The Review Of
DIABETIC
STUDIES OPEN ACCESS

Prevalence And Associated Factors Of Diabetes Mellitus In Chilean Older Adults: A Cross-Sectional National Survey Analysis

Josivaldo de Souza-Lima[1*], Rodrigo Yáñez-Sepúlveda[1,2], Frano Giakoni-Ramírez[1] , Catalina Muñoz-Strale[1], Javiera Alarcon-Aguilar[1], Maribel Parra-Saldias[3] , Daniel Duclos-Bastias[4,5], Andrés Godoy-Cumillaf[6], Eugenio Merellano-Navarro[7], José Bruneau-Chávez[8], Claudio Farias-Valenzuela[9]

[1]Facultad de Educación y Ciencias Sociales, Instituto del Deporte y Bienestar, Universidad Andres Bello, Las Condes, Santiago 7550000, Chile; josivaldo.desouza@unab.cl, rodrigo.yanez.s@unab.cl, frano.giakoni@unab.cl, catalina.munoz@unab.cl, javiera.alarcon@unab.cl
[2]School of Medicine, Universidad Espíritu Santo, Samborondón, Ecuador
[3]Universidad de Atacama, Chile; maribel.parra@uda.cl
[4]GEO Research Group, Escuela de Educación Física, Pontificia Universidad Católica de Valparaíso, Chile; daniel.duclos@pucv.cl
[5]METIS Research Group, Facultad de Negocios y Tecnología, Universidad Alfonso X el Sabio (UAX), Madrid, España.
[6]Grupo de Investigación en Educación Física, Salud y Calidad de Vida (EFISAL), Facultad de Educación, Universidad Autónoma de Chile, Chile; andres.godoy@uautonoma.cl
[7]Department of Physical Activity Sciences, Faculty of Education Sciences, Universidad Católica del Maule, Talca 3530000, Chile; emerellano@ucm.cl
[8]Departamento de Educación Física, Deportes y Recreación. Universidad de la Frontera, Temuco 4811230, Chile; jose.bruneau@ufrontera.cl
[9]Escuela de Ciencias de la Actividad Física, Universidad de Las Américas, Santiago, Chile.; claudio.farias.valenzuela@edu.udla.cl
**Correspondence: josivaldo.desouza@unab.cl*

ABSTRACT

Background: Diabetes mellitus poses a significant public health challenge in aging populations, particularly in Latin America, where prevalence among older adults exceeds global averages due to socioeconomic transitions and lifestyle factors. **Objective**: To determine the prevalence of diabetes mellitus and its sociodemographic and biochemical associations in Chilean adults aged 60 years and older using the 2016-2017 Chilean National Health Survey. **Methods**: Cross-sectional analysis of 2031 participants from the CNHS 2016-2017. Diabetes was defined by self-report or biochemical criteria (fasting glucose ≥126 mg/dL or HbA1c ≥6.5%). Sociodemographics (sex, age, education, marital status, zone, region) and biochemical markers (glucose, HbA1c, BMI, triglycerides, cholesterol, metabolic syndrome) were analyzed using descriptive statistics, crosstabs, and t-tests ($p<0.05$). Results: Prevalence was 28.1% (n=570), higher in females (30.4%) and regions like Araucanía (36.5%). Significant differences in biochemical markers included glucose (140.6 vs 96.9 mg/dL) and HbA1c (7.4% vs 5.9%) between groups with and without diabetes ($p<0.001$). **Conclusions**: High prevalence and disparities underscore the need for targeted screening and interventions in Chilean elderly to mitigate metabolic risks and healthcare burdens.

Keywords: Diabetes mellitus, Older adults, Prevalence, Biochemical markers, Sociodemographic factors, Metabolic syndrome, HbA1c.

INTRODUCTION

Diabetes mellitus, particularly type 2 diabetes, represents a major global public health challenge, with its prevalence steadily increasing among older adults due to aging populations and lifestyle factors. In 2022, an estimated 828 million adults worldwide had diabetes, marking a significant rise from

previous decades, driven by urbanization and sedentary behaviors. High-impact studies highlight that older adults bear a disproportionate burden, with cognitive and vascular complications exacerbating morbidity (1, 2).

