangement and at certain point in his/her life is in a particular trajectory of living arrangements? How are living arrangement's developmental trajectories related to age and distributed over the latter part of the life course. Similarly, what is the pace at which these living arrangements change? How long can an individual expect to live in a particular living arrangement before experiencing a significant change?

Overall, our approach and empirical results present a more complex picture of the household dynamics of elderly individuals in Mexico than previous work based primarily on cross-sectional analysis. This new information suggests that public policies that seek to be more effective targeting certain "at-risk" individuals, will do good considering that at risk population may differ from one living arrangement to another. More research, however, is necessary in order to determine why certain individuals are more "at-risk" of experiencing negative health and economic shocks.

It's important to note that here we've used the ADL-LCA approach in a very descriptive way, looking for typical developmental trends in living arrangements, whereas the probability model estimated within this framework easily dovetails with other causal inference and decomposition techniques. This allows for more elaborated models where the search for typical trajectories can be made (conditioned) to directly answer specific questions regarding particular outcomes, such as which living arrangement's developmental trajectories relate to this particular outcome growth curve. As long as sample size and variability of the data set allow for it, analytical possibilities are quite many.

But most importantly, we believe these methodological tools have the potential to stimulate new research agendas, with new questions, that will help our developing societies to keep strengthening our social security networks for the greater good.

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## APPENDIX A

**Figure A: Illustration of MHAS-ALD**

**AGE (SD)**

| COHORT From | COHORT To | 52 (1.1) [50-53] | 55 (1.4) [54-57] | 59 (1.4) [58-61] | 63 (1.4) [62-65] | 67 (1.3) [66-69] | 71 (2.1) [70-73] | 75 (2.3) [74-77] | 81 (4.0) [78-81] | 86 (4.4) [82-] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 1962 | 2012 | 2015 | | | | | | | | Refresh-ment Only |
| 1955 | 1958 | | 2012 | 2015 | | | | | | | |
| 1951 | 1954 | | | 2012 | 2015 | | | | | | |
| 1948 | 1951 | 2001 | 2003 | | 2012 | 2015 | | | | | Original plus Refreshment |
| 1944 | 1947 | | 2001 | 2003 | | 2012 | 2015 | | | | |
| 1940 | 1943 | | | 2001 | 2003 | | 2012 | 2015 | | | |
| 1936 | 1939 | | | | 2001 | 2003 | | 2012 | 2015 | | |
| 1932 | 1935 | | | | | 2001 | 2003 | | 2012 | 2015 | |
| 1928 | 1931 | | | | | | 2001 | 2003 | | 2012 | |
| 1924 | 1927 | | | | | | | 2001 | 2003 | | |
| 1920 | 1923 | | | | | | | | 2001 | 2003 | |
| 1909 | 1919 | | | | | | | | | 2001 | |

**TIME OF MEASUREMENT**

Longitudinal
Cross-Sectional
Time-Lag

## Appendix B

**Table 5: Distribution of the elderly individuals per locality size by class**

| | Classes | | | | |
|---|---|---|---|---|---|
| Locality size | 1 | 2 | 3 | 4 | Total |
| 100,000 - + | 2,302 | 3,055 | 3,369 | 2,826 | 11,552 |
| 15,000 - 99,999 | 502 | 614 | 658 | 566 | 2,340 |
| 2,500 - 14,999 | 396 | 444 | 436 | 482 | 1,758 |
| < 2,500 | 562 | 865 | 796 | 972 | 3,195 |
| Total | 3,762 | 4,978 | 5,259 | 4,846 | 18,845 |

Source: Personal elaboration based on data from MHAS I-IV.

