WORKING PAPER Nº IDB-WP-1723

Care Dependence and Hospitalizations: Evidence from the Mexican Health and Aging Study

Mayra Sáenz
Marco Stampini
Natalia Aranco

Inter-American Development Bank
Social Protection and Labor Markets Division

August 2025

Care Dependence and Hospitalizations: Evidence from the Mexican Health and Aging Study

Mayra Sáenz*
Marco Stampini**
Natalia Aranco**

* Department of Economics at Universidad del Rosario, Colombia
** Social Protection and Labor Markets Division, Inter-American Development Bank

Inter-American Development Bank
Social Protection and Labor Markets Division

August 2025

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library
Saenz, Mayra.
Care dependence and hospitalizations: evidence from the Mexican health and aging study / Mayra Saenz, Marco Stampini, Natalia Aranco.
p. cm. — (IDB Working Paper Series ; 1723)
Includes bibliographical references.
1. Long-term care facilities-Mexico. 2. Medical care-Government policy - Mexico. 3. Population aging-Government policy-Mexico. 4. Continuum of care-Government policy-Mexico. 5. Older people-Care-Mexico. I. Stampini, Marco. II. Aranco, Natalia. III. Title. IV. Series.
IDB-WP-1723

JEL C odes: I10; J14; H5; J18.

Key words: Long-Term Care, Older Adults, Prolonged Hospitalizations, Care Needs, Population Aging, IDB Cares, Public Policy, Mexico.

http://www.iadb.org

Care Dependence and Hospitalizations: Evidence from the Mexican Health and Aging Study

Mayra Sáenz, Marco Stampini, Natalia Aranco [1]

August 21, 2025

Abstract - We study the effect of care dependence on hospitalizations among older people in Mexico, analyzing data from the Mexican Health and Aging Study (MHAS) from 2001 to 2021. We use fixed-effects logistic regression to estimate the average marginal effects on the probability of hospitalization during the last year (yes/no) and high-dimensional fixed-effects models to assess the percentage change in its duration (number of nights at the hospital). Our analysis reveals that difficulties with Activities of Daily Living (ADLs) and/or Instrumental Activities of Daily Living (IADLs) increase both the risk and the duration of hospitalizations. Key findings include a significant increase in the probability of hospitalization by 5.2 to 11.4 percentage points for individuals with 1–2 ADL impairments (relative to persons without impairments) and 8.6 to 17.9 percentage points for individuals with three or more ADL impairments. For IADL impairments, the probability of hospitalization increases by 6.1 to 12.7 percentage points for those with 1–2 limitations and 11.6 to 22.8 percentage points for those with three or more limitations. We also find evidence of a significant effect on the duration of the hospitalization (conditional on being hospitalized), which increases by 13.4% for persons with 1-2 ADL impairments, and 22.7% for individuals with 3 or more ADL impairments. For IADLs, hospitalization duration increases by 12.6% to 17.5%, although the latter is only significant at the 10% level. These results underscore the necessity for targeted interventions that reduce both the frequency and duration of hospitalizations among older people with care needs, for example, through greater provision of long-term care and better coordination between healthcare and long-term care services.

JEL classification: I10, J14, H5, J18.

Keywords: prolonged hospitalizations; care needs; long-term care; population aging; older adults; public policy; Mexico.

[1] Mayra Sáenz is an Assistant Professor in the Department of Economics at Universidad del Rosario in Colombia; Natalia Aranco and Marco Stampini are with the Social Protection and Labor Markets Division of the Inter-American Development Bank (IDB). Email: mayra.saenz@urosario.edu.co, mstampini@iadb.org, nataliaara@iadb.org. The authors thank Pablo Ibarrarán, David Kaplan, Christian Vázquez, and an anonymous referee for comments and suggestions. Any remaining errors are the sole responsibility of the authors. The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the IDB, its Board of Directors, or the countries they represent.

1 Introduction and motivation

Latin America and the Caribbean experience a rapid increase in the share of older population, which leads to higher demand for both healthcare and long-term care (Aranco et al. 2018; Aranco et al. 2022). The countries of the region are still in the process of adapting their healthcare sector to the needs of an aging population; this requires a focus on preventing and managing chronic conditions, and a greater role for primary healthcare and integration with social services. At the same time, long-term care services are either scarce (in coverage and quality, when publicly financed) or unaffordable for most (when provided by the private sector). One of the consequences of this situation is an excess of long costly hospitalizations, which compensate (at least in part) for insufficient primary healthcare, social care, long-term care, and coordination among them.

In this context, it becomes very important to understand the relationship between care needs and hospitalizations and their duration. Yet, there is limited evidence on this relationship from Latin American and Caribbean countries. This study aims to address this gap by leveraging data from the Mexican Health and Aging Study (MHAS), which provides rich longitudinal data on individuals aged 50 and older.

Care needs are defined by the need of support for everyday tasks, which are classified as Activities of Daily Living (ADLs) or Instrumental Activities of Daily Living (IADLs). Various studies have documented that difficulties in completing ADLs and IADLs are associated with higher assistance needs and a decrease in quality of life for older people. Katz et al. (1963) pioneered the development of the ADLs scale, which includes tasks such as bathing, dressing, and feeding oneself. Since then, the literature has evolved to include IADLs, which involve more complex tasks like shopping and managing finances (Lawton and Brody, 1970). These scales have been widely used in studies exploring care needs and dependency in the older population.