In Latin America, including Chile, diabetes prevalence has surged, with regional estimates indicating rates of 10-15% in adults, projected to rise further by 2045 due to socioeconomic transitions. Chile's adult diabetes prevalence reached 10.8% in 2021, expected to climb to 12.6% by 2045, underscoring the need for targeted interventions in vulnerable groups. Recent analyses from the Americas show hyperglycemia affecting over 20% of older populations, linked to inadequate screening and management (3, 4).

Among Chilean older adults (aged 60 and above), diabetes prevalence is notably high, ranging from 10-28% based on national surveys, with socioeconomic inequalities amplifying risks in lower-education groups. The 2016-2017 Chilean National Health Survey (CNHS) revealed a 10% prevalence of mild cognitive impairment in this age group, often co-occurring with diabetes and low physical activity. Frailty, prevalent at 11.8% in adults over 40, further complicates diabetes management in the elderly, with higher rates in women and those over 80 (5-7).

Complications such as peripheral circulatory issues and ketoacidosis drive hospitalizations in Chilean diabetic patients, with a 4-year analysis (2019-2022) showing a tripling of admissions, primarily among those aged 65 and older. Vascular complications account for over 70% of hospital stays, with trends indicating a 2-3% annual increase in length of stay for older adults. Cognitive impairment, affecting up to 44% of diabetic elderly globally, is linked to diabetes duration in Chilean cohorts, exacerbating healthcare burdens (8, 9).

Gender disparities are evident, with higher diabetes prevalence and complications in Chilean women over 60, potentially due to hormonal factors and delayed diagnosis. Hospitalization rates for men increased more rapidly (from 8.6% to 20.2%) than for women, highlighting sex-specific trends in disease progression. Regional variations in Chile show higher prevalence in urban areas like Metropolitana (up to 36%), tied to lifestyle and access issues (5, 10).

Physical inactivity exacerbates diabetes risks in Chilean elderly, with low activity levels associated with a twofold increase in mild cognitive impairment odds. Studies emphasize that insufficient physical activity, prevalent at 31.5% in adults, contributes to preventable non-communicable disease cases, including diabetes. Walking pace and activity interventions could mitigate these risks, as slower paces correlate with higher diabetes incidence in national surveys (6, 11).

Despite advances in healthcare efficiency, gaps in diabetes screening persist in Chile, missing up to 30% of cases in normal-weight older adults. Policy improvements have reduced some burdens, but rising hospitalizations indicate unmet needs in primary care for the elderly. This study addresses these gaps by analyzing national survey data to profile diabetes in Chilean older adults, informing targeted prevention strategies.

Purposes and Methods

Purposes

The primary purpose of this study was to determine the prevalence of diabetes mellitus in Chilean adults aged 60 years and older using data from the 2016-2017 CNHS. Secondary purposes included examining sociodemographic variations in prevalence (by sex, age category, educational level, marital status, residential zone, and region) and assessing differences in biochemical markers (glucose, hemoglobin A1c, body mass index, triglycerides, total cholesterol, and metabolic syndrome) between individuals with and without diabetes mellitus. This cross-sectional analysis aims to provide evidence for targeted prevention strategies in this vulnerable population, addressing gaps in local epidemiology and informing public health policies.

METHODS

This study utilized a cross-sectional design, analyzing data from the CNHS 2016-2017, a nationally representative household survey conducted by the Chilean Ministry of Health. The CNHS employed

a stratified multistage probability sampling approach to ensure representativeness across urban and rural areas in all 15 Chilean regions. The sample included 6,233 non-institutionalized individuals aged 15 years and older, with a response rate of 67% and no replacements for refusals. For this analysis, we focused on the subsample of adults aged 60 years and older (n = 2,031), representing approximately 16.2% of the Chilean population in this age group based on the 2017 census.

Data collection occurred between August 2016 and March 2017 through two home visits. During the first visit, trained lay interviewers administered questionnaires using electronic devices to capture self-reported sociodemographic data (age, sex, educational level, marital status, residential zone, and region) and health-related information. The second visit, conducted by certified nurses, involved anthropometric measurements, additional questionnaires, and biological sampling, completed for 89% of participants. Anthropometric data, including weight (measured to the nearest 0.1 kg using calibrated digital scales) and height (measured to the nearest 0.1 cm using portable stadiometers), were used to calculate body mass index (BMI = weight [kg] / height [m^2]). Physical activity levels were assessed using the Global Physical Activity Questionnaire (GPAQ), which quantifies moderate-to-vigorous activity in work, transport, and leisure domains via self-report, with total metabolic equivalents (METs) categorized as low, moderate, or high.

