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IMPACT OF HOME AND LEISURE ACCIDENT RATES ON DISABILITY AND COSTS OF LONG-TERM CARE IN SPAIN ACCORDING THE EDAD 2020 SURVEY

IMPACTO DE LOS ACCIDENTES EN EL HOGAR Y DE OCIO EN LA DISCAPACIDAD Y COSTES DE LARGA DURACIÓN EN ESPAÑA SEGÚN LA ENCUESTA EDAD 2020

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ABSTRACT

Home and leisure accidents (HLAs) are one of the main causes of mortality attributable to causes other than aging and have a major impact on health systems. However, to date, studies measuring their socioeconomic impact are limited, unlike those associated with other causes such as accidents on the roads or in the workplace. We seek to analyze the long-term care (LTC) needs associated with HLAs in Spain using data from the recent EDAD 2020 survey. We conclude that the care needs derived from such accidents increase with age. The significant annual economic costs of HLAs in Spain, amounting to 2,158 million euros in 2020 or 0.19% of GDP, underscore the necessity to back preventive policies and to encourage insurance products that provide coverage for disabilities resulting from accidents at home and during leisure activities in general.

Keywords: Social care; long-term care costs; preventive actions.

RESUMEN

Los accidentes domésticos y de ocio (HLA) son una de las principales causas de mortalidad atribuible a causas distintas al envejecimiento y tienen un importante impacto en los sistemas de salud. Sin embargo, hasta la fecha, los estudios que miden su impacto socioeconómico son limitados, a diferencia de los asociados a otras causas como los

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accidentes de tráfico, o laborales. Buscamos analizar las necesidades de cuidados de larga duración (LTC) asociadas a los HLA en España a partir de datos de la reciente encuesta EDAD 2020. Concluimos que las necesidades de cuidados derivadas de este tipo de accidentes aumentan con la edad. Los importantes costes económicos anuales de los HLA en España, estimados en 2.158 millones de euros en 2020 o el 0.19% del PIB, subrayan la necesidad de apostar por políticas preventivas y fomentar productos aseguradores que cubran las discapacidades derivadas de los accidentes en el hogar y de ocio en general.

Palabras clave: Atención social; costes de cuidados de larga duración; medidas preventivas.

1. INTRODUCTION

The relationship between accidents in the home and those that occur during leisure time, on the one hand, and permanent injuries, on the other, is one that has attracted virtually no research interest. Unlike the analysis of the impact of other types of accident, such as traffic accidents or accidents at work (see, among many others, Mohanty *et al.* (2022)), those occurring at home or while performing leisure, cultural and sports activities have been largely ignored, due to the lack of rigorous databases that might support detailed analyses. However, two trends highlight the increasing need to advance in the study of home and leisure accidents (HLAs): on the one hand, population aging will probably cause an increase of accidents at home, given the high correlation between advanced ages and falls in the home; and, on the other, people's changing habits with regards to their participation in sports and leisure activities, with higher than ever accident rates being recorded among youngsters due to participation in sport activities, and among the older population when other types of leisure and cultural activity are included in the analysis.[1] The increase in the number of people left vulnerable to risks of home and leisure accidents and their associated physical and socioeconomic consequences motivate our analysis.

In this study, we define HLAs as any unintended event that causes physical and/or psychological injuries to a person while inside their home or in any of the outbuildings of that property, or while participating in a recreational, leisure, sport or educational activity. As such, suicides, incidents of self-harm, traffic accidents, work accidents and acts of violence are excluded from the definition.

According to the most recent data, about 24.6 million people suffered HLAs in the European Union (EU) between 2012 and 2014 (EuroSafe, 2016). Recently, in November 2022, the Swiss Council for Accident Prevention BFU[2] reported that more accidents occur at home and in leisure time, excluding sports, than on the roads and in sports combined. According to BFU projections, the trend is increasing, and people over the age of 85 are especially prone to serious injuries occurred in private homes (81% of cases corresponding to falls). These results are in line with earlier reports published by the World Health Organization (WHO, 2009), indicating that 63% of all unintentional injuries occur at home, in sports or during leisure time. Indeed, the rate of fatalities resulting from injuries incurred during HLAs in the EU is projected to be double that of traffic accidents, and more than ten times that of workplace accidents (EuroSafe, 2006). In Norway, Lund and Bjerkdal (2001) found that 20% of all accidents resulted from domestic and leisure activities, with the ratio between disability pensions and mortality resulting from home accidents standing at 1:2.7 in the 15-64 age group. As for prevention, Keall *et al.* (2015) show that home modifications

[1] For example, a rising number of leisure trips are made by the elderly in Spain today thanks to policies implemented by the Ministry of Health, Social Services and Equality (IMSERSO) to improve welfare in this age group.

[2] On 15 November 2022, the Swiss Council for Accident Prevention BFU, on behalf of the State Secretariat for Economic Affairs, published the first safety barometer on HLAs, in which they analyze accidents over the last ten years.

aimed at preventing domestic injuries help reduce specific bodily damages by 39%, and injuries attributed to falls that require medical attention by 26%.

Studies examining the relationship between HLAs and permanent injuries and disability are rare. In a study of severe domestic injuries as a cause of disability in Turkey, Kiliç et al. (2017) show that the risks of HLAs causing injury and subsequent disability are, respectively, four and six times higher in children under the age of five than in the rest of the age groups. Chammem *et al.* (2021) indicate that the occurrence of a harsh event affecting elderly people, such as a domestic accident, usually motivates a significant change in their lifestyle or living environment. Studies of the relationship between home accidents and the elderly are more frequent than for younger population (Spanish Ministry of Health, Social Services and Equality, 2011; Heywood and Turner, 2007; De Vicente and García, 2013). Here, we define disability as the difficulty performing the basic activities of daily living (ADLs) (that is, of mobility, eating, maintaining continence, etc.) as well as the so-called instrumental and functional activities (that is, answering the phone, managing personal finances, etc.). These disabilities are considered permanent when they affect an individual for more than a year and are deemed irreversible (their sequelae affecting the individual for the rest of their life).

Several studies have analyzed the effects of HLAs in terms of hospital visits/admissions, and medical and administrative expenses (Alves *et al.,* 2020; Veisten *et al.,* 2009; Hopkin and Simpson, 1996), as well as during the COVID-19 pandemic (Alves *et al.,* 2021). Others have analyzed their social impact on early mortality, reduction in productivity and the social costs attributable to disability (Veisten and Nossum, 2007). In Spain, a report entitled "Injury Prevention Program: Detection of Domestic and Leisure Accidents 2011" (DADO 2011), carried out by the Ministry of Health, Social Services and Equality in the framework of an initiative launched by the European Parliament and the EU Council in 1999, is probably the most pertinent source of information for studying the profile of HLAs. Data for the report were obtained about the sociodemographic characteristics of the victims, the nature of the accidents and the injuries incurred in a total of 7,751 domestic and leisure accidents.[3] HLA injuries are among the most frequently occurring injuries in Spain but among the least studied, with 5 out of every 100 Spaniards suffering an HLA each year, according to the DADO report (2011).

