

Calculator

Dependency Prevalence
and Need to Receive
Long-term Support

CALCULATION METHODOLOGY



The calculator is an adapted version of models that estimate the future prevalence of dependence and the probability of receiving long-term support (González-González, forthcoming).¹

The calculator was created based on a multinomial logistic regression model to analyze the determinants of future dependence ([model 1](#)) and a logistic regression model to analyze the determinants of receiving or not receiving support, based on being in a situation of dependence ([model 2](#)). The methodology was designed based on data from the National Health and Aging Study (*Encuesta Nacional sobre Salud y Envejecimiento en México* - ENASEM) a nationally representative panel of adults over 50 in Mexico.

The estimates allow for identifying the probability of being in a situation of dependency and, for those who are already dependent, understanding who is more likely to receive support. In addition, the calculator allows the user to see how the change in certain risk behaviors (such as smoking or drinking alcohol), or the presence of chronic diseases, affect these probabilities.

THE MODEL



We used a multinomial logistic regression model to analyze the determinants of future dependence ([model 1](#)) and a logistic regression model to analyze the determinants of receiving or not receiving support, based on being in a situation of dependency ([model 2](#)). The models are defined as follows:

1

$$\ln \frac{\Pr(D_{i,12}=MD,SD,DH)}{\Pr(D_{i,12}=ND)} = b_1 \cdot de_{i,01} + b_2 \cdot se_{i,01} + b_3 \cdot CND_{i,01} + b_4 \cdot R_{i,01}$$

2

$$\Pr(apoyo_{i,12} = 1) = b_1 \cdot de_{i,01} + b_2 \cdot se_{i,01} + b_3 \cdot DS$$

¹ See César González-González, Marco Stampini, Gianluca Cafagna, M. Carmen Hernández Ruiz, and Pablo Ibarrarán (forthcoming), "Simulaciones del costo de un sistema de apoyo para los adultos mayores en situación de dependencia en México," Inter-American Development Bank, Washington, DC.

The dependent variable of the first model, the level of dependence in 2012 ($D_{i,12}$), is defined based on an adapted version of the Katz index (Katz *et al.*, 1963)² that considers the following basic activities of daily living (ADLs):

- Walk from one side of the room to the other
- Bathe in a tub or shower
- Eat (for example, cut your own food)
- Lie down and get out of bed
- Use the toilet (including getting on or off or squatting)
- Getting dressed

Each of these variables was dichotomized, with code 0 assigned if the respondent reported having no difficulty performing the activity and code 1 assigned if the respondent reported having difficulty. The dependency level variable includes four categories:

- No dependency (*ND*, if the respondent reported having no difficulty with any ADLs)
- Mild dependence (*MD*, if the respondent reported having difficulty with one or two ADLs)
- Severe dependence (*SD*, if the respondent reported having difficulty with three ADLs or more)
- Deceased (*DH*, if the respondent died between 2001 and 2012)

Consistent with other studies (Díaz-Venegas *et al.*, 2016)³, death was included among the categories of the dependent variable to avoid a selection bias for survival. Unlike González-González *et al.*, (forthcoming), for the calculator three sub-models were estimated, one for each of the levels of initial dependence (non-dependence, mild dependence, and severe dependence).

The dependent variable used for model 2 is a dichotomous variable with two categories: 1) receives support, and 2) does not receive support. By definition, only respondents with dependency can receive support. There was no difference between paid support and support without payment.

The independent variables of model 1 include demographic characteristics (*de*), socioeconomic characteristics (*se*), chronic noncommunicable diseases (*CND*), and behaviors and risk factors (*R*), all measured in 2001.

In model 2, the demographic and socioeconomic characteristics measured in 2001 and the level of dependency observed in 2012 are included as independent variables.

Here the independent variables of the models are presented in detail. Demographic characteristics include age categorized into decennial groups (50-59, 60-69, 70-79, 80 years and older) and gender (a dichotomous variable equal to 1 for men). The socioeconomic characteristics include only the level of education (none, incomplete primary, complete primary, more than primary education), unlike the original model that also included other variables.⁴

Chronic self-reported noncommunicable diseases include hypertension, arthritis, diabetes, heart attack, stroke, lung disease, and cancer. Risk factors and behaviors include tobacco use (never smoked, used to smoke, currently smoke), alcohol consumption (never drank,⁵ used to drink, currently drink), body mass index (underweight or normal, overweight, obese) and having fallen or not in the two years prior to the survey. The level of dependency in 2012 included in model 2 is based on the categories “mild dependence” and “severe dependence,” since in the estimation of this model only older adults are considered dependent.

The coefficients resulting from both models are used to estimate the probabilities of dependence (non-dependence, mild, and severe) and the probability of receiving support.

² Katz, S., Ford, A. B., Moskowitz, R. W., Jackson, B. A., y Jaffe, M. W. 1963. “Studies Of Illness In The Aged. The Index Of Adl: A Standardized Measure Of Biological And Psychosocial Function”. Journal of the American medical association, 185: 914-919.

³ Díaz-Venegas, C., Reistetter, T. A., y Wong, R. 2016. “Differences in the Progression of Disability: A U.S.-Mexico Comparison”. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 73(5): 913-922.

⁴ Incomplete primary education corresponds to less than 6 years of schooling; complete primary education corresponds to 6 years of schooling; more than primary education corresponds to more than 6 years of schooling.

⁵ Used to smoke corresponds to having smoked more than 100 cigars in their lifetime.

DATA

Data to design the calculator came from ENASEM. The goal of ENASEM is to design, collect, and disseminate data to achieve various research objectives that include aging processes, diseases, and the burden of disability of older Mexican adults (Wong *et al.*, 2015⁶).⁷ In 2001, the baseline survey was conducted with national representation of adults born in 1951 or earlier. Follow-up surveys were conducted in 2003, 2012, and 2015.

To estimate the determinants of dependency and future support, data from the 2001 and 2012 ENASEM surveys were used. The sample used for the estimations includes persons interviewed in 2001 who were once again interviewed in 2012, or for whom there were death certificates indicating that those persons died between those years.

The sample of the multivariate analysis of the determinants of future dependence includes a total of 11,109 people. Interviewees in 2001 that were not in the 2012 follow-up because they were not located or refused to participate were excluded from the sample. The first sub-model (no current dependence) used a sample of 10,018 persons, the second (current slight dependency) 678 persons, and the last (moderate current dependence) 413 persons.

The analysis of the determinants of receiving or not receiving support considered only those persons age 50 and over interviewed in 2001 who were found to be dependent in 2012 (n=2,447). We excluded 150 respondents for missing values in the independent variables, so the final sample included 2,297 respondents.

⁶ Wong, R., Michaels-Obregón, A., Palloni, A., Gutiérrez-Robledo, L. M., González-González, C., López-Ortega, M., Téllez-Rojo, M. M., y Mendoza-Alvarado, L. R. 2015. "Progression of aging in Mexico: The Mexican health and aging study (MHAS) 2012". *Salud Pública de México*, 57(2015), S79-S89.

⁷ For more details about ENASEM, see: <http://www.mhasweb.org>.

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