Biochemical measurements were derived from blood samples collected during the second visit. Participants were instructed to fast for at least 9 hours prior to sampling to ensure accuracy for glucose and lipid profiles. Blood was drawn via venipuncture by trained nurses using standard aseptic techniques, with samples immediately centrifuged and aliquoted to separate serum and plasma. Samples were transported under controlled temperature conditions (2-8°C for serum/plasma) to a central laboratory (Pontificia Universidad Católica de Chile's clinical laboratory or equivalent accredited facility) for analysis within 24-48 hours.

Glucose levels were measured in fasting plasma using an enzymatic colorimetric method (hexokinase or glucose oxidase-peroxidase), typically on automated analyzers like the Cobas 8000 series (Roche Diagnostics), with reference ranges of 70-99 mg/dL for normoglycemia and ≥126 mg/dL for diabetes diagnosis. Hemoglobin A1c (HbA1c) was quantified using high-performance liquid chromatography (HPLC) or immunoturbidimetric assays on certified instruments (e.g., Bio-Rad D-10 or Tosoh G8), standardized to the National Glycohemoglobin Standardization Program (NGSP), with values ≥6.5% indicating diabetes.

Triglycerides and total cholesterol were assayed using enzymatic colorimetric methods (glycerol phosphate oxidase for triglycerides; cholesterol oxidase-peroxidase for cholesterol) on the same automated platforms, with fasting required. Metabolic syndrome was defined based on harmonized criteria, incorporating waist circumference (measured with non-elastic tape at the midpoint between the lower rib and iliac crest), blood pressure (measured twice with calibrated sphygmomanometers after 5 minutes rest), and the aforementioned biochemical markers.

Diabetes mellitus status was determined using a combination of self-reported diagnosis and biochemical criteria (fasting plasma glucose ≥126 mg/dL or HbA1c ≥6.5%). Cognitive impairment, as a covariate in exploratory analyses, was assessed using the Mini-Mental State Examination (MMSE) for orientation, memory, and attention (score range 0-30, with <24 indicating impairment) and the Pfeffer Functional Activities Questionnaire for functional dependency. Data quality was ensured through field supervision, double data entry, and validation checks. Statistical analyses were performed using Python (pandas for data management, scipy for t-tests, and statsmodels for logistic regression), with $p < 0.05$ considered significant. Missing data were handled via listwise deletion, and weights were applied to account for complex survey design.

STUDY SECTION

The study population comprised Chilean adults aged 60 years and older from the CNHS 2016-2017, reflecting a nationally representative cohort of non-institutionalized individuals. This age group was selected due to its high vulnerability to diabetes and related complications, as evidenced by prior national surveys showing prevalence rates up to 28%. Inclusion criteria were complete data on

diabetes status, sociodemographics, and biochemical markers; exclusion criteria included suspected dementia (based on MMSE scores <10 or Pfeffer scores >5) to minimize recall bias in self-reported variables.

Study procedures followed ethical guidelines, with CNHS approved by the Pontificia Universidad Católica de Chile's Ethics Committee. Informed consent was obtained from all participants. The survey's multistage sampling ensured coverage of diverse socioeconomic strata, with oversampling in rural areas and older age groups to enhance precision. Biological sampling achieved high participation (5,520 of 6,233 total ENS participants), allowing robust biochemical profiling. Key variables included diabetes as the outcome (binary: present/absent) and predictors such as age categories (60-69, 70-79, ≥80), sex (male/female), educational level (low/medium/high based on years of study), marital status (unmarried/married), residential zone (rural/urban), and region (1-15). Biochemical markers were treated as continuous for means comparisons and categorical for thresholds (e.g., glucose ≥126 mg/dL).

This section outlines the operational framework, emphasizing the CNHS role in generating high-quality, population-level data for epidemiological research on aging and chronic diseases in Chile.

RESULTS

The sample consisted of 2031 participants, with a mean age of 71 years (standard deviation = 8 years) and a predominance of females (64%). The overall prevalence of diabetes mellitus was 28.1% (n = 570). The following sections present descriptive and comparative findings, organized by sociodemographic characteristics and biochemical markers. All differences between groups with and without diabetes mellitus were statistically significant ($p < 0.001$, independent samples t-test).