In a similar way, Mateos *et al.* (2012) study the sociodemographic characteristics of victims (age, sex, time, place, type and cause of accident) in a representative sample of 2,889 HLAs registered in 88 primary healthcare centers in Castile and León,[4] and report that the most frequent accidents are falls occurring in the home on weekdays. De Vicente and García (2013) arrived at similar conclusions using a sample of 1,067 individuals aged over 65 who reside in their family homes. Falls are found to be the most frequent type of accident being recorded in 36% of the households analyzed.

Now we propose conducting a similar analysis to that carried out by Alemany *et al.* (2013) for the impact of road traffic injuries, albeit that our objective here is to determine the impact of injuries resulting from HLAs on long-term care (LTC) prevalence rates in Spain. All information here about disabilities, aging and the population's health status has been obtained from the Survey of Disability, Personal Autonomy and Long Term Care situations EDAD 2020, conducted by the Spanish National Institute of Statistics. Since 2007, Spanish Law 39/2006 of 14 December has promoted the provision of personal care for dependent people and offers long-term care to citizens who cannot perform the basic ADLs without the help of a third party. Note that from responses obtained in the EDAD2020 survey we cannot exactly know whether or not people have an official LTC level as stablished by the

[3] Based on 206,588 interviews conducted in 74,514 Spanish households.
[4] Spain's largest region in terms of area in the north-west of the country.

Spanish law, but we can estimate it based on the answers that the respondents do offer about whether or not they suffer from the disabilities that are taken into account in the official assessment of the level of LTC in Spain, and their severity, information that does appear in the survey. The authors use the formula that the regulated LTC scale itself establishes in order to estimate the LTC score assigned to each individual. In line with what the LTC Law itself indicates, if the estimated score for the individual is less than 25, it is estimated that the respondent has a LTC level equal to zero and is not entitled to public LTC coverage. If the estimated score is between 25 and 50 points, the respondent has a LTC level equal to one (I), or moderate level, with public coverage. If the score is between 50 and 75 points, the estimated LTC level is two (II) or severe; and if it is greater than 75, the estimated LTC level is maximum or level III. Logically, these last two with public coverage.

Here, we analyze: (a) chronic impairment attributable to HLAs; (b) estimated LTC prevalence rates attributable to HLAs among people aged 6 years and older; (c) estimated LTC prevalence severity levels attributable to HLAs; (d) estimated 2020 LTC annual cost associated with HLAs, according prevalence rates for each severity level and expected hours of care by third parties; and its volume as a fraction of the Spanish GDP. Finally, we compare distributions of impairment, age and LTC prevalence severity levels for people presenting disabilities attributable to both HLAs and other causes. In so doing, we select the least restrictive definition and consider a victim of an HLA needing long term care when they present at least one limitation (sight, hearing, communication, etc.) attributable to HLA causes.[5]

2. DATA AND METHODS

The Survey of Disability, Personal Autonomy and Long Term Care situations EDAD 2020 is a macro-survey aimed at all people aged 2 and over who reside in family homes throughout the Spanish territory. This survey is not conducted with regular periodicity. 68,000 households are interviewed after a stratified two-stage sampling is performed. A multichannel interviewing method is implemented (web questionnaire, personal interview and computer-assisted telephone interview). The concept of disability is identified when an individual answer positively to the whether they suffer "significant limitations to the performance of activities of daily living that have lasted or are expected to last more than one year, and that have their origin in an impairment". Once the presence of a person with a disability at home has been recognised, an additional extensive questionnaire for that person is conducted individually. Table 1 presents the set of activities of daily living (ADLs) considered in the analysis and corresponds directly to the protocol for evaluation of the degree of LTC published in the Spanish LTC assessment scale (RD 174/2011 and Resolution of July 13, 2012). As mandated by law, the evaluation aims to identify whether or not there are limitations to perform each ADL, and the corresponding level of difficulty.

[5] Note that this can introduce a bias in the estimates. According to Shults *et al.* (2004), albeit in the context of road traffic injuries, estimated LTC prevalence rates could be up to 20% lower if we consider a road traffic disability as having occurred when the individual attributes all activity of daily living limitations to the road accident.

Activities of Daily Living	Age and weights by age		
	6 y.o.	7-17 y.o.	18+ y.o.
Eating and drinking	22.4	18.3	16.8
Urination and Defecation	20.3	16.1	14.8
Washing	12.1	9.6	8.8
Other body care	-	3.2	2.9
Dressing	16.3	12.9	11.9
Health maintenance	-	3.2	2.9
Body transfers	12.1	11.0	9.4
Displacement within the home	16.8	13.4	12.3
Displacement outside the home	-	12.3	12.2
Perform household tasks	-	-	8.0

Table 1. List of basic activities of daily living according to the LTC Spanish Law and maximum number of points for LTC evaluation by age.
Source: BOE, February 18, 2011, nº 42; BOE, August 3, 2012, nº 185).

In this study, we consider those individuals that explicitly stated that at least one of their functional or sensory limitations are attributable to HLAs. We then use the Spanish LTC valuation score, which we call the LTC index, to quantify the LTC severity level of the disabled individuals and their LTC needs. The LTC index considers the 21 disabilities presented in Table 2, which are directly related to the ten categories of functional/sensory limitations defined in Table 1.

The LTC index of person i, S_i, is calculated using the following formula,

$$S_i = \sum_{j=1}^{21} D_{ij} C_{ij} P_{ij} \qquad (1)$$

where D_{ij} is a dichotomous variable with a value of 1 if individual i suffers disability j and 0 otherwise ($i = 1, \dots, N; j = 1, \dots, 21$) and N is the sample size; C_{ij} is a categorical variable for which the Law establishes a value of 0.9 if the need for support j for individual i is moderate, 0.95 if it is severe, 1 if it is full, and 0 if no support is required; and, variable P_{ij} includes the scoring factors provided in Table 1 for disability j.

The LTC index ranges between 0 and 100. When the score is under 25, the individual suffers some impairment but the severity is considered low and the evaluation concludes that the individual does not require third-person help (level 0); if the score is between 25 and 50, the individual is considered to have moderate LTC (level 1) and requires help at least once a day; if the score is between 50 and 75, the LTC level is considered severe (level 2) and the individual requires help more than once a day, albeit not permanently; finally, if the score is over 75, the individual has full LTC (level 3) and requires permanent help.

Here, we calculate national LTC prevalence rates estimates by incorporating the population aged 6 years or older (INE, 2021) from the EDAD 2020 sample weights and the 2020 Spanish Census estimates. The analysis has been conducted using R. First, we estimate the LTC prevalence rates attributable to HLAs by using formula (1). Note that we refer to HLA-long term care when an impairment is attributable to disabilities that were caused by a home or leisure accident. Then, we estimate the costs associated to dependent individuals in terms of third-person help as a consequence of their HLA, and compare these costs and those attributable to other causes. We consider the same LTC-need scenarios

used in previous studies as provided by geriatricians and social workers (Artís *et al.*, 2007, Ayuso and Guillen, 2011) to undertake these calculations.