Care dependence is associated with a higher risk of hospitalization, as well as with longer hospitalizations. Gill et al. (2010) find that the inability to perform ADLs independently is a strong predictor of hospitalization in the United States, as functional dependency is associated with greater vulnerability to infections, falls, and other health complications. This vulnerability increases the burden on hospital systems, as these patients often require more intensive interventions. Bo et al. (2016) find a high prevalence of major geriatric syndromes—such as functional dependence, cognitive impairment, frailty, and chronic immobilization—among older inpatients in Italy. Approximately one-third of these patients experienced prolonged hospital stays not driven by clinical needs, particularly among older individuals with dementia, who had severe functional

impairments but low comorbidity. Umegaki et al. (2003) find evidence of longer hospitalizations for care dependent older persons in Japan. Dressing was identified as the most important factor influencing length of stay, as it requires both physical and cognitive abilities.

Aranco et al. (2024) conceptualize and empirically estimate the prevalence and cost of prolonged stays among elderly hospital patients in Brazil and Mexico. They estimate the relevance of three sources of prolonged stays: (i) lack of appropriate primary healthcare that leads to more complex admissions; (ii) hospital inefficiency; and (iii) lack of rehabilitation, social, and long-term care at discharge. Based on their analysis, the lack of rehabilitation, social, and long-term care accounts for 12% of total hospital days in Brazil and 7% in Mexico.

Building on these findings, our study uses data from six MHAS waves (2001, 2003, 2012, 2015, 2018, and 2021) to investigate the link between care dependence and hospitalizations in Mexico. We explore how different levels of care needs —categorized by ADL and IADL limitations— affect the probability of being hospitalized and the length of hospital stays. While our study does not rely on experimental variation or a natural experiment, we exploit the panel nature of the MHAS and apply individual fixed-effects models to control for unobserved, time-invariant heterogeneity across individuals. Under the assumption that time-varying unobservables are not driving the relationship between care needs and hospital outcomes, our estimates can be interpreted as causal effects.

By employing both fixed-effects logistic regression and high-dimensional fixed-effects models, we provide evidence that greater functional dependency is associated with higher healthcare utilization among older people. These results have significant implications for policymakers, as they highlight the need for preventive care and enhanced long-term care and support services to reduce unnecessary hospital utilization.

While our data originate from a panel survey (MHAS), we treat the sample as a pooled cross-section for the purpose of estimation. To strengthen internal validity, we include individual fixed effects, which account for all time-invariant unobserved heterogeneity that may affect both care dependence and hospitalization outcomes. Although this approach does not fully exploit the panel structure of the data, it provides a stronger basis for interpretation than models without such controls, provided that time-varying confounders are not driving the results.

The remainder of this paper is organized as follows. Section 2 presents the data used in the analysis, detailing the sources and key variables. Section 3 outlines the methodology, including the econometric models employed to assess the relationship between functional dependency and hospitalization outcomes. Section 4 presents the results of the analysis. Section 5 discusses the

findings in relation to existing literature and concludes with implications for policy and future research.

2 Data and descriptive statistics

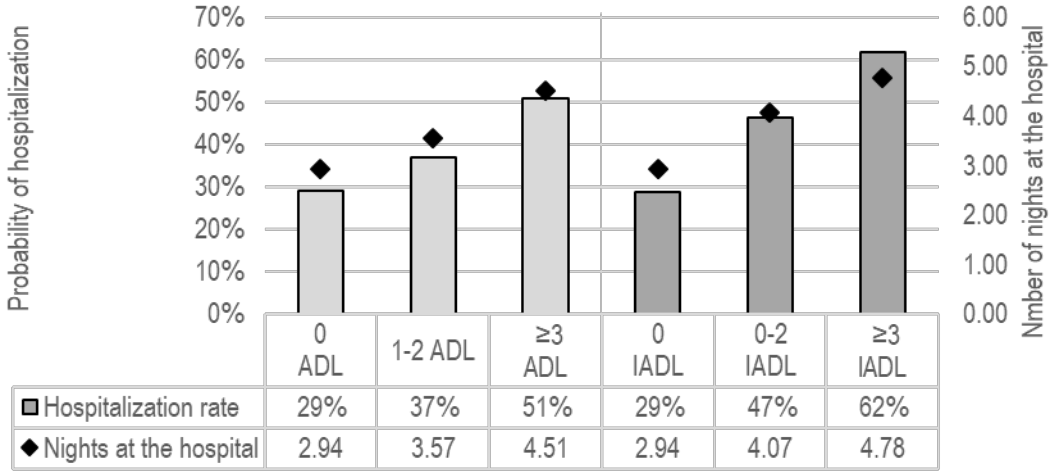
This study employs pooled data from the Mexican Health and Aging Study (MHAS), a nationally representative longitudinal survey designed to examine health and aging dynamics among older persons in Mexico. The MHAS surveys were conducted in 2001, 2003, 2012, 2015, 2018, and 2021. The first wave included individuals born before 1951 (who were at least 50 years old in 2001). Additional cohorts were added over time. Key variables in our analysis include: hospitalization (a dummy for at least one night of hospitalization in the previous year); number of nights at the hospital during the previous year; care dependence, measured by the need of support with ADLs or IADLs.