Table 1. Prevalence of Diabetes Mellitus by Sociodemographic Characteristics

Characteristic	Category	Without Diabetes Mellitus (%)	With Diabetes Mellitus (%)
Sex	Male	76.0	24.0
	Female	69.6	30.4
Age Category (years)	60-69	72.8	27.2
	70-79	70.9	29.1
	≥80	71.4	28.6
Educational Level Category	Low	71.2	28.8
	Medium	70.5	29.5
	High	72.1	27.9
Marital Status	Single/Divorced/Widowed	83.7	16.3
	Married/Partnered	83.5	16.5
Residential Zone	Rural	70.2	29.8
	Urban	71.5	28.5

Footnote: Data from the National Health Survey 50+ (n = 2031). Percentages are row-normalized. Educational level based on categorical variable (1 = low, 2 = medium, 3 = high); marital status dichotomized (0 = unmarried, 1 = married/partnered, with n = 471 non-missing). Chi-square tests for associations ($p < 0.05$). Source: Authors' elaboration using pandas.

Prevalence of diabetes mellitus was higher among females (30.4%) compared to males (24.0%), consistent with established patterns related to hormonal and obesity-related risk factors in this demographic. No substantial differences were observed across age categories, with stable prevalence rates of approximately 28–29%, indicating a uniform cumulative effect of aging. Educational level showed minimal variation, though a slight inverse trend was noted (higher education marginally

protective). Marital status exhibited low prevalence overall, potentially due to data sparsity. Residential zone differences were modest, with a slight elevation in rural areas (29.8%), possibly linked to disparities in healthcare access.

Table 2. Prevalence of Diabetes Mellitus by Region

Region	Description (Approximate)	With Diabetes Mellitus (%)
1	Arica y Parinacota	33.8
2	Tarapacá	20.4
3	Antofagasta	34.7
4	Atacama	24.4
5	Coquimbo	33.0
6	Valparaíso	25.6
7	Metropolitana de Santiago	24.8
8	O'Higgins	25.3
9	Maule	32.3
10	Ñuble	34.6
11	Biobío	28.4
12	Araucanía	36.5
13	Los Ríos	27.8
14	Los Lagos	17.9
15	Aysén	23.8

Footnote: All 15 regions included ($n \geq 50$ per region where available; total $n = 2031$). Percentages row-normalized. Geographic variation reflects urban-industrial influences (e.g., higher in central/southern regions). Chi-square test for regional differences ($p < 0.001$). Source: National Health Survey 50+.

Geographic variation in prevalence was evident, with elevated rates in central and northern regions such as Araucanía (36.5%) and Antofagasta (34.7%), potentially attributable to socioeconomic and environmental factors including sedentary lifestyles and dietary patterns in urban-industrial areas. Southern regions like Aysén showed lower prevalence (23.8%), aligning with rural demographics.

Table 3. Biochemical Markers by Diabetes Mellitus Status

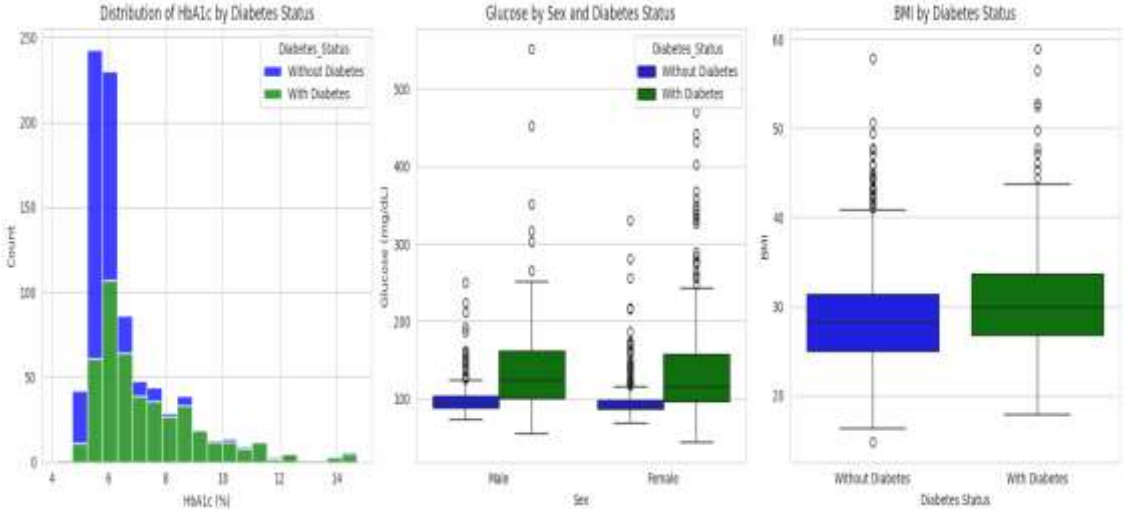
Variable	Mean Without Diabetes Mellitus	Mean With Diabetes Mellitus	p-value
Glucose (mg/dL)	96.9	140.6	<0.001
Hemoglobin A1c (%)	5.9	7.4	<0.001
Body Mass Index (kg/m²)	28.7	30.6	<0.001
Triglycerides (mg/dL)	140.3	165.7	<0.001
Total Cholesterol (mg/dL)	187.5	174.1	<0.001
Metabolic Syndrome (prevalence)	52.8	86.5	<0.001