**Table 6: Household structure by age. Class 1**

| Time-periods Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Age (Years) | 51.6 | 54.8 | 58.6 | 62.7 | 66.7 | 71.0 | 75.2 | 80.8 | 86.1 |
| Sex (0 Man 1 Women) | 65.3% | 66.7% | 67.3% | 62.7% | 60.3% | 61.0% | 60.1% | 59.2% | 61.9% |
| Household Size | 6.4 | 6.3 | 6.3 | 6.2 | 6.0 | 6.0 | 6.0 | 5.6 | 5.2 |
| Presence in the Household of (1-Yes 2-No) | | | | | | | | | |
| Children | 98.5% | 97.3% | 97.8% | 97.1% | 94.8% | 97.3% | 98.6% | 97.8% | 96.7% |
| Children less than 6 years old | 2.0% | 1.3% | 0.9% | 0.9% | 0.3% | 0.0% | 0.0% | 0.2% | 0.0% |
| Children between 6 and 11 years old | 8.1% | 4.8% | 2.2% | 1.0% | 0.4% | 0.5% | 0.8% | 0.4% | 0.2% |
| Children between 12 and 14 years old | 12.9% | 6.8% | 3.9% | 2.5% | 1.3% | 0.5% | 0.7% | 0.4% | 0.2% |
| Children between 15 and 17 years old | 22.2% | 15.1% | 9.0% | 4.8% | 2.2% | 1.4% | 0.9% | 0.9% | 0.2% |
| Children between 12 and 17 years old | 31.0% | 19.6% | 11.9% | 6.8% | 3.5% | 1.7% | 1.4% | 1.3% | 0.4% |
| Children 18 years old and over | 97.0% | 95.7% | 96.9% | 96.6% | 94.6% | 97.1% | 98.5% | 97.8% | 96.7% |
| Children 18 years old and over (Students) | 6.6% | 4.2% | 2.8% | 2.3% | 1.0% | 1.0% | 0.4% | 0.8% | 0.7% |
| Children that work | 80.0% | 79.7% | 81.0% | 81.7% | 78.4% | 80.0% | 77.8% | 75.2% | 72.2% |
| Children 18 years old and over that work | 78.8% | 78.6% | 80.4% | 81.3% | 78.3% | 79.9% | 77.8% | 75.2% | 72.2% |
| Children's partners | 45.7% | 46.3% | 46.7% | 44.5% | 45.9% | 46.7% | 49.7% | 50.4% | 48.3% |
| Death of a Household member | 0.3% | 1.7% | 2.2% | 3.6% | 3.7% | 4.0% | 3.2% | 4.3% | 4.4% |
| Partner of ego | 75.8% | 73.1% | 68.7% | 65.7% | 59.0% | 51.4% | 41.5% | 33.6% | 26.5% |
| Nonrelatives | 1.0% | 1.1% | 0.8% | 1.3% | 0.9% | 1.2% | 2.1% | 1.8% | 2.7% |
| Other relatives | 89.1% | 92.3% | 96.9% | 94.7% | 93.7% | 93.5% | 97.7% | 96.6% | 89.8% |

**Table 6 (continued)**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ascendants | 4.3% | 5.2% | 4.2% | 2.6% | 1.3% | 1.0% | 0.6% | 0.8% | 1.8% |
| Further descendants | 81.0% | 85.4% | 91.9% | 90.6% | 90.2% | 89.9% | 94.6% | 92.5% | 83.1% |
| Partner female under 41 | 1.5% | 0.4% | 0.1% | 0.1% | 0.1% | 0.2% | 0.1% | 0.0% | 0.0% |
| Partner's death | 1.6% | 1.6% | 1.6% | 4.5% | 5.6% | 6.2% | 7.8% | 7.1% | 6.4% |

Source: Personal elaboration based on data from MHAS I-IV.