Although MHAS is longitudinal, we use a pooled cross-sectional design, combining all available waves to increase statistical power. The sample is therefore unbalanced, and we do not track individuals over time. However, the panel structure allows us to include individual fixed effects, which control for time-invariant confounders.

Figure 1 illustrates that more severe functional limitations correlate with both higher likelihood of hospitalization and longer hospital stays. Notably, individuals with more than three ADL limitations experienced a hospitalization rate of 51%, compared to 29% for those with no ADL limitations. Additionally, conditional on being hospitalized, individuals with more than three ADL limitations spend 4.51 nights at the hospital, compared to 2.94 nights for those with no ADL limitations. The results are similar when focusing on IADL impairments.

As shown in Figure 1 and detailed in the note, most older people in the MHAS sample report no ADL or IADL limitations (77% and 84%, respectively), while 8% report three or more ADL impairments and 2% report three or more IADL impairments. Although severe care dependence is clearly not a universal condition among older people, it has significant implications for hospital use and healthcare costs. The statistics presented in Figure 1 provide the motivation for the multivariate analysis presented in Section 4. This multivariate analysis will attempt to control for other correlates that affect hospitalizations, e.g. the prevalence of chronic conditions.

Figure 1 – Probability of Hospitalization and Number of Hospital Nights, by Number of ADL and IADL



	0 ADL	1-2 ADL	≥3 ADL	0 IADL	0-2 IADL	≥3 IADL
Hospitalization rate	29%	37%	51%	29%	47%	62%
Nights at the hospital	2.94	3.57	4.51	2.94	4.07	4.78

Note: Based on pooled data from 2001, 2003, 2012, 2015, 2018, and 2021 of the Mexican Health and Aging Studies (MHAS) for individuals aged 50 or older. The number of nights spent in the hospital is restricted to individuals who declared at least 1 night of hospitalization. The prevalence of ADL and IADL impairments is as follows: 77% of the persons in the sample have 0 ADL impairments, 15% have 1-2 ADL impairments, 8% have ≥3 ADL impairments; 84% of the persons in the sample have 0 IADL impairments, 13% have 1-2 IADL impairments, 2% have ≥3 IADL impairments.

Table 1 provides additional information on the characteristics of our sample. It includes information on: sex; urban or rural residence; education; household assets (as a measure of socioeconomic status); care arrangements (primary source of care received and number of children); health status.

Those with more severe care needs (measured by the number of ADL or IADL limitations) are typically older, with individuals having three or more ADL limitations averaging 70.8 years old compared to 64.1 years old for those with no limitations. Those with a larger number of ADL or IADL limitations also tend to have lower educational attainment. Individuals with three or more ADL limitations average 4.1 years of schooling, while those with no limitations average 5.8 years.

In terms of family structure, those with significant functional limitations are less likely to have a partner. This may indicate reduced social support for those with severe limitations. Caregiving arrangements also shift notably with increasing functional impairment. The share of individuals receiving care from paid professionals or relatives decreases as functional limitations become more severe. This may be partly explained by the fact that individuals with more ADL or IADL limitations tend to be older, have lower educational attainment, and more often reside in rural areas—contexts where access to care services may be more limited. This pattern could reflect economic constraints, reduced availability of informal caregivers, or gaps in long-term care provision.

Health conditions such as diabetes, cancer, heart attacks, and arthritis also show higher

prevalence rates among those with more severe functional limitations, emphasizing the interconnectedness of chronic health conditions and functional decline.

Table 1 - Descriptive statistics, pooled sample and by number of ADL and IADL impairments

VARIABLES	Pooled mean	ADL			IADL		
		0	1-2	≥3	0	1-2	≥3
Hospitalizations in the last 12 months:							
Stayed at hospital	0.321	0.293	0.371	0.510	0.289	0.465	0.617
Nights at hospital (ln)	1.165	1.08	1.272	1.507	1.077	1.404	1.565
ADLs and IADLs:							
ADL 1-2	0.143	-	-	-	-	-	-
ADL ≥3	0.078	-	-	-	-	-	-
IADL 1-2	0.124	-	-	-	-	-	-
IADL ≥3	0.031	-	-	-	-	-	-
Socio-demographics:							
Gender (male =1)	0.397	0.417	0.341	0.304	0.42	0.255	0.342
Rural	0.353	0.347	0.38	0.366	0.353	0.341	0.424
Age	65.235	64.071	68.548	70.789	64.085	70.565	75.229
Education years	5.525	5.832	4.619	4.137	5.788	4.308	3.273
Has a partner	0.666	0.687	0.611	0.56	0.691	0.534	0.518
Number of Children:							
Resident sons	0.662	0.68	0.62	0.556	0.678	0.587	0.508
Resident daughters	0.641	0.654	0.581	0.626	0.651	0.588	0.574
Non-resident sons	1.801	1.723	2.039	2.146	1.75	2.061	2.17
Non-resident daughters	1.84	1.763	2.11	2.107	1.782	2.08	2.449
Care from:							
Kids and Grandkids	0.92	0.964	0.791	0.714	0.962	0.683	0.719
Relatives	0.819	0.928	0.566	0.196	0.943	0.168	0.057
Non-Relatives	0.822	0.93	0.566	0.22	0.945	0.174	0.083
Paid professionals	0.817	0.929	0.552	0.19	0.943	0.148	0.06
Health and Habits:							
Ever had diabetes	0.283	0.246	0.383	0.467	0.254	0.44	0.436
Ever had cancer	0.041	0.034	0.053	0.082	0.038	0.056	0.067
Ever had a heart attack	0.087	0.071	0.124	0.184	0.073	0.161	0.19
Ever had arthritis	0.242	0.197	0.362	0.469	0.212	0.405	0.407
Ever drunk any alcohol	0.235	0.26	0.163	0.113	0.258	0.114	0.078
Ever smoked	0.381	0.386	0.369	0.346	0.392	0.315	0.341
Household Assets:							
Has TV	0.946	0.948	0.95	0.922	0.948	0.945	0.907
Has a washing machine	0.772	0.777	0.767	0.734	0.776	0.762	0.715
Has phone	0.704	0.708	0.677	0.707	0.709	0.689	0.618
Has a water heater	0.545	0.557	0.515	0.476	0.557	0.498	0.416
Observations	24,053	18,419	3,666	1,968	19,993	3,136	576