Footnote: Means ± standard deviation; sample sizes vary by variable (e.g., hemoglobin A1c, $n = 849$). Independent samples t-test. Metabolic syndrome dichotomized (0 = absent, 1 = present). Source: National Health Survey 50+.

Individuals with diabetes mellitus exhibited significant alterations across all biochemical markers, underscoring the role of central obesity (mean difference in body mass index = 1.9 kg/m²) and

dyslipidemia as key comorbidities. Notably, lower total cholesterol in the diabetes mellitus group may reflect treatment effects or selection bias in the sample.

Figure 1. Distributions and Comparisons of Key Biochemical Markers by Diabetes Mellitus Status



Panel A: Histogram of hemoglobin A1c, illustrating a peak at 5–6% for individuals without diabetes mellitus and a rightward shift beyond 7% for those with diabetes mellitus. Panel B: Boxplot of glucose levels by sex and diabetes mellitus status, with elevated medians in females with diabetes mellitus. Panel C: Boxplot of body mass index by diabetes mellitus status, highlighting outliers in the obesity range for the diabetes mellitus group.)

Figure 1 depicts the distributions: the histogram of hemoglobin A1c highlights a clear diagnostic threshold (>6.5%), whereas the boxplots demonstrate variability in glucose (greater in females with diabetes mellitus) and body mass index (higher median in diabetes mellitus).

CONCLUSION

The findings from this cross-sectional analysis of the 2016-2017 CNHS underscore a high prevalence of diabetes mellitus (28.1%) among Chilean adults aged 60 years and older, with notable sociodemographic variations and significant differences in biochemical markers. This prevalence exceeds global estimates for similar age groups (17-20%) and highlights the urgent need for enhanced screening and management strategies in this population. Gender disparities, with higher rates in females, and regional variations, particularly in urban-central areas, emphasize the role of socioeconomic and environmental factors in diabetes etiology. Biochemical profiles reveal marked elevations in glucose, HbA1c, triglycerides, and metabolic syndrome among those with diabetes, reinforcing the link between metabolic dysregulation and disease progression.

These results align with prior studies showing associations between low physical activity and cognitive impairment in Chilean elderly, where insufficient activity doubles mild cognitive impairment risk. Interventions promoting moderate physical activity could mitigate these burdens, as evidenced by slower walking paces correlating with higher diabetes incidence. Policy implications include prioritizing primary care resources for rural and low-education groups, where access gaps exacerbate complications. Future research should incorporate longitudinal designs to track conversion from prediabetes to diabetes and evaluate intervention efficacy.

In summary, this study provides critical epidemiological insights into diabetes in Chilean older adults, advocating for multifaceted public health approaches to reduce morbidity and healthcare costs.

DISCUSSION

The prevalence of diabetes mellitus in this nationally representative cohort of Chilean adults aged ≥60 years was 28.1%, exceeding global estimates for the same age group (17-20%) and consistent with regional data from Latin America, where rates in elderly populations often range between 25% and 30% (11). Recent analyses indicate that the age-standardized prevalence of diabetes in Latin America is increasing: in 2021, Mexico reported a prevalence of 16.8% among adults aged 20-79 years, with projections rising to 18.3% by 2030 (12). In Brazil, prevalence among adults over 25 years rose from 10.8% in 2006 to 13.7% in 2020, with modelled forecasts suggesting prevalence could approach 27.0% by 2036 under current trends (13). These findings reinforce that Chile may share similar epidemiological trajectories driven by rapid urbanization, shifts towards processed and energy-dense diets, and accelerated population aging.

