Introduction

The population of Mexico today has more adults aged 60 and older than children younger than five. Even so, the proportion of older adults as a share of the total population is significantly lower in Mexico than in high income countries. However, Mexico and other countries in the region of Latin America are undergoing a period of accelerated aging that is partly due to the fast pace at which mortality rates dropped after 1930, and partly to the more-recent sudden drop in fertility rates. In the last 20 years, research on aging has accelerated as well and the scientific community has benefitted from having new sources of information and databases. Longitudinal surveys on health and aging with multiple purposes and with a wide socioeconomic perspective emerged in several countries, and Mexico was no exception. The purpose of these studies is to generate knowledge to improve the quality of life of older adults, producing databases and facilitating their use among the scientific community. Several attributes of population studies of older adults are highly desirable, among them a multidisciplinary content, a longitudinal design, and national representation in the samples. Studies that have these traits enable the study of the dynamics of aging, including changes in physical and mental health, disability, labor force participation, and other social, economic, family and well-being conditions that are influenced by aging. The editorial piece in this volume, by Eduardo Sojo, President of the National Institute of Statistics and Geography (INEGI), highlights the unique aspects and contributions of this type of study for researchers and policy makers.

This special volume of *Salud Pública de México* presents a series of research papers that use the databases of the *Mexican Health and Aging Study (MHAS),* also known by its name in Spanish, *Estudio Nacional de Salud y Envejecimiento en México (Enasem)*. The study includes a national longitudinal survey on health and well-being applied to a sample of adults aged 50 and older (approximately 15 000 persons). To date the panel has completed three waves that extend over the period 2001 to 2012; more than 3 000 deaths have occurred among the study participants, enabling in-depth studies of phenomena related to adult morbidity and mortality. The databases and documentation are made available to the scientific community usually one year after the completion of each wave.

In June 2013, co-sponsored by the Mexican National Institute of Geriatrics, a workshop on analysis of longitudinal data on aging was held in Mexico City. As part of the event, several researchers presented results of research projects on aging using data from the MHAS/Enasem. A subset of these papers was selected for publication in the current special volume, after undergoing peer review according to the requirements of the journal.

The first paper is presented by Wong, Palloni and co-authors, a descriptive summary of the background, justification and design of the MHAS/Enasem, the longitudinal traits, thematic content, and fieldwork of the three study waves that have been completed, as well as the main results of the third wave that was completed in 2012 and the plans for the fourth wave in 2015. The relatively high response and follow-up rates achieved in the panel survey are highlighted –much higher than those observed in other similar studies, and which are critical for all longitudinal studies. The authors point out how the successful completion of the third wave firmly established the study, enabling the empirical estimation of time-trajectories of health conditions and behaviors with a multidisciplinary perspective and specifically a wide socioeconomic approach. The analytical potential of the databases is illustrated by the selection of main results presented and the publications that are cited, covering a wide variety of topics in aging. The study

website is mentioned as an important tool to accomplish one of the objectives of the MHAS/Enasem: to disseminate and foster the utilization of the databases for research and evidence-based policy formulation.

Mejía-Arango, Michaels-Obregón and co-authors present a paper on older adult cognition. This is a descriptive analysis of great value and important to the users of the MHAS/Enasem data. The paper presents a summary of the cognition exercises that have been applied in the three waves of the longitudinal study, the cognitive domains covered, the way in which the exercises have changed and can be compared across the three waves, the scoring method to obtain cognition scores, and the cut-off points used to classify respondents according to a cognition scale (normal, mild impairment, moderate impairment, severe impairment). The cut-off points are provided by age, sex and education groups of the MHAS/Enasem respondents. Because of this paper, the data users will be able to make better informed decisions about how to use the cognition scores and cut-off points for their models of health and well-being in older adults. The topic of cognitive aging and dementia have quickly gained importance over the last decade, so that having the cognitive follow up of a national sample of older adults in Mexico represents a great analytical advantage.

In the paper by Beltrán Sánchez, Andrade and Riosmena, the authors indicate how substantial changes that impact older adults occurred in Mexico through the decade covered by the study. These structural changes may have influenced the knowledge, understanding, and treatment of two chronic illnesses of high prevalence: diabetes and hypertension. On the one hand, older adults who reach age 60 or older are successively achieving higher levels of education. On the other hand, the coverage of health insurance increased significantly in particular due to the emergence of *Seguro Popular*, a universal health insurance program that started circa 2003-2004. The research question is whether there was a noticeable change over time in the propensity to self-report the diseases or to use medications to treat them, and if these changes can be attributed mostly to an increase in the population's education or the population's health insurance coverage. The empirical analysis uses the 2001 and 2012 surveys, finding that the propensity to treat the diseases with medication increased over the decade, and in general the majority of this change was due to the *effect* of having health insurance rather than the use of medications for treatment. Important differences in these general findings are reported by age groups and gender. This research question is significant in that the ability of older adults to manage diseases determines not only the likelihood of living longer but also the possibility of maintaining good quality of life during old age.