Note: The number of nights spent in the hospital is restricted to individuals who declared at least 1 night spent in the hospital. Number of observations for the pooled mean = 7697; ADL: 0 = 5231, 1-2 = 1444, ≥ 3 = 1022; IADL: 0 = 5778, 1-2 = 1382, ≥ 3 = 576. ADL and IADL means are based on pooled data from 2001, 2003, 2012, 2015, 2018, and 2021 of the Mexican Health and Aging Studies (MHAS) for individuals aged 50 or older.

Descriptive differences suggest that individuals with higher levels of functional limitations experience more frequent and longer hospital stays. However, these raw comparisons may reflect not only the effect of care dependence, but also differences in other characteristics such as age or chronic conditions. To isolate the role of functional limitations, we estimate regression models that include extensive controls and individual fixed effects.

3 Methodology

We apply distinct modeling strategies for each outcome variable in our analysis to explore the relationship between care dependence and hospital utilization.

Although the Mexican Health and Aging Study (MHAS) is a panel, we do not estimate dynamic panel models. Instead, we exploit the panel's longitudinal structure to include individual fixed effects, which account for time-invariant unobserved characteristics. We pool the data across waves to maximize sample size and statistical power. To control for unobserved time-invariant heterogeneity, we include individual fixed effects in all regressions. This strategy does not produce dynamic estimates, but it strengthens internal validity relative to cross-sectional designs, under the assumption that time-varying unobservables are not confounding the relationship between care dependence and hospital outcomes.

For the likelihood of hospitalization, the dependent variable is a binary outcome in which having been hospitalized in the previous 12 months is coded as 1 and not having been hospitalized is coded as 0. The probability of hospitalization is analyzed using fixed-effects logistic regression, which allows controlling for individual variability due to differences in functional status, such as care needs for ADLs or IADLs. This approach isolates the influence of functional status on the likelihood of hospitalization. After estimating the logistic regression model, we compute the marginal effects to understand the change in the probability of hospitalization associated with each predictor.

The mathematical representation of the model is as follows:

[1] $$logit\big(P(y_{it} = 1|X_{it})\big) = X_{it}\beta + \alpha_i + \gamma_t + \varepsilon_{it}$$

Where y_{it} is the binary indicator for hospitalization for individual i at time t; X_{it} is a vector with individual covariates and β is the corresponding vector of coefficients associated with a one-unit increase in X_{it}; α_i captures individual-specific fixed effects; γ_t denotes time-specific fixed effects, and ε_{it} is the error term. The control variables included in X_{it} can be seen in Table 1, and refer to

functional status (measured as the number of limitations with ADL and IADL), sociodemographic characteristics (age, sex, geographical residence, education, and marital status), number of children, caregiving arrangements, health status (presence of chronic conditions and health-related habits), and household assets. The marginal effects derived from this model indicate the estimated change in the likelihood of hospitalization for a one-unit increase in each predictor variable.[2]

For the duration of hospital stays, we apply a natural logarithmic transformation to the number of hospital nights, to reduce the skewedness (variance) of the original variable and facilitate its interpretation in percentage terms. The transformed outcome is then modeled using a high-dimensional fixed-effects model. This allows to account for both observed and unobserved heterogeneities. By effectively controlling for constant individual traits and environmental factors over time, we mitigate potential confounding factors. The mathematical representation is as follows:

$$[2] \quad \ln(n_{it}) = X_{it}\pi + \theta_i + \rho_t + \omega_{it}$$

Where n_{it} represents the count of hospital nights, coefficients π express the percentage change in hospital nights associated with a one-unit increase in each predictor, and similarly to equation [1], θ_i , ρ_t , and ω_{it} capture individual-specific fixed effects, time-specific fixed effects, and the error term, respectively. The model is estimated on the sample of individuals who had at least one night of hospitalization during the previous 12 months.