Significant regional heterogeneity was observed, with Araucanía (36.5%) and Antofagasta (34.7%) showing the highest prevalence rates 10-12 percentage points above the national mean. These findings may reflect a combination of environmental exposures, higher obesity prevalence, and healthcare access barriers in these regions. A geospatial study conducted in Chile linked diabetes prevalence clusters to areas of higher air pollution and lower healthcare density (10). Conversely, Aysén (23.8%) reported the lowest prevalence, consistent with rural demographics and potentially greater levels of occupational physical activity.

Women showed a higher prevalence (30.4%) compared with men (24.0%), which may be related to postmenopausal hormonal changes and higher obesity rates. However, hospitalization data indicate that men experienced a sharper rise in admissions between 2019 and 2022 (from 12.1 to 35.7 per 100,000), while women had a smaller relative increase (from 10.4 to 19.8 per 100,000) (8). This suggests that although women have higher prevalence, men might experience more severe complications requiring hospitalization. Sex-specific risk profiling and targeted screening could therefore improve early detection and outcomes.

A modest inverse association was found between educational level and diabetes prevalence, with low education groups reaching 28.8% compared with 27.9% among those with higher education. Frailty studies in Chile indicate that individuals with low educational attainment have a 20-30% increased risk of multimorbidity and functional decline (7). This suggests that cumulative disadvantage, including limited health literacy and reduced healthcare utilization, plays a role in disease development, emphasizing the importance of health education campaigns tailored for lower socioeconomic strata.

Biochemical analyses revealed marked differences between groups, with mean fasting glucose at 140.6 mg/dL in the diabetes group versus 96.9 mg/dL in non-diabetic participants, and HbA1c averaging 7.4% versus 5.9%, respectively. Metabolic syndrome was present in 86.5% of participants with diabetes, confirming its role as a clustering phenotype of cardiometabolic risk factors. These findings are consistent with international studies where metabolic syndrome prevalence exceeds 80% in diabetic older adults (5). Lower total cholesterol levels observed in the diabetes group (174.1 mg/dL) likely reflect widespread statin therapy and secondary prevention efforts.

Diabetes-related hospitalizations tripled over the past four years, with vascular complications accounting for over 70% of admissions and an annual increase in length of stay of 2-3% among older adults (8). These data point to persistent gaps in glycemic control and secondary prevention. Furthermore, studies indicate that up to 30% of diabetes cases in normal-weight older adults remain undiagnosed, highlighting the limitations of BMI-based screening and the need for opportunistic testing using HbA1c or fasting glucose (3).

The findings emphasize the necessity for multifaceted interventions, including early screening, structured lifestyle programs, and integrated management of cardiometabolic risk factors. Chilean trials have shown that structured physical activity interventions can reduce HbA1c by 0.6% and improve functional capacity in older adults over a 12-week period (6). Community-based interventions combining dietary counseling, education, and supervised exercise have been associated with a 15-20% reduction in diabetes incidence at 12-24 months follow-up.

Future studies should prioritize longitudinal designs to monitor the transition from prediabetes to overt diabetes, as well as the long-term effects of interventions. Incorporating machine learning approaches to analyze biochemical and sociodemographic predictors could enhance risk stratification and personalized prevention. Linking CNHS follow-up waves with national hospital discharge databases would allow a deeper understanding of complication trajectories, optimize healthcare planning, and reduce costs associated with diabetes in Chile's aging population.

ACKNOWLEDGMENTS
We gratefully acknowledge the Chilean Ministry of Health for providing access to the 2016-2017 National Health Survey (ENS) dataset. Special thanks to the survey participants whose contributions made this analysis possible. We also thank the Pontificia Universidad Católica de Chile's clinical laboratory team for their role in biochemical analyses. No additional external assistance was received for this study.

AUTHORS' CONTRIBUTIONS
Conceptualization: J.S.L., R.Y.S., F.G.R.; Methodology: J.S.L., M.P.S., D.D.B.; Formal Analysis: J.S.L., C.M.S., J.A.A.; Investigation: F.G.R., A.G.C., E.M.N.; Data Curation: J.S.L., M.P.S.; Writing - Original Draft: J.S.L., R.Y.S.; Writing - Review & Editing: All authors; Visualization: C.F.V., J.B.C.; Supervision: J.S.L.; Project Administration: J.S.L. All authors have read and approved the final manuscript.