The next paper, by Pinto and Beltrán Sánchez, deals with the relationship between obesity and overweight and the new cases of diabetes mellitus that emerge among adults aged 50 and over. The authors use longitudinal data covering the period 2001 to 2012 to examine the effect of body mass index, health behaviors, and social determinants at baseline over the incidence of diabetes over time. The models highlight the effect of genetic predisposition to the risk of diabetes, measured through the self-report of whether a parent or sibling has diabetes. The relatively high prevalence of older adults who are overweight or obese is noted, about 40 percent and 20 percent of adults aged 50 and older, respectively. The results show a significant effect of overweight and obesity on the development of new cases of diabetes mellitus. Controlling for covariates, obesity at baseline triples the risk of new diabetes in eleven years; overweight and genetic predisposition double this risk. An important finding for public health is that the younger cohorts, those aged 50-59, have a relatively higher risk of developing diabetes mellitus than adults aged 60 or older.

The paper by Palloni, Beltrán Sánchez, Novak and co-authors continues with the theme of overweight and obesity and estimates the effect of these conditions on survival of older adults, both in direct and indirect ways through diseases, mainly diabetes. Data from the three waves of the MHAS/Enasem are used and comparisons are made between the objective and self-reported height and weight to capture overweight and obesity. The comparisons reveal highly consistent results with the two measures, confirming previous literature that suggests consistency between the self-report of height and the objective measures of weight in the MHAS/Enasem. The authors estimate that current older adults lose on average 1.5 to 2 years of life expectancy at age 50 due to overweight and obesity. The study of the consequences of excessive body weight for mortality is important, given that other researchers suggest that at least overweight has a protective effect for survival in old age. This paper presents empirical evidence of the negative effects of overweight and obesity, in particular through an increased propensity to develop chronic diseases that are in turn negatively related with the probability of survival. The authors suggest that the estimates obtained are conservative, given that if other indirect costs of the conditions—such as loss of income due to illnesses—were considered, the cost to society of overweight and obesity would be much higher.

Next, the research paper by Kumar, Karmakar, Tan and co-authors uses time-proportional risk methods

to estimate the effect of overweight and obesity on the incidence of functional limitations or physical disability over the eleven years covered by the study. The topic has great significance for Mexico given the high prevalence of overweight and obesity and the co-morbidities associated with these conditions which impact disability. The authors use data on older adults aged 50 and over from the three waves of the MHAS/Enasem to consider loss of independent function in activities of daily living, such as bathing, eating, getting dressed, and using the toilet. Among individuals who start the study without physical limitations, the relationship between body mass and the risk of subsequent disability follows a U-shape. The propensity to develop disability is lower among individuals who are overweight at the beginning of the period, compared to those with low-weight, normal weight or obese. Previous literature findings for other countries are confirmed: overweight seems to show a protective effect for survival among older adults.

The paper by González-González, Palloni and Wong examines the relationship between the type of diseases reported by older adults at baseline and the risk of dying over time. The epidemiological transition has manifested in the Mexican population, as chronic diseases have become more important while infectious diseases have been losing relative importance. However, as the transition has not been homogeneous across groups of the population, this research aims to document whether infectious diseases still show a noticeable effect on adult mortality, and to assess the increased risk of having both chronic and infectious diseases on mortality, independent of other factors. The authors use data from the three waves of the MHAS/Enasem to estimate the risk of mortality with proportional hazard models. Results indicate a higher risk of mortality when an individual suffers from both types of disease, with the main diseases being cancer, stroke, and diabetes (as chronic) and kidney infection and pneumonia (as infectious). These diseases at baseline are associated with the highest risk of dying at follow-up. The results underscore the importance of public policy programs that can incorporate monitoring and control of both types of diseases, which still coexist in developing country societies with high levels of inequality, in particular older adults' vaccination programs.

In the next paper, Sáenz and Wong use a life-cycle perspective to identify how socioeconomic status at early ages and educational achievement are associated with the risk of mortality in middle- and old-age. Previous studies of this association, conducted mainly in developed countries, have established that factors that reflect childhood and adolescence conditions (such as educational achievement, migration, employment, and economic status) predetermine later exposures to mortality risk factors in old age. Data from the three waves of MHAS/Enasem are used to capture the economic status in early age, as well as covariates over the young adult ages. Mortality risk is estimated from the baseline observation until the moment of death, separating the sample in two age cohorts: those born before and after 1940. Using proportional hazard models, the authors find no effects of childhood socioeconomic conditions on the risk of dying after age 50. However, educational achievement is indeed associated with the risk of death, and the effect varies by age cohort. These implications are important given the speed at which access to education has been increasing over successive generations in Mexico.