These high-dimensional fixed-effects models allow us to account for both observed and unobserved heterogeneities. Specifically, the inclusion of individual fixed effects helps remove bias stemming from unobserved time-invariant characteristics (e.g., baseline health status or genetic predispositions) that may affect both functional dependency and hospitalization outcomes. This strengthens the internal validity of the analysis. While we do not rely on experimental or quasi-experimental variation, the fixed-effects specification enhances our ability to interpret these effects with greater confidence, provided that time-varying unobservables do not drive the results.

[2] The marginal effects translate the logistic regression coefficients, which are expressed in terms of log-odds, into easier to interpret probability changes. For instance, if the logistic regression model indicates that moving from 0 ADLs to 1-2 ADLs increases the log-odds of hospitalization by a certain value, the corresponding marginal effect will tell us how much the probability of hospitalization increases in percentage points due to this change.

Throughout this paper, we refer to the estimated relationships as effects. Although our estimation does not exploit longitudinal variation in the panel, the use of individual fixed effects in a pooled cross-sectional framework allows us to control for time-invariant characteristics that may confound the relationship between care dependence and hospitalization. Under the assumption that unobserved time-varying shocks are not correlated with changes in care dependence, this approach yields estimates that can be interpreted as suggestive of causal effects.

Under the assumption that unobserved time-varying factors do not bias the results, this strategy offers a credible approximation of the causal effect of changes in care dependence on hospital outcomes. While we refrain from making strong causal claims, the inclusion of individual fixed effects strengthens the internal validity of the estimates relative to models without such controls.

4 Results: effect of care dependence on hospitalizations

The multivariate analysis confirms that care dependence increases both the likelihood of hospitalization (Models 1 and 2) and the duration of hospital stays (Models 3 and 4) (Table 2). The effect is more pronounced when care dependence is most severe. Our analytical approach includes models with and without controls to verify the robustness of these effects.

Specifically, individuals with mild ADL dependence (limitations in 1-2 ADLs) are between 11.4 percentage points more likely to have been hospitalized in the previous year (Model 1) and 5.2 percentage points more likely (Model 2) than those with complete ADL autonomy. For those with more severe care needs (limitations in three or more ADLs), the likelihood of hospitalization increases by 17.9 percentage points in Model 1 and 8.6 percentage points in Model 2.

Additionally, individuals with care needs for 1-2 ADLs tend to have longer hospital stays compared to those with no ADL-related care needs, by 13.4% in Model 3 and 12.3% in Model 4. In cases of more severe functionality impairment (limitations in three or more ADLs), the increases in stay durations are even more pronounced, reaching 22.7% and 20.8% in Models 3 and 4, respectively.

Care needs for IADLs have similarly significant effects on the risk of hospitalization. Individuals with mild IADL care needs (limitations in 1-2 IADLs) are between 12.7 (Model 1) and 6.1 percentage points (Model 2) more likely to be hospitalized than those with no IADL-related care needs. Conditional on being hospitalized, the duration of their stays is longer by 13.0% (Model 3) and 12.6% (Model 4), although with lower levels of statistical significance. For those experiencing more severe IADL needs (limitations in three or more IADLs), the probability of hospitalization

increases by 22.8 percentage points in Model 1 and 11.6 percentage points in Model 2, while the increase in stay duration (17.5%) is only significant at the 10% level in Model 4. For clarity, coefficients in Models 1 and 2 represent average marginal effects in percentage points, whereas coefficients in Models 3 and 4 represent percentage changes in the duration of hospital stays.

Our analysis also incorporates various sociodemographic and health-related variables such as age, partnership status, and household assets. While not all these controls yield statistically significant results, their inclusion is crucial for a holistic view, providing a layered understanding of the multifaceted influences on hospitalization needs. While the MHAS contains variables that could serve as additional predictors of hospitalization, such as history of falls and anthropometric measures from which BMI could be derived, these were excluded from the present analysis because they are not consistently measured across all survey waves and, in some waves, have limited coverage. Including them would reduce comparability over time and complicate the longitudinal fixed-effects design. We acknowledge their potential relevance and note that their inclusion could be explored in future work or in targeted sensitivity analyses.

Table 2 - Effects of Care Dependence on the Probability of Hospitalization and Number of Hospital Nights

	Probability of hospitalization		Number of hospital nights	
	(1)	(2)	(3)	(4)
1-2 ADLs	0.114***	0.052***	0.134**	0.123**
	(0.011)	(0.010)	(0.060)	(0.060)
≥3 ADLs	0.179***	0.086***	0.227***	0.208**
	(0.016)	(0.016)	(0.084)	(0.084)
1-2 IADLs	0.127***	0.061***	0.130**	0.126*
	(0.012)	(0.012)	(0.066)	(0.066)
≥3 IADLs	0.228***	0.116***	0.162	0.175*
	(0.021)	(0.022)	(0.104)	(0.105)
Lives in rural or urban		-0.014		0.259
		(0.021)		(0.197)
Age (years)		0.002***		0.022
		(0.000)		(0.029)
Partnered		-0.014		-0.003
		(0.010)		(0.093)
Number of resident sons		0.006		-0.015
		(0.006)		(0.059)
Number of resident daughters		-0.008		-0.032
		(0.007)		(0.060)
Number of non-resident sons		0.017***		-0.009
		(0.005)		(0.048)
Number of non-resident daughters		0.006		0.051
		(0.005)		(0.050)
Ever had diabetes		0.058***		0.060
		(0.014)		(0.097)
Ever had cancer		0.111***		0.352***
		(0.024)		(0.131)
Ever had a heart attack		0.093***		0.422***
		(0.019)		(0.105)
Ever had arthritis		0.017*		-0.149*
		(0.010)		(0.090)
Ever drunk any alcohol		-0.044***		-0.157**
		(0.010)		(0.065)
Ever smoked		0.004		-0.061
		(0.008)		(0.078)
Household has a TV		-0.022		0.043
		(0.015)		(0.126)
Household has a washing machine		0.010		0.031
		(0.008)		(0.071)
Household has a phone		-0.006		-0.075
		(0.007)		(0.061)
Household has a water heater		0.012		0.036
		(0.008)		(0.068)
Constant			1.168***	-0.478
			(0.026)	(1.943)
Observations	24706	24706	3,767	3,767
R-squared			0.568	0.577