1. Is blind.	12. Has major difficulties learning or performing tasks without help or supervision.
2. Has major difficulties seeing the letter of a newspaper when wearing glasses or contacts.	13. Has major difficulties keeping the body in the same position for a while or changing positions without help or supervision.
3. Has major difficulties seeing a face at a 4 meter distance when wearing glasses or contact lenses.	14. Has major difficulties moving outside of their home without help or supervision. (including using or driving means of transport).
4. Has other major visual difficulties when wearing glasses or contact lenses. (night vision, colour differentiations, people blind in one eye…).	15. Has major difficulties lifting or carrying an object using hands and arms without help or supervision.
5. Is deaf.	16. Has major difficulties manipulating and moving objects using arms, hands and fingers without help or supervision.
6. Has major difficulties hearing what is being said in a conversation between multiple people without help.	17. Has major difficulties cleaning or drying themselves, taking showers or performing other basic body care activities without help or supervision.
7. Has major difficulties hearing an alarm, siren or any other loud sound without help (or is deaf in one ear).	18. Has major difficulties dressing, undressing or feeding themselves, going to the bathroom or taking medicine without help or supervision.
8. Has major difficulties speaking their usual language, holding a conversation or understanding the meaning of what other people say.	19. Has major difficulties organizing and buying food, clothes or other house items without help or supervision (older than 12).
9. Has major difficulties understanding written texts, expressing themselves through them or understanding gestures, drawings… (excluding those who didn't learn how to read or write but don't have any health issue or impairment)	20. Has major difficulties undertaking daily housework activities without help or supervision (older than 12).
10. Has major difficulties using the telephone without help or supervision.	21. Has major difficulties relating to other people, starting emotional relationships or starting a family.
11. Has major difficulties paying attention with their eyes or sustaining attention with their ears.	

Table 2. Types of disability considered in the LTC index.
Source: EDAD 2020 (INE 2021).

The average costs (per hour or per year) for formal LTC services provided in Spain are presented in Table 3, and the care needs at each LTC severity level are presented in Table 4. According previous research (Artís *et al.*, 2007; Alemany *et al.*, 2013), an individual with a moderate level of LTC needs can be expected to require home help for three hours each day; individuals with a severe level of LTC needs require support in a day care center and home help for one hour each day; and those with full disability require supervision in a nursing home because their needs are permanent. Because the same caregiver can visit

several patients, severe dependents will incur a lower average expected cost than moderate dependents. According to the Resolution passed on 13 July 2012 by the Spanish Secretary of State for Social Services and Equality, public coverage extends to a maximum of 20 hours per month for those with moderate dependence; between 21 and 45 hours per month for those with severe dependence; and between 46 and 70 hours per month for those with full dependence. Copayment costs can be high.

Home help – public welfare services (per hour)	14.88
Day care for dependent individuals – public welfare services	8,916.52
Residential placement for dependent – public welfare services	18,839.62

Table 3. Average costs (per hour or per year) for formal LTC services in Spain (year 2020, in euros).
Source: Based on data from IMSERSO (2021).

LTC severity levels	LTC services	Expected annual individual cost 2020
Moderate (Level 1)	Home care service (3 h/day)	16,293.60
Severe (Level 2)	Day care center and home service (1 h/day)	14,347.72
Full (Level 3)	Nursing home	18,839.62

Table 4. Long term care needs at each severity level.
Source: Based on data from IMSERSO (2021) and scenarios used in literature (Artís *et al.*, 2007; Alemany *et al.,* 2013).

3. RESULTS

Based on the estimated Spanish population aged 6+ according to EDAD 2020 the prevalence of disabilities considering all causes is 9.35%. The prevalence of disabilities caused by HLAs is 0.42%, which is higher than the prevalence of disabilities attributed to traffic accidents, which is estimated at 0.20%. In absolute terms, in Spain we estimate that there are more than 4 million people with disabilities aged 6 or older. We estimate that 193,799 individuals[6] present a disability attributable to HLAs and 91,679 individuals have a disability caused by a traffic accident.

In Table 5 we present estimated impairment prevalence rates for every 100 disabled individuals when considering i) all possible causes, ii) only accidents in the home, and iii) only leisure accidents, for each of the 21 impairments included in the LTC index. Figure 1 presents a comparison and shows that mobility and physical effort impairments among victims of HLAs is significantly high.[7] Of those disabled as a result of HLAs, 71.50% (home) and 58.92% (leisure), respectively, have major difficulties walking, moving or travelling outside their home unaided (type 14 in Table 2). Similarly, 57.37% and 47.13%, respectively, have difficulties maintaining the body in the same position, changing their

[6] Note that 2,273 individuals present a disability attributable to both home and leisure accidents and they have been counted only once.
[7] This conclusion is corroborated by the DADO report (Spanish Ministry of Health, Social Services and Equality, 2011) that identifies fractures and dislocations as the injuries presenting the highest incidence of sequelae for victims.

body posture or walking and moving in their house without help or supervision (type 13 in Table 2).

Similarly, they also have problems when trying to perform their own self-care: 47.66% (home) and 32.60% (leisure), respectively, have major difficulties cleaning or drying parts of body or performing other basic body care activities without help or supervision (type 17 in Table 2); and 42.27% and 30.24%, respectively, have difficulties dressing, undressing, feeding themselves, going to the bathroom or taking medicine unaided (type 18 in Table 2).

In some cases, estimated impairment prevalence rates are higher among victims of home accidents than among those that have suffered leisure accidents. This is the case of undertaking daily housework activities (type 20 in Table 2): 58.27% for disabilities due to home accidents (vs. 36.46% for those caused by leisure accidents); organizing and buying food, clothes or other house items without help or supervision (type 19 in Table 2): 56.44% (vs. 39.57%, respectively); lifting or carrying an object using hands and arms without help or supervision (type 15 in Table 2): 31.75% (vs. 28.54%); seeing the letter of a newspaper when wearing glasses or contact lenses (type 2 in Table 2): 13.44% (vs. 10.91%); and being blind (type 1 in Table 2): 3.03% (vs. 2.01%). In contrast, major difficulties manipulating and moving objects using arms, hands and fingers without help or supervision (type 16 in Table 2): 20.58% (vs. 17.75%) are more marked among those that have suffered leisure accidents than for those who suffered a home accident.