**Table 7: Household structure by age. Class 2**

| Time-periods Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Age (Years) | 51.6 | 54.7 | 58.6 | 62.8 | 66.6 | 70.8 | 75.0 | 80.4 | 85.5 |
| Sex (0 Man 1 Women) | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Household Size | 4.6 | 4.5 | 4.3 | 3.9 | 3.8 | 3.6 | 3.4 | 3.5 | 3.5 |
| Presence in the Household of (1-Yes 2-No) | | | | | | | | | |
| Children | 96.3% | 95.7% | 90.4% | 80.8% | 73.4% | 67.1% | 65.4% | 69.2% | 72.9% |
| Children less than 6 years old | 7.6% | 4.2% | 3.0% | 1.5% | 1.0% | 0.9% | 0.3% | 0.4% | 0.2% |
| Children between 6 and 11 years old | 23.1% | 15.4% | 9.4% | 5.1% | 3.2% | 2.8% | 1.3% | 1.1% | 0.2% |
| Children between 12 and 14 years old | 25.6% | 19.5% | 13.1% | 6.7% | 3.9% | 2.7% | 1.8% | 1.8% | 0.9% |
| Children between 15 and 17 years old | 36.6% | 28.8% | 20.6% | 11.6% | 6.6% | 3.5% | 2.8% | 1.4% | 1.1% |
| Children between 12 and 17 years old | 50.6% | 39.8% | 28.3% | 15.8% | 9.1% | 5.3% | 4.2% | 2.9% | 1.7% |
| Children 18 years old and over | 75.5% | 81.2% | 79.0% | 74.1% | 69.2% | 64.0% | 62.9% | 66.9% | 71.8% |
| Children 18 years old and over (Students) | 18.1% | 16.4% | 11.7% | 8.4% | 5.5% | 3.2% | 1.6% | 0.9% | 0.6% |
| Children that work | 51.5% | 57.1% | 59.4% | 58.0% | 55.8% | 50.0% | 48.4% | 50.6% | 50.0% |
| Children 18 years old and over that work | 48.7% | 54.7% | 57.7% | 56.7% | 55.0% | 49.6% | 48.1% | 50.3% | 49.8% |
| Children's partners | 3.8% | 5.5% | 8.4% | 8.5% | 9.7% | 9.4% | 7.0% | 10.4% | 14.4% |
| Death of a Household member | 0.3% | 0.9% | 1.6% | 2.8% | 2.3% | 2.8% | 2.6% | 3.1% | 3.2% |
| Partner of ego | 95.6% | 95.2% | 94.9% | 92.4% | 89.6% | 86.7% | 82.1% | 71.7% | 57.6% |
| Nonrelatives | 0.6% | 0.5% | 0.4% | 0.7% | 0.7% | 0.7% | 0.8% | 0.8% | 1.1% |
| Other relatives | 12.7% | 16.6% | 22.5% | 22.9% | 25.6% | 25.9% | 23.4% | 27.0% | 31.7% |
| Ascendants | 3.3% | 3.5% | 2.8% | 2.5% | 1.7% | 1.3% | 1.0% | 0.8% | 0.7% |
| Further descendants | 6.3% | 10.1% | 15.3% | 17.2% | 20.4% | 21.9% | 20.0% | 23.6% | 27.8% |
| Partner female under 41 | 9.6% | 5.9% | 4.3% | 2.3% | 1.3% | 1.2% | 0.6% | 0.6% | 0.4% |
| Partner's death | 0.0% | 0.4% | 0.5% | 1.7% | 3.0% | 3.8% | 5.7% | 10.9% | 11.2% |

Source: Personal elaboration based on data from MHAS I-IV.

**Table 8: Household structure by age. Class 3**

| Time-periods Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Age (Years) | 51.5 | 54.7 | 58.5 | 62.7 | 66.6 | 70.9 | 75.0 | 80.7 | 85.6 |
| Sex (0 Man 1 Women) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Household Size | 4.2 | 4.0 | 3.7 | 3.4 | 3.2 | 3.1 | 2.9 | 2.9 | 3.0 |
| Presence in the Household of (1-Yes 2-No) | | | | | | | | | |
| Children | 0.5% | 0.2% | 0.2% | 0.2% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% |
| Children less than 6 years old | 9.9% | 3.7% | 1.8% | 0.8% | 0.5% | 0.2% | 0.2% | 0.0% | 0.0% |
| Children between 6 and 11 years old | 16.2% | 9.1% | 3.1% | 1.3% | 0.3% | 0.2% | 0.0% | 0.2% | 0.0% |
| Children between 12 and 14 years old | 29.1% | 19.1% | 9.8% | 2.4% | 0.8% | 0.2% | 0.2% | 0.3% | 0.2% |
| Children between 15 and 17 years old | 37.6% | 24.2% | 11.8% | 3.5% | 1.0% | 0.4% | 0.2% | 0.5% | 0.2% |
| Children between 12 and 17 years old | 83.6% | 87.5% | 83.5% | 75.5% | 65.1% | 63.6% | 64.4% | 70.3% | 77.8% |
| Children 18 years old and over | 19.1% | 15.3% | 9.8% | 4.4% | 1.7% | 1.1% | 0.7% | 0.4% | 0.2% |
| Children 18 years old and over (Students) | 58.7% | 64.4% | 63.2% | 61.0% | 53.6% | 50.3% | 48.6% | 49.5% | 48.9% |
| Children that work | 55.8% | 62.6% | 62.5% | 60.7% | 53.5% | 50.3% | 48.5% | 49.3% | 48.9% |
| Children 18 years old and over that work | 4.7% | 7.2% | 7.3% | 8.1% | 8.8% | 9.4% | 9.0% | 10.5% | 15.3% |
| Children's partners | 0.2% | 1.4% | 1.8% | 3.2% | 3.1% | 3.1% | 2.7% | 4.0% | 3.0% |
| Death of a Household member | 74.3% | 73.8% | 68.2% | 63.3% | 59.1% | 49.8% | 42.4% | 26.9% | 16.6% |
| Partner of ego | 0.7% | 0.6% | 0.6% | 0.6% | 0.9% | 0.6% | 1.2% | 1.4% | 1.5% |
| Nonrelatives | 16.5% | 21.4% | 22.4% | 23.7% | 26.1% | 27.2% | 26.2% | 28.5% | 31.9% |
| Other relatives | 4.8% | 4.2% | 3.4% | 2.2% | 1.4% | 1.1% | 0.3% | 0.2% | 0.2% |
| Ascendants | 7.9% | 12.6% | 15.3% | 18.1% | 21.6% | 23.4% | 22.6% | 24.6% | 26.6% |
| Further descendants | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Partner female under 41 | 1.1% | 1.8% | 2.6% | 5.1% | 6.8% | 8.2% | 9.5% | 14.8% | 7.2% |
| Partner's death | 0.5% | 0.2% | 0.2% | 0.2% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% |