In turn, Díaz-Venegas, de la Vega Estrada and coauthors describe the progression in functional limitations in the population of older adults and the main sociodemographic determinants of this progression. The activities of daily living (ADL's) are well-established indicators of functionality, and the authors consider five ADL's (eating, bathing, dressing, using the toilet, and getting in and out of bed) to obtain an index of functional limitations. With the panel data from 2001 to 2012 and multivariate models, the number of ADL limitations among adults aged 60 and older in 2012 is modeled. Main findings include: first, difficulty with dressing is the ADL limitation with the highest prevalence in all three waves of the MHAS/Enasem. Second, the presence of depressive symptoms at baseline is associated with more physical limitations in subsequent years. Third, there are social disparities in disability such that those with higher educational achievement have fewer functional limitations at follow-up. The study underlines the need for deeper knowledge on how each ADL limitation progresses in order to develop public policy to minimize the negative consequences of old-age physical disability.

The manuscript by Aguilar-Navarro, Amieva, Gutiérrez-Robledo and Ávila Funes deals with the prevalence of frailty. This is a clinical syndrome that has been found to predict functional deterioration and death among older adults. MHAS/Enasem provides an opportunity to examine whether this predictive power is upheld or improved in a study using a national sample or older adults with 11-year follow-up. The population of the study was defined by the presence of the phenotype that includes: recent weight loss, weakness, excessive tiredness, slow walking, and low physical activity. With combinations of these conditions, the population is characterized as no-frailty, pre-frail, and frail. Using the surveys 2001 to 2012 as well as multivariate and proportional hazard models to control for socioeconomic and health factors, the authors examine the predictive

power of frailty status at baseline to model subsequent loss of functional capacity and mortality. The results indicate that four out of ten adults aged 60 and older are frail, and that the condition is a strong predictor of the development of functional limitations and death after controlling for other characteristics. Thus the study confirms the predictive power of the frailty phenotype after a follow-up of over 10 years in a population of Mexican older adults. The paper concludes with possible future work to continue advancing this line of research.

The paper presented by Salinas examines the influence of the health care reform initiative by the Mexican government, *Seguro Popular*, which started circa 2004, on the health of older adults from 2001 to 2012. This topic has great research potential with the MHAS/Enasem database, because the study contains observations before and after this important reform started in Mexico. This paper focuses on preventive health care among individuals aged 50 and older, compared across four groups: those with new recent access to health insurance, those who start and end with access, those starting and ending without access, and the (few) cases who have coverage at the beginning but had lost it by the end of the period 2001 to 2012. The analyses include use of vaccinations; screening tests for prostate, breast and cervical cancers; and tests such as cholesterol, glucose, and blood pressure. The results indicate that more than half of the population of older adults without health insurance in 2001 was covered by *Seguro Popular* by 2012. There was a generalized increase in the utilization of preventive services over the period for all the population, whether or not they had health insurance. Even though there was a substantial increase in insurance coverage, socioeconomic disparities prevail with respect to coverage and the use of vaccines and preventive measures. There remains a minority of people without health insurance in 2012, and these older adults live mostly in rural areas of the country. In general, however, the author finds a positive influence of *Seguro Popular* on the use of preventive interventions for older adults.

The research papers presented in this volume were developed by both young and established researchers, with a multidisciplinary mix and using statistical techniques that illustrate the variety of thematic interests, approaches and methods that can be used, and the overall analytical potential of the MHAS/Enasem database. The study is vast and fundamental for the development of the research agenda on aging in Mexico, in particular for issues such as the cost of health care and caregiving, socioeconomic disparities, family and social networks, occupational histories, migration experiences, and multiple other socioeconomic determinants of well-being as people age. We hope that this volume will generate the keen interest that the topic of population aging deserves in the scientific community, so as to continue to develop research and interventions to improve the quality of life of both current and future older adults in Mexico.

In closing, we would like to acknowledge the scientific influence of Dr. Richard Suzman, of the US National Institute on Aging (NIA) of the National Institutes of Health, in our multidisciplinary studies of aging. At the time of going to press, we learned of his death. He was one of the key proponents of producing high-quality population-based data, with open access, in order to advance research on aging of the human race. He served as Director of the Division of Behavioral and Social Research at the NIA, and played a central role in mobilizing interest around and creating a global network of multidisciplinary surveys on aging, starting with the Health and Retirement Study in the United States, and including the Mexican Health and Aging Study in Mexico and similar studies in many other countries. His vision of global inclusion and his voice for rigorous research will continue to inspire researchers of population aging for years to come.

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