Type of impairment*	Prevalence per 100 individuals with disabilities caused by any cause	Prevalence per 100 individuals with disabilities caused by home accidents	Prevalence per 100 individuals with disabilities caused by leisure accidents
1. Is blind.	2.54	3.03	2.01
2. Has major difficulties seeing the letter of a newspaper when wearing glasses or contacts.	12.61	13.44	10.91
3. Has major difficulties seeing a face at a 4 meter distance when wearing glasses or contact lenses.	10.22	10.01	8.32
4. Has other major visual difficulties when wearing glasses or contact lenses. (night vision, colour differentiations, people blind in one eye…).	6.38	4.45	4.33
5. Is deaf.	3.01	3.31	3.78
6. Has major difficulties hearing what is being said in a conversation between multiple people without help.	17.52	11.31	15.04
7. Has major difficulties hearing an alarm, siren or any other loud sound without help (or is deaf in one ear).	9.11	6.90	5.03
8. Has major difficulties speaking their usual language, holding a conversation or understanding the meaning of what other people say.	10.78	6.85	5.75

9. Has major difficulties understanding written texts, expressing themselves through them or understanding gestures, drawings… (excluding those who didn't learn how to read or write but don't have any health issue or impairment).	14.29	11.25	9.32
10. Has major difficulties using the telephone without help or supervision.	16.89	15.31	12.62
11. Has major difficulties paying attention with their eyes or sustaining attention with their ears.	6.43	2.86	3.11
12. Has major difficulties learning or performing tasks without help or supervision.	13.68	12.54	7.74
13. Has major difficulties keeping the body in the same position for a while or changing positions without help or supervision.	32.11	57.37	47.13
14. Has major difficulties moving outside of their home without help or supervision. (including using or driving means of transport).	42.89	71.50	58.92
15. Has major difficulties lifting or carrying an object using hands and arms without help or supervision.	21.41	31.75	28.54
16. Has major difficulties manipulating and moving objects using arms, hands and fingers without help or supervision.	14.82	17.75	20.58
17. Has major difficulties cleaning or drying themselves, taking showers or performing other basic body care activities without help or supervision.	25.21	47.66	32.60
18. Has major difficulties dressing, undressing or feeding themselves, going to the bathroom or taking medicine without help or supervision.	24.19	42.27	30.24
19. Has major difficulties organizing and buying food, clothes or other house items without help or supervision (older than 12).	36.42	56.44	39.57
20. Has major difficulties undertaking daily housework activities without help or supervision (older than 12).	36.80	58.27	36.46
21. Has major difficulties relating to other people, starting emotional relationships or starting a family.	12.48	5.45	9.37

*Highest prevalence rates associated with HLAs vs. other causes are shaded.

Table 5. Estimated impairment prevalence rates for Spanish population over 6 years old with disability due to any cause and separately as a result of home and leisure accidents (EDAD 2020)

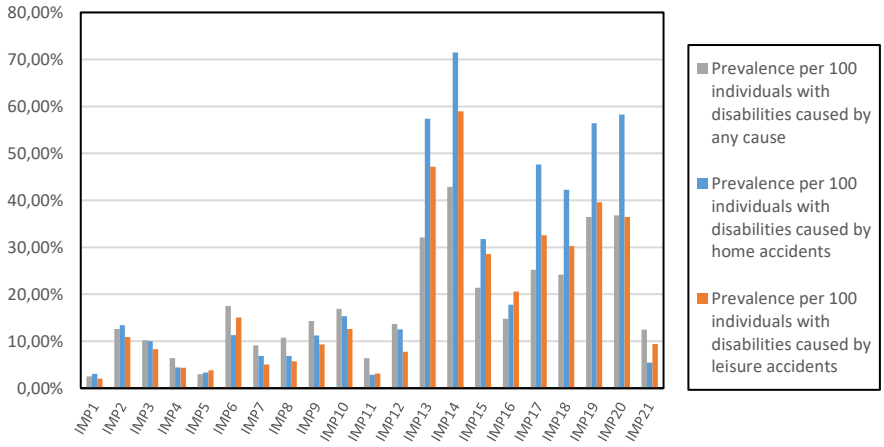


Figure 1. Estimated impairment prevalence rates for Spanish population over 6 years old with a disability due to any cause and separately as a result of home or leisure accidents. For definition of impairments see Table 5.

Table 6 shows the estimated number of people with disabilities caused by HLAs vs. the rest of causes by age interval in Spain, according to EDAD 2020 (total Spanish population by age interval is also shown). Table 7 and Figure 2 present the estimated rates of prevalence of disabilities as a result of HLAs vs. all other causes, by age interval. As is evident (Table 6), the number of people with disabilities among younger adults (especially up to the age of 44) attributable to leisure accidents is higher than that attributable to home accidents, a pattern that is also reflected in the estimated prevalence rates (Table 7). Indeed, up to approximately the age of 54, the prevalence of leisure accidents is higher than that of domestic accidents. However, after that age, the prevalence rates for home accidents begin to increase exponentially, at rates that are even higher than those attributable to the rest of causes. These results confirm previous research findings that identify domestic accidents as one of the leading causes of disability in the elderly (BFU, 2022; De Vicente and Garcia, 2013). Rates of leisure accidents also increase with age but their incidence in the older population is notably lower than that of accidents in the home.

Age	Home accidents	Leisure accidents	Rest of causes	Total Spanish population
06-17	-	440	125,030	5,872,685
18-24	-	1,737	73,142	3,348,241
25-34	710	2,005	108,280	5,277,455
35-44	2,929	10,613	208,172	7,081,178
45-54	9,701	11,969	458,663	7,632,603
55-64	19,280	11,628	646,641	6,446,168
65-74	13,633	10,930	730,470	4,705,891
75-84	36,481	15,305	947,338	3,088,905
+85	41,312	7,399	826,525	1,576,125
Total	124,046	72,026	4,124,259	45,029,251

Table 6. Estimated number of people with disabilities as a result of HLAs vs. the rest of causes by age interval, EDAD 2020 (and estimated Spanish population by age interval, 2020).
Source: Based on EDAD 2020 and estimated Spanish population by age interval according to National Institute of Statistics (INE, 2021). *Note that, unexpectedly, the estimated

number of people with disabilities due to home accidents in the 65-74 age group is lower than the one in the 55-64 age group.

Age	Estimated prevalence of disabilities- home accidents (%)	Estimated prevalence of disabilities- leisure accidents (%)	Estimated prevalence of disabilities- rest of causes (%)
06-17	-	0.007	2.129
18-24	- (0.004)	0.052 (0.022)	2.184 (1.572)
25-34	0.013 (0.003)	0.038 (0.015)	2.052 (2.131)
35-44	0.041 (0.020)	0.150 (0.047)	2.940 (3.681)
45-54	0.127 (0.035)	0.157 (0.047)	6.009 (6.442)
55-64	0.299 (0.083)	0.180 (0.072)	10.031 (10.856)
65-74	0.290 (0.347)	0.232 (0.097)	15.522 (17.884)
75-84	1.181 (0.782)	0.495 (0.193)	30.669 (33.167)
+ 85	2.621 (1.934)	0.469 (0.297)	52.440 (55.678)

Table 7. Estimated prevalence of disabilities when impairments are attributable to HLAs vs. all other causes, EDAD 2020, by age interval (in parentheses the same estimates obtained based on EDAD 2008 as obtained in Alemany et al., 2018).
Source: Based on EDAD 2020. Estimated Spanish population by age interval in 2020 according to National Institute of Statistics (INE, 2021). Data in parentheses based on EDAD 2008 and estimated Spanish population by age interval in 2008 (Alemany et al., 2018).