Note: * The number of nights is included as a logarithmic transformation, allowing for a more robust analysis of skewed data. Also, the number of nights spent in the hospital focuses exclusively on individuals who reported staying at least one night in the hospital, thus narrowing the study sample to those directly experiencing hospitalization. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The reference category is ADL=0 and IADL=0.

To help the interpretation of the regression results, in Table 3, we present the expected number of hospital nights (conditional on having been hospitalized) by level of care dependence.[3] We also report the absolute difference in expected nights of hospitalization, relative to the reference group (individuals with no functional limitations).

Table 3 - Expected Number of Hospital Nights, by Level of Care Dependence

Limitation	Expected hospital nights	95% confidence interval	Differences from reference category
ADL: 0	3.36	3.19 - 3.54	0.00
ADL: 1–2	3.80	3.47 - 4.16	0.44
ADL: ≥3	4.14	3.61 - 4.73	0.78
IADL: 0	3.42	3.26 - 3.59	0.00
IADL: 1–2	3.88	3.51 - 4.30	0.46
IADL: ≥3	4.07	3.40 - 4.89	0.65

Note: ADL: 0 and IADL: 0 are the reference categories.

Table 3 shows that the expected number of hospital nights increases with the severity of functional limitations, both in ADLs and IADLs.[4] Among those hospitalized, individuals with 1–2 ADL limitations are expected to stay 3.80 nights on average, 0.44 nights longer than those without limitations. In comparison, those with more than 3 ADL limitations are predicted to stay 4.14 nights, an increase of 0.78 nights compared to the reference group. A similar pattern is observed for IADLs, where the presence of mild and severe care dependence levels is associated with 0.46 and 0.65 additional nights, respectively. These results confirm that care dependence significantly increases hospital stay duration, even when controlling for demographic, health, and socioeconomic factors.

Although the average difference in hospital nights between individuals with and without functional limitations may appear modest, often less than a single night, its implications are very meaningful. In Mexico, the average cost of a day of hospitalization is approximately USD 750. In contrast, each day of long-term care provided at home costs approximately USD 20. This means

[3] The predicted values for each functional limitation category are obtained by computing the average of the linear predictor conditional on each group and transforming the estimates back to the original scale through exponentiation. This approach yields the expected number of hospital nights for individuals in each ADL and IADL category, holding other covariates constant.

[4] Predicted probabilities of hospitalization by levels of care dependence are not reported in Table 3 due to methodological limitations associated with fixed-effects logistic models. These models estimate within-individual variation and absorb all time-invariant heterogeneity, making it difficult to obtain population-averaged predictions that are comparable across groups. As a result, predicted probabilities from such models are typically not interpretable in a straightforward manner. For this reason, we focus on the expected number of hospital nights conditional on hospitalization, which can be more reliably derived and interpreted from a fixed-effects linear model.

that saving half day of hospitalization ensures savings that could be used to provide 37.5 days of home-based long-term care.

The implications are even more meaningful at the population level. When aggregated across the large and growing number of older adults with care needs, even small increases in length of stay result in a notable rise in total hospital days. These additional hospital days represent a significant demand on healthcare resources and highlight the broader system-level impact of functional decline in aging populations.

4.1 Heterogeneous Effects

The effect of being care dependent on hospitalizations may vary according to the personal and contextual characteristics of the individual. To assess this hypothesis, we estimate equations [1] and [2] above, including heterogeneous effects, focusing on three key variables: sex, area (urban or rural), and having children or not. We show the results in Tables A1 and A2 in the Annex.

For these heterogeneous effects models, coefficients are reported in log-odds form rather than marginal effects because the fixed-effects logistic framework with multiple interactions involving time-invariant variables makes it infeasible to compute subgroup-specific average marginal effects that are both interpretable and comparable across groups. The interpretation of these coefficients should therefore focus on the sign, magnitude, and statistical significance of the estimated associations.

We find that individuals with three or more IADL limitations residing in rural areas exhibit a statistically significant increase in the probability of being hospitalized compared to individuals with the same number of IADL limitations residing in an urban setting. This interaction suggests that severe functional impairments combined with rural residence can exacerbate the likelihood of hospitalization. Rural areas are usually characterized by limited healthcare infrastructure, greater travel distances to medical facilities, and fewer healthcare providers, factors that collectively contribute to increased hospitalization risks for those with substantial care needs.