Source: Personal elaboration based on data from MHAS I-IV.

**Table 9: Household structure by age. Class 4**

| Time-periods Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Age (Years) | 51.7 | 54.9 | 58.7 | 62.6 | 66.7 | 71.1 | 75.1 | 80.9 | 85.7 |
| Sex (0 Man 1 Women) | 58% | 58% | 58% | 56% | 54% | 53% | 54% | 54% | 56% |
| Household Size | 2.7 | 2.3 | 2.2 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 | 1.9 |
| Presence in the Household of (1-Yes 2-No) | | | | | | | | | |
| Children | 25.5% | 8.3% | 3.1% | 1.6% | 1.6% | 0.7% | 0.2% | 0.2% | 0.1% |
| Children less than 6 years old | 1.3% | 0.5% | 0.3% | 0.2% | 0.1% | 0.0% | 0.0% | 0.0% | 0.1% |
| Children between 6 and 11 years old | 4.9% | 1.6% | 0.5% | 0.6% | 0.2% | 0.1% | 0.1% | 0.0% | 0.0% |
| Children between 12 and 14 years old | 7.2% | 2.5% | 0.7% | 0.5% | 0.1% | 0.0% | 0.2% | 0.1% | 0.0% |
| Children between 15 and 17 years old | 6.1% | 4.0% | 1.9% | 0.4% | 0.1% | 0.1% | 0.0% | 0.1% | 0.1% |
| Children between 12 and 17 years old | 11.4% | 5.8% | 2.3% | 0.8% | 0.3% | 0.1% | 0.2% | 0.2% | 0.1% |
| Children 18 years old and over | 11.3% | 1.3% | 0.3% | 0.4% | 1.1% | 0.6% | 0.0% | 0.0% | 0.0% |
| Children 18 years old and over (Students) | 0.5% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Children that work | 7.1% | 0.2% | 0.2% | 0.0% | 0.6% | 0.1% | 0.0% | 0.0% | 0.0% |
| Children 18 years old and over that work | 6.3% | 0.1% | 0.1% | 0.0% | 0.6% | 0.1% | 0.0% | 0.0% | 0.0% |
| Children's partners | 3.3% | 0.1% | 0.0% | 0.1% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| Death of a Household member | 0.5% | 2.5% | 2.0% | 3.5% | 3.4% | 2.9% | 2.0% | 1.9% | 1.4% |
| Partner of ego | 59.0% | 60.3% | 62.3% | 63.9% | 62.4% | 56.4% | 51.3% | 45.6% | 40.0% |
| Nonrelatives | 1.1% | 1.5% | 1.1% | 1.7% | 1.5% | 1.6% | 1.7% | 2.2% | 3.8% |
| Other relatives | 32.5% | 25.7% | 24.5% | 22.4% | 20.6% | 19.1% | 19.0% | 19.3% | 20.9% |
| Ascendants | 15.2% | 11.3% | 9.3% | 6.8% | 2.7% | 1.5% | 0.5% | 0.2% | 0.0% |
| Further descendants | 8.6% | 6.9% | 8.0% | 8.7% | 10.6% | 10.3% | 10.4% | 9.9% | 12.1% |
| Partner female under 41 | 2.2% | 1.1% | 0.7% | 0.3% | 0.1% | 0.0% | 0.0% | 0.2% | 0.2% |
| Partner's death | 0.0% | 1.5% | 2.2% | 1.6% | 4.2% | 5.4% | 5.0% | 10.1% | 6.6% |

Source: Personal elaboration based on data from MHAS I-IV.

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