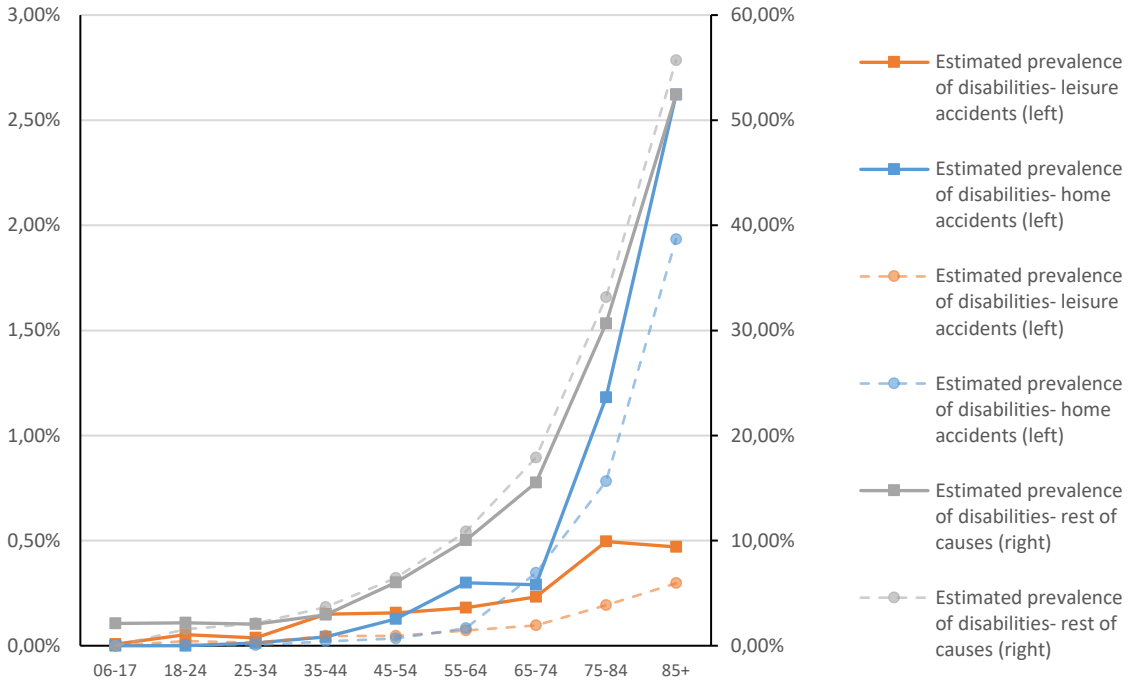


Figure 2. Estimated prevalence of disabilities in the Spanish population over 6 years old in relation to HLAs vs. the rest of causes, by age interval, EDAD 2020 (Dashed line: results according EDAD 2008 as published in Alemany *et al.*, 2018).
Source: Based on Table 7 and Alemany *et al.*, 2018. Left-hand scale: estimated prevalence of disabilities attributable to HLAs (home accidents in blue and leisure accidents in orange); right-hand scale: estimated prevalence of disabilities attributable to all other causes (grey).

When we use formula (1) and compute the LTC index for a person i, S_i, according to EDAD 2020, we obtain the Spanish LTC prevalence rates attributable to HLAs and the rest of causes by level of severity (levels 0, 1, 2, and 3), as has been explained at section 2. Our results (Table 8 and Figure 3) highlight the marked impact of home and leisure accidents on the LTC severity levels, with higher rates than those reported for the rest of causes (with the sole exception of the rate for level 2 attributable to leisure accidents – last column Table 8). However, notable differences are detected by age interval. Thus, while the incidence of home accidents on LTC care needs is very low up to the age of 35, leisure accidents have a marked incidence on the prevalence of full severity level (level 3) up to the age of 24. For the 25-34 age group, 42.72% of people with LTC needs attributable to leisure accidents present a moderate severity level (level 1) and 26.39% a severe level (level 2), figures that are significantly higher than those attributable to the rest of causes in this age group (12.34 and 5.48%, respectively). Given these LTC levels in young people attributable to leisure accidents, and specifically the need for long-term assistance, the impact on LTC costs, as we discuss in the next section, is likely to be high.

The LTC severity level for victims of home accidents after the age of 55 is predominantly moderate to severe (levels 1 and 2, respectively). For example, in the 55-64 age group, the prevalence of moderate and severe LTC needs is 36.84 and 13.49%, respectively vs. 17.57 and 6.27%, respectively, for the rest of causes (excluding leisure accidents). The LTC needs becomes more evident in the population over the age of 65; indeed, between 75 and 84 y.o., almost 78% people with LTC needs as a result of a domestic accident are at level 1 or higher vs. c. 47% of those with LTC needs as a result of other causes (excluding leisure accidents).

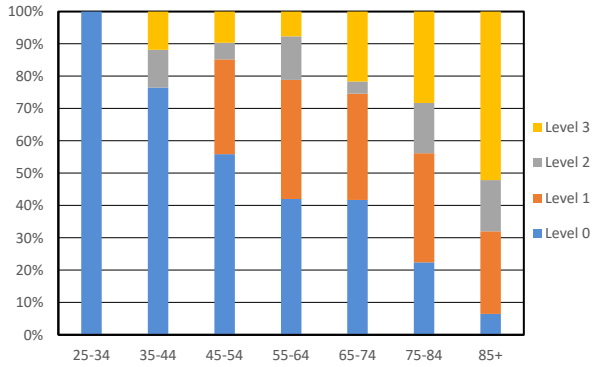
These percentages increase to 93 and 63% respectively from the age of 85. Moreover, we detect a marked rise in those presenting full severity level (level 3) in later life, increasing from 21.59% in the 65-74 age group to 52.11% for victims of domestic accidents aged over 85.

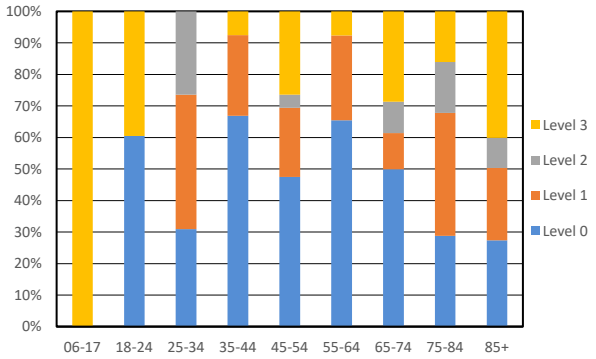
In short, what our result show is the notable incidence of leisure accidents on the LTC needs of Spain's young and adult population, and the rising incidence of home accidents on that of Spain's older population.