Interactions with sex are mostly non-significant. This suggests that while differences between men and women exist in broader health care contexts, they do not significantly influence hospitalization when considering the severity of care dependence alone. For instance, the coefficients for interactions of ADLs impairments and sex, or IADLs impairments and sex, are not statistically significant.

Similarly, the presence of children does not significantly alter the probability of hospitalization or its duration, suggesting that familial support from children does not substantially alleviate the immediate healthcare needs associated with ADL or IADL limitations.

5 Conclusions and policy implications

We analyze the relationship between care dependence and hospital utilization among older people in Mexico. We show that individuals with severe limitations in ADLs and IADLs are significantly more likely to be hospitalized, and for longer periods. The results corroborate previous studies linking functional impairment to increased use of hospital services and provides the first evidence, to our knowledge, of this relationship from a Latin American and Caribbean country.

In the context of Mexico's healthcare landscape, characterized by limited resources and increasing cost pressures, designing and implementing strategies that safely reduce the number and length of hospitalizations could ease the financial burden on hospitals, while simultaneously improving the quality of life of the older population. Our findings suggest that focusing on strengthening both preventive healthcare and social services as well as post-discharge rehabilitation and long-term care services for people with functional dependence is a promising path in this direction. Previous evidence from Mexico suggests that the lack of rehabilitation and long-term care services after discharge account for 7% of all hospitalization days among older people (Aranco et al. 2024).

Although our analysis relies on pooled cross-sectional data, the use of individual fixed effects allows us to control for time-invariant confounders that could otherwise bias the relationship between care dependence and hospitalization outcomes. This strategy strengthens the internal validity of our findings and lends credibility to the estimated effects, though we remain cautious in interpreting them as strictly causal.

Long-term care services in Mexico are still scarcely developed, although the topic is gaining space in the country's political agenda. Our analysis highlights the fact that investing in affordable and high-quality long-term care services could lead to savings in the healthcare system. For these savings to materialize, it will be key to ensure that social and healthcare services are coordinated and follow a person-centered approach to care. Our findings also underscore the challenges faced by healthcare systems in rural settings. Targeted interventions may be needed to improve health and social care access in these regions.

References

Aranco, N., Stampini, M., Ibarrarán, P., y Medellín, N. (2018). Panorama de envejecimiento y dependencia en América Latina y el Caribe. https://doi.org/10.18235/0000984

Aranco, N., Bosch, M., Stampini, M., Azuara Herrera, O., Goyeneche, L., Ibarrarán, P., Oliveira, D., Reyes Retana Torre, M., Savedoff, W. D., & Torres Ramirez, E. (2022). Aging in Latin America and the Caribbean: social protection and quality of life of older persons. https://doi.org/10.18235/0004287

Aranco, N., Bauhoff, S., Schwarz, N. V., & Stampini, M. (2024). Are Long Hospitalizations Substituting Primary and Long-term Care?: Evidence from Brazil and Mexico. https://doi.org/10.18235/0013126

Bo, M., Fonte, G., Pivaro, F., Bonetto, M., Comi, C., Giorgis, V., Marchese, L., Isaia, G., Maggiani, G., Furno, E., et al. (2016). Prevalence of and factors associated with prolonged length of stay in older hospitalized medical patients. *Geriatrics & gerontology international*, 16(3):314–321.

Gill, T. M., Gahbauer, E. A., Han, L., and Allore, H. G. (2010). Trajectories of disability in the last year of life. *New England Journal of Medicine*, 362(13):1173–1180.

Katz, S., Ford, A. B., Moskowitz, R. W., Jackson, B. A., and Jaffe, M. W. (1963). Studies of illness in the aged: the index of ADL: a standardized measure of biological and psychosocial function. *jama*, 185(12):914–919.

Lawton, M. and Brody, E. M. (1970). Assessment of older people: self-maintaining and instrumental activities of daily living. *Nursing Research*, 19(3):278.

Umegaki, H., Ando, F., Shimokata, H., Yamamoto, S., Nakamura, A., Endo, H., Kuzuya, M., and Iguchi, A. (2003). Factors associated with long hospital stay in geriatric wards in Japan. *Geriatrics & Gerontology International*, 3(2):120–127.

A. Appendix: Additional results

Although we use a pooled specification, the inclusion of individual fixed effects allows us to control for all time-invariant individual characteristics, observed or unobserved, and thus better isolate the association between changes in care dependence and changes in hospital use within the same individual over time. To examine whether the effect of care dependence on hospital usage varies across subgroups, we extend equations 1 and 2 to include interaction terms between categorical indicators of ADL/IADL impairments (e.g., 1–2 or ≥3 limitations) and individual characteristics (e.g., sex, rural area, having children). This approach examines heterogeneous effects, that is, whether certain population groups experience stronger or weaker effects of functional limitations.