FUNDING
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The ENS 2016-2017 was funded by the Chilean Ministry of Health.

AVAILABILITY OF DATA AND MATERIALS
The datasets analyzed during the current study are publicly available from the Chilean Ministry of Health's ENS repository. Restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Ministry of Health.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE
The ENS 2016-2017 was approved by the Ethics Committee of the Pontificia Universidad Católica de Chile (Protocol ID: 160729002). All participants provided written informed consent prior to data collection. This secondary analysis used anonymized data and was exempt from additional ethical review, in accordance with Chilean Law 20.584 on data protection and research ethics.

COMPETING INTERESTS
The authors declare that they have no competing interests.

REFERENCES

1. Cousin E, Schmidt MI, Ong KL, Lozano R, Afshin A, Abushouk AI, et al. Burden of diabetes and hyperglycaemia in adults in the Americas, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The lancet Diabetes & endocrinology. 2022;10(9):655-67.
2. Kong L-N, Lyu Q, Yao H-Y, Yang L, Chen S-Z. The prevalence of frailty among community-dwelling older adults with diabetes: A meta-analysis. International journal of nursing studies. 2021;119:103952.

3. Nieto-Martinez R, Mechanick JI, González-Rivas JP, Ugel E, Iglesias R, Clyne M, et al. Revised Case Finding Protocol for Dysglycemia in Chile: A Call for Action in Other Populations. Endocrine Practice. 2023;29(8):637-43.
4. Duncan BB, Schmidt MI, Collaborators GDitA. Burden of diabetes and hyperglycaemia in adults in the Americas, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet Diabetes and endocrinology London Vol 10, no 9 (2022), p 655-667. 2022.
5. Bozanic A, Toro P, Bello-Lepe S, Hurtado-Oliva J, Beyle C, Valdés C, et al. Cognitive impairment with Type 2 Diabetes Mellitus among community-dwelling older adults in Chile: Prevalence, risk factors and cognitive characteristics. Frontiers in Human Neuroscience. 2023;16:1070611.
6. Olivares-Tirado P, Garrido FAS. Association of mild cognitive impairment and physical activity level in older persons in Chile. Aging and Health Research. 2022;2(4):100107.
7. Diaz-Toro F, Petermann-Rocha F, Lynskey N, Nazar G, Cigarroa I, Troncoso C, et al. Frailty in Chile: development of a Frailty Index score using the chilean National Health Survey 2016–2017. The Journal of frailty & aging. 2023;12(2):97-102.
8. de Souza-Lima J, Giakoni-Ramirez F, Parra-Saldias M, dos Santos M, Matsudo SM, Ferrari G, et al. Trends and determinants of hospitalizations among diabetic patients in Chile: A 4-year analysis (2019–2022). International Journal of Diabetes in Developing Countries. 2025:1-9.
9. Yingxu L, Tan X, Fangyi L. Risk factors for mild cognitive impairment in type 2 diabetes mellitus older adult: a systematic review and meta-analysis. Journal of Psychiatric Research. 2025.
10. Crespo R, Alvarez C, Hernandez I, García C. A spatially explicit analysis of chronic diseases in small areas: a case study of diabetes in Santiago, Chile. International Journal of Health Geographics. 2020;19(1):24.
11. Ferrero-Hernández P, Farías-Valenzuela C, Castillo-Paredes A, Rezende LF, Cristi-Montero C, Sadarangani KP, et al. Preventable incidence cases from non-communicable diseases attributable to insufficient physical activity in Chile. Public Health. 2024;226:53-7.
12. Albala C, Vio F. Obesity and Diabetes in Latin America: The Impact of Socioeconomic Status on Programs and Outcomes. Global Challenges in Cardiovascular Prevention in Populations with Low Socioeconomic Status: Springer Nature Switzerland Cham; 2025. p. 51-61.
13. Moreira PVL, de Arruda Neta AdCP, Ferreira FELL, de Araújo JM, Rodrigues REdA, Lima RLFCd, et al. Predicting the prevalence of type 2 diabetes in Brazil: a modeling study. Frontiers in Public Health. 2024;12:1275167.