	06-17	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
LTC prevalence rates attributable to home accidents										
Level 0 (%)	-	-	100	76.50	55.86	42.01	41.74	22.37	6.50	26.61
Level 1 (%)	-	-	-	-	29.36	36.84	32.85	33.77	25.50	30.06
Level 2 (%)	-	-	-	11.61	5.12	13.49	3.82	15.57	15.89	13.06
Level 3 (%)	-	-	-	11.88	9.66	7.66	21.59	28.29	52.11	30.27
LTC prevalence rates attributable to leisure accidents										
Level 0 (%)	-	60.52	30.89	66.83	47.43	65.45	49.87	28.75	27.33	47.10
Level 1 (%)	-	-	42.72	25.66	22.01	26.90	11.52	39.00	22.95	25.36
Level 2 (%)	-	-	26.39	-	4.15	-	9.97	16.24	9.57	7.37
Level 3 (%)	100	39.48	-	7.51	26.40	7.65	28.65	16.01	40.14	20.17

LTC prevalence rates attributable to other causes										
Level 0 (%)	75.16	68.63	70.83	70.87	71.11	69.93	67.25	53.42	37.66	59.53
Level 1 (%)	8.55	6.06	12.34	16.82	17.05	17.57	18.14	21.54	19.06	18.17
Level 2 (%)	6.32	11.51	5.48	6.74	5.48	6.27	5.84	10.17	13.77	8.60
Level 3 (%)	9.98	13.80	11.35	5.57	6.36	6.23	8.77	14.87	29.51	13.69

Table 8. Spanish LTC prevalence rates attributable to HLAs and the rest of causes by severity level (levels 0, 1, 2, and 3) and by age, 2020.
Source: Based on EDAD 2020 and formula [1]. Level 0 – no help needed from third person; Level 1 - moderate LTC needs; level 2 - severe LTC needs; level 3 - full LTC needs.





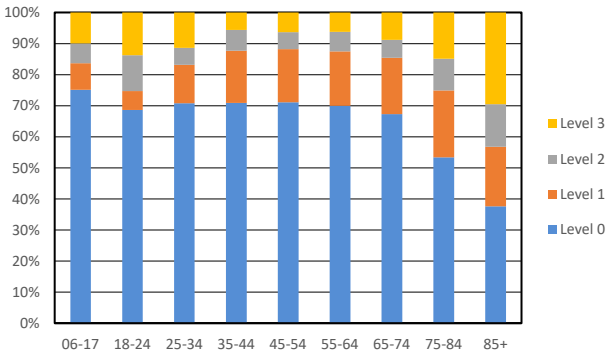


Figure 3. Spanish LTC prevalence rates attributable to home accidents (upper graph), leisure accidents (middle graph) and the rest of causes (lower graph) by severity level (levels 0, 1, 2, and 3) and age.
Source: Own elaboration based on table 8.

Based on the estimated prevalence of the LTC levels presented by Spain's disabled population over 6 years old, and according long term care needs at each severity level as presented in table 4, in Table 9 we present the estimated total annual costs related to third parties help -we name them LTC costs-in 2020 (the year the survey was conducted) for individuals with disabilities attributable to HLAs and those with impairments attributable to the rest of causes. In the case of home accidents (upper panel), these costs rise to c. 1,547 million euros in 2020; in the case of leisure accidents they rise to c. 647 million euros. These totals represent 0.138% and 0.058% of Spanish GDP for 2020, respectively.[8] The impact in terms of cost for domestic accidents is, as expected, greater than that of leisure accidents, given the higher number of people that need help from third parties attributable to the former. This impact is also greater than that attributable to the rest of causes, including most notably disabilities caused by road traffic injuries (the LTC cost of traffic accidents is estimated at 869 million euros in 2020, 44% lower than the costs attributable to domestic accidents).

The highest percentage of home accidents was suffered by those over the age of 55, with LTC costs as a percentage of total costs representing 5.28% in the 55-64 age group, 3.23% in the 65-74 age group, 5.95% in the 75-84 age interval and reaching 7.03% for those aged over 85. In contrast, LTC costs for victims of leisure accidents are higher for the young and adult populations, representing 3.26% of total costs for those in the 18-24 age group, 3.88% of total costs for those in the 25-34 age group and 5.60% for those in the 35-44 age interval. Above the age of 65, LTC costs attributable to leisure activities are notably lower (less than 3% in all age groups).

Results, when analyzed according to the severity level, are also revealing. Individuals aged 18-24 with level 3 following a leisure accident represent 6.36% of annual LTC costs, a figure that is 9.50% in the case of those in the 45-54 age group. These percentages correspond approximately to 12.92 million euros for the former and 59.53 million for the latter. Level 3 in the 75-84 age group with a disability attributable to home accidents represent 6.72% of annual LTC costs, and 8.04% in those aged 85+ (that is, 194.41 and 405.56 million euros, respectively).

Despite the obvious impact of full severity level (level 3) on total LTC costs, the costs associated with the lower severity level in 2020 should not be ignored. For example, level 1 in the 25-34 age group with a disability attributable to leisure accidents account

[8] According to Alemany *et al.* (2018) these percentages were 0.05% and 0.01% of 2008 Spanish GDP (considering only people aged 18 and over).

for 6.02% (c. 13.96 million) of annual estimated LTC costs, while level 1 in the 75-84 age group, victims of home accidents, represent 5.54% of annual costs (200.72 million euros).

Total estimated LTC costs attributable to leisure accidents represent 647 million euros in 2020, while total estimated LTC costs attributable to home accidents represent 1,547 million euros in 2020.

	6-17	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
LTC attributable to home accidents										
Level 1	-	-	-	-	46.41	115.74	72.97	200.72	171.66	607.50
Level 2	-	-	-	4.88	7.13	37.30	7.46	81.51	94.16	232.45
Level 3	-	-	-	6.56	17.65	27.84	55.46	194.41	405.56	707.48
Total (a.1)	-	-	-	11.44	71.19	180.88	135.89	476.63	671.39	1,547.42
LTC attributable to leisure accidents										
Level 1	-	-	13.96	44.38	42.93	50.96	20.51	97.25	27.67	297.66
Level 2	-	-	7.59	-	7.13	-	15.63	35.66	10.16	76.18
Level 3	8.28	12.92	-	15.01	59.53	16.76	59.00	46.18	55.96	273.64
Total (a.2)	8.28	12.92	21.55	59.39	109.59	67.72	95.14	179.08	93.80	647.47
LTC attributable to other causes										
Level 1	174.14	72.24	217.70	570.49	1,274.14	1,851.66	2,159.12	3,325.00	2,567.42	12,211.92
Level 2	113.29	120.81	85.11	201.39	360.45	581.32	612.54	1,382.19	1,632.44	5,104.89
Level 3	235.00	190.15	231.60	218.40	549.69	758.48	1,206.63	2,654.01	4,594.81	10,607.01
Total (b)	522.43	383.21	534.41	990.27	2,184.28	3,191.47	3,978.29	7,361.19	8,794.67	27,923.82
Total costs due to all causes*	530.71	396.12	555.96	1,061.10	2,365.06	3,425.03	4.209.32	8,006.47	9,548.23	30,080.50
Costs due to domestic accidents (a.1)/total (%)	-	-	-	1.08	3.01	5.28	3.23	5.95	7.03	5.14
Costs due to leisure accidents (a.2)/total (%)	1.56	3.26	3.88	5.60	4.63	1.98	2.26	2.24	0.98	2.15
Total costs due to any cause (c)/GDP (%)	0.047	0.035	0.050	0.095	0.212	0.306	0.377	0.716	0.854	2.691
Costs due to domestic accidents/GDP (%)	-	-	-	0.001	0.006	0.016	0.012	0.043	0.060	0.138
Costs due to leisure accidents/GDP (%)	0.001	0.001	0.002	0.005	0.010	0.006	0.009	0.016	0.008	0.058
Cost Level 1 (domestic) / total cost Level 1 (all causes) (%)	-	-	-	-	3.40	5.78	3.24	5.54	6.20	4.64
Cost Level 2 (domestic) / total cost Level 2 (all causes) (%)	-	-	-	2.37	1.90	6.03	1.17	5.47	5.43	4.30
Cost Level 3 (domestic) / total cost Level 3 (all causes) (%)	-	-	-	2.73	2.82	3.47	4.20	6.72	8.04	6.11
Cost Level 1 (leisure) / total cost Level 1 (all causes) (%)	-	-	6.02	7.22	3.15	2.54	0.91	2.68	1.00	2.27