In our specification, the model includes two dummy variables for each type of care dependence (ADLs and IADLs) to capture different levels of severity. Interaction terms are constructed for each dummy and interacting characteristic (e.g., male sex, rural residence, or having children). For example, for the length of hospitalization, the interaction between care dependence and rural residence is modelled as follows:

[3] $$\ln(n_{it}) = \beta_1 ADL12_{it} + \beta_2 ADL3_{it} + \beta_3 IADL12_{it} + \beta_4 IADL3_{it} + \beta_5 rural_{it} + \beta_6(ADL12_{it} * rural_{it}) + \beta_7(ADL3_{it} * rural_{it}) + \beta_8(IADL12_{it} * rural_{it}) + \beta_9(IADL3_{it} * rural_{it}) + \theta_i + \rho_t + \omega_{it}$$

Here β_1 measures the effect of having 1–2 ADLs limitations for the reference group (urban individuals). A positive and statistically significant estimate of β_6 would indicate that, for individuals in rural areas, the association between having 1–2 ADL limitations and hospitalization duration is stronger than for their urban counterparts. The total effect in rural areas would be $\beta_1 + \beta_6$. These interactions help identify whether policy responses should be adjusted depending on geography, sex, or having children that can potentially provide care.

Table A1: Heterogeneous Effects for the Probability of Hospitalization

	Male	Rural	Children
Main Effects			
1-2 ADLs = 1	0.300***	0.349***	0.479*
	(0.0581)	(0.0546)	(0.281)
≥*3* ADLs = 1	0.476***	0.625***	0.678*
	(0.0873)	(0.0829)	(0.356)
1-2 IADLs = 1	0.442***	0.388***	0.394
	(0.0626)	(0.0611)	(0.289)
≥*3* IADLs = 1	0.782***	0.673***	1.365**
	(0.113)	(0.111)	(0.606)
Standalone Effects			
Male = 1			
	-		
Rural area = 1		-0.0983	
		(0.141)	
Has children = 1			0.240
			(0.205)
Interactions			
1-2 ADLs * Male			
	0.127		
	(0.0969)		
≥3 ADLs * Male	0.296*		
	(0.152)		
1-2 IADLs * Male	-0.113		
	(0.115)		
≥3 IADLs * Male	-0.0349		
	(0.196)		
1-2 ADLs * Rural		-0.00954	
		(0.104)	
≥3 ADLs * Rural		-0.194	
		(0.162)	
1-2 IADLs * Rural		0.0716	
		(0.119)	
≥3 IADLs * Rural		0.336*	
		(0.200)	
1-2 ADLs * Has children			-0.139
			(0.284)
≥3 ADLs * Has children			-0.110
			(0.362)
1-2 IADLs * Has children			0.00608
			(0.293)
≥3 IADLs * Has children			-0.626
			(0.612)
Observations	24,706	24,706	24,706

Note: * The model controls for additional variables such as age, number of children, years of education, household assets, and the presence of non-communicable diseases (diabetes, cancer, heart attack, arthritis), as well as alcohol consumption, which are not shown in the table but are included in the analysis. Resident and non-resident children are included in the variable: has children. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Variables that do not vary over time, such as gender, are absorbed by the individual fixed effects and therefore omitted from the main model. To assess their potential role in shaping outcomes, we include interaction terms between gender and levels of functional dependency. Marginal effects are not reported for these models because, in the presence of multiple interaction terms involving time-invariant characteristics within a fixed-effects logistic framework, subgroup-specific marginal effects lose comparability and interpretability. We therefore present log-odds coefficients, which accurately reflect the estimated direction and statistical significance of heterogeneous effects across groups.

Table A2: Heterogeneous Effects for the Number of Hospital Nights

	Male	Rural	Children
Main Effects			
1-2 ADLs = 1	0.179**	0.126*	-0.363
	(0.0750)	(0.0683)	(0.360)
≥3 ADLs = 1	0.254**	0.187**	0.221
	(0.103)	(0.0934)	(0.443)
1-2 IADLs = 1	0.100	0.169**	0.340
	(0.0790)	(0.0740)	(0.406)
≥3 IADLs = 1	0.173	0.173	-0.0633
	(0.128)	(0.121)	(0.694)
Standalone Effects			
Male = 1			
	-		
Rural = 1		0.280	
		(0.206)	
Has children = 1			0.366
			(0.321)
Interactions			
1-2 ADLs * Male	-0.149	-	-
	(0.124)		
≥3 ADLs * Male	-0.125	-	-
	(0.177)		
1-2 IADLs * Male	0.0750	-	-
	(0.142)		
≥3 IADLs * Male	-0.0159	-	-
	(0.218)		
1-2 ADLs * Rural		-0.0152	-
		(0.140)	
≥3 ADLs * Rural		0.116	-
		(0.205)	
1-2 IADLs * Rural		-0.202	-
		(0.156)	
≥3 IADLs * Rural		-0.0264	-
		(0.231)	
1-2 ADLs * Has children			0.501
			(0.365)
≥3 ADLs * Has children			-0.0207
			(0.450)
1-2 IADLs * Has children			-0.226
			(0.410)
≥3 IADLs * Has children			0.243
			(0.702)
Constant	-0.424	-0.376	-0.645
	(1.948)	(1.946)	(1.960)
Observations	3,767	3,767	3,767

Note: * The model controls for additional variables such as age, number of children, years of education, and household assets, which are not shown in the table but are included in the analysis. Resident and non-resident children are included in the variable: has children. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Variables that do not vary over time, such as gender, are absorbed by the individual fixed effects and therefore omitted from the main model. To assess their potential role in shaping outcomes, we include interaction terms between gender and levels of functional dependency.