Cost Level 2 (leisure) / total cost Level 2 (all causes) (%)	-	-	8.19	-	1.90	-	2.46	2.39	0.59	1.41
Cost Level 3 (leisure) / total cost Level 3 (all causes) (%)	3.40	6.36	-	6.26	9.50	2.09	4.47	1.60	1.11	2.36

Table 9. Estimated annual LTC costs by severity level when disability is attributable to HLAs vs. other causes in the Spanish population aged 6+ (2020, results in millions of euros).
Source: Based on data from IMSERSO (2020) and estimated rates of LTC severity levels (Table 8). The calculations do not include Level 0 as no public coverage is recognized for this severity level. * Note that the total sum is lower than a.1+a.2 +b because cost for those cases where LTC is caused by both home and leisure accidents are considered only once. Domestic Product 2020: 1,117,989 million euros.

4. DISCUSSION

Different studies have focused on assessing the social and economic impacts that long-term care can have, both from the point of view of formal and informal care provision (Guralnik *et al.,* 2002; Comas-Herrera *et al.,* 2003; Del Pozo and Escribano, 2012; Sole-Auro and Crimmins, 2014, Alcañiz *et al.,* 2016; Klimaviciute and Pestieau, 2023 and so on). However, studies on the incidence of HLAs and their impact on LTC needs are practically non-existent in the literature. Indeed, disability and long term care have typically been analyzed globally, sometimes in the context of mortality (Artís *et al.,* 2007; Kogure *et al.,* 2021, and so on) with few studies focusing on specific causes of disability (Mayhew and Smith, 2021) or regional disparities (Pons-Novell and Guillen, 2022). To the best of our knowledge, some authors have analyzed factors, other than aging and health, in the context of road traffic injuries (Alemany *et al.*, 2013; Zimmerman *et al.,* 2012; Shults *et al.*, 2004), but analyses of other causes, including HLAs, are much less frequent.

Changes in lifestyle such as increasing sports activities, greater propensity to travel, and increased cultural activities may be associated with an increase in the accident rate linked to these causes, which may increase the likelihood of LTC needs if preventive policies are not designed to address this impact. In addition, the elderly is more prone to domestic accidents, what in contexts of greater longevity may contribute to an increase in LTC needs (Chammem *et al.*, 2021).

According to the EDAD 2020 survey, the estimated disability prevalence rates in Spain for people aged 6+ are 9.35% when including all causes, and 0.42% when considering only HLAs. Although the percentage of HLAs in total disability cases is lower, victims of HLAs still constitute a significant group of individuals with lifelong LTC needs.

Our results confirm that the incidence of HLAs in Spain is greater than that attributable to traffic accidents, and therefore, public entities should attach more importance to accidents of this type, as is the case with traffic accidents where road safety campaigns are frequent. Providing more information to the public, including both the younger and the elderly population, about the potential consequences of HLAs could reduce their physical and economic consequences. Moreover, greater awareness of the associated LTC needs may lead individuals to seek additional coverage for this type of risk, such as through insurance (Mayhew *et al.*, 2021; Xia *et al.*, 2022; Shang *et al.*, 2023; He *et al.*, 2023).

For victims of domestic and leisure accidents, the greatest functional limitations are related to mobility and the realization of physical effort. The impact of home accidents on the LTC prevalence rates is higher in those aged over 55, while leisure accidents have a more marked effect on the young and adult populations (up to the age of 54). Indeed, the incidence of leisure accidents in preventing young and adult people from forming part of the labor market should not be ignored. However, we should not underestimate the increasing incidence of leisure accidents among older individuals, reflecting what is probably a change in lifestyle (travelling more, greater participation in cultural activities, etc.). The LTC prevalence attributable to domestic accidents present an exponential behavior with age, a pattern that is not observed for leisure accidents.

Various studies have analyzed the economic impact of HLAs in terms of administrative costs and hospitalization rates (Alves *et al.*, 2020; Walter, 2010; Veisten *et al.*, 2009; Veisten and Nossum, 2007; Hopkin and Simpson, 1996) but, to the best of our knowledge, we are unaware of any studies that have attempted to quantify the costs of LTC (i.e. assistance from a third party) when the cause of disability is either a domestic or leisure accident. Previous studies demonstrate that the adoption of preventive measures in the homes of the elderly (replacement of bathtubs for showers, etc.), or the provision of technical aids (elevators and rotating discs in armchairs, adjustable beds, etc.) can help increase autonomy, reducing the

probability of accidents and LTC needs (Meseri *et al.*, 2017; Keall *et al.*, 2015; Alemany *et al.*, 2013; Heywood and Turner, 2007). The rapidly rising numbers of people that will reach advanced ages, as a consequence of increasing longevity, means we cannot underestimate the relevance of HLAs, given the impact they are likely to have on the budget for the LTC coverage, both at the public and individual level. However, one of the limitations of our work would be given by the aggregation we carry out in relation to the care needs for the different LTC levels, as they appear in the table 4. We have followed the criterion used in previous studies (Alemany *et al.*, 2013) but as Del Pozo and Escribano (2013) point out, the level of heterogeneity in terms of benefits received based on the LTC law in Spain could be high. The analysis of dispersion in the estimates is proposed as a future line of research. To do this, it will be necessary to have more detailed information on the personalized help offered by law to people who suffer long term care needs from HLA causes, or to make estimates based on the personalized help for any cause, using processes similar to those carried out by other authors (Del Pozo and Escribano, 2013).

One of the main reflections obtained from the research carried out is the tendency to work together leisure accidents and household accidents in the existing literature. From our point of view, it is to be expected that both causes will begin to be worked on independently, as a greater number of people in older age ranges become available, and that both causes will end up representing a greater weight in the set of causes that lead to long-term care.

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6. REFERENCES

Alcañiz, M., Alemany, R., Bolancé and C., Guillen, M. (2016). El coste de los cuidados de larga duración en la población española: análisis comparativo entre los años 1999 y 2008. *Revista de Métodos Cuantitativos para la Economía y la Empresa*. 12, 111-131.

Alemany, R., Ayuso, M. and Guillen, M. (2013). Impact of road traffic injuries on disability rates and long-term care costs in Spain. *Accident Analysis and Prevention*. 60, 95-102.

Alemany, R., Ayuso, M. and Guillen, M. (2018). Impact of home and leisure accident rates on disability and costs of long term care in Spain. *UB Riskcenter Working Paper Series*, 2018/03.

Alves, T., Rodrigues, E., Neto, M., Mexia and R., and Matias-Dias, C. (2020). Proportion of Home and Leisure Accidents in mainland Portugal, in 2019. *European Journal of Public Health*. 30, Supplement 5.

Alves, T., Rodrigues, E., Neto, M., Mexia, R. and Matias-Dias, C. (2021). Falls in older people at home and leisure time during the COVID-19 pandemic in Portugal. *European Journal of Public Health*. 31, Supplement 3.

Artís, M., Ayuso, M., Guillen, M. and Monteverde, M. (2007). Una estimación actuarial del coste individual de la dependencia en la población de mayor edad en España. *Estadística Española*. 49 (165), 373-402.

Ayuso, M. and Guillen, M. (2011). El coste de los cuidados de larga duración en España bajo criterios actuariales: ¿es sostenible su financiación? *El Estado del Bienestar en la Encrucijada: Nuevos Retos ante la Crisis Global*, Serie Ekonomi Gerizan, XVIII, Federación de Cajas de Ahorro Vasco-Navarras, Vitoria-Gasteiz. 213-228.

BFU (2022). *Safety barometer on home and leisure accidents*. Bern. Swiss Council for Accident Prevention.

Chammem, R., Domi, S., Della Vecchia, C., Gilbert, T. and Schott, A.M. (2021). Experience and perceptions of changes in the living environment by older people losing their autonomy: a qualitative study in the Caribbean. *Risk Management and Healthcare Policy*. 14, 743-756.

Comas-Herrera, A., Wittenberg, R. Gori, C., Costa-i-Font, J., di Maio, A., Patxot, C., Pickard, L., Pozzi, A. and Rothgang, H. (2003). *European study of long-term care expenditure: investigating the sensitivity of projections of future long-term care expenditure in Germany, Spain, Italy and the United Kingdom to changes in assumptions about demography, dependency, informal care, formal care and unit costs*. [PSSRU discussion paper 1840]. Comas-Herrera, A., Wittenberg, R. (eds.). London. PSSRU.

Del Pozo, R. and Escribano, F. (2012). Impacto económico del cuidado informal tras la ley de promoción de la autonomía personal y atención a las personas en situación de dependencia. *Revista Española de Salud Pública*. 86, 381-392.

Del Pozo, R. and Escribano, F. (2013). Aggregate and individual expected cost of the Dependency Law in Spain according to Monte Carlo simulation and multi-state disability models. *Hacienda Pública Española-Review of Public Economics.* 204, 85-110.

De Vicente, A. and García, G. (2013). *La vivienda del mayor: condiciones y riesgos*. Madrid. Fundación Mapfre.

EuroSafe (2006). *Injuries in the European Union, Summary on injury statistics for the years 2002-2004.* Vienna. Austrian Road Safety Board.

EuroSafe (2016). *Injuries in the European Union, Summary on injury statistics for the years 2012-2014*. 6th Edition. Amsterdam. European Association for Injury Prevention and Safety Promotion.

Guralnik, J.M., Alecxih, L., Branch L.G. and Wiener, J.M. (2002). Medical and Long-Term Care costs when older persons become more dependent. *American Journal of Public Health*. 92, 1244-1245.

He, A.J., Qian, J., Chan, W.S. and Chou, K.L. (2023). Willingness to purchase hypothetical private Long-Term Care insurance plans in a super-ageing society: Evidence from Hong Kong. *Journal of Aging and Social Policy*. 35(6), 780-805.

Heywood, F. S. and Turner, L. (2007). *Better outcomes, lower costs. Implications for health and social care budgets of investment in housing adaptations, improvements and equipment: a review of the evidence*. United Kingdom. Office for Disability Issues, Department of Work and Pensions, HMSO.

Hopkin, J. M. and Simpson, H. F. (1996). Valuation of home accidents: a comparative review of home and road accidents. *UK: Transport Research Laboratory*. 225.

IMSERSO (2021). *Servicios sociales dirigidos a las personas mayores en España. (Informe a 31/12/2020)*. Madrid. Instituto de Mayores y Servicios Sociales.

INE (2021). *Revisión del padrón municipal 2020, población española por edad y sexo*. Madrid. Instituto Nacional de Estadística.

Keall, M. D., Pierse, N., Howden-Chapman, P., Cunningham, C., Cunningham, M., Guria, J. and Baker, M. G. (2015). Home modifications to reduce injuries from falls in the Home Injury Prevention Intervention (HIPI) Study: a cluster-randomised controlled trial. *Lancet*. 385, 231-238.

Klimaviciute, J. and Pestieau, P. (2023). The economics of long-term care. An overview. *Journal of Economic Surveys*. 37, 1192-1213.

Kiliç, B., Meseri, R., Demiral, Y., Sönmez, Y., Kaynak, C. and Ergör, A. (2017). Severe home injuries and disabilities in 2nd Inönü District, Izmir. *Journal of Basic and Clinical Health Sciences*. I, 23-26.

Kogure, A., Fushimi, T. and Kamiya, S. (2021). Mortality forecasts for Long-Term Care subpopulations with longevity risk: A Bayesian approach. *North American Actuarial Journal*. S534-S544.

Lund, J. and Bjerkedal, T. (2001). Permanent impairments, disabilities and disability pensions related to accidents in Norway. *Accident Analysis and Prevention*. 33 (1), 19-30.

Mateos, M. L., Vián, E. M., Gil, M., Lozano, J. E., Santamaría, E. and Herrero, B. (2012). Incidencia, características epidemiológicas y tipos de accidentes domésticos y de ocio. Red centinela sanitaria de Castilla y León. *Atención Primaria.* 44 (5), 250-257.

Mayhew, L. and Smith, D. (2021). An investigation into inequalities in adult lifespan. *North American Actuarial Journal*. S545-S565.

Mayhew, L., Rickayzen, B. and Smith, D. (2021). Flexible and affordable methods of paying for Long-Term Care Insurance. *North American Actuarial Journal*. S196-S214.

Meseri, R., Demiral, Y., Sönmez, Y., Kaynak, C. and Ergör, A. (2017). Severe home injuries and disabilities in 2nd Inönü District, Izmir. *Journal of Basic and Clinical Health Sciences*. I, 23-26.

Mohanty, M., Panda, R., Rao Gandupalli, S., Raj Arya, R. and Kumar Lenka, S. (2022). Factors propelling fatalities during road crashes: A detailed investigation and modelling of historical crash data with field studies. *Heliyon.* 8 (11), e11531.

Pons-Novell, J. and Guillen, M. (2022). The autonomous capacity of the elderly population in Spain for shopping and preparing meals. *International Journal of Environmental Research and Public Health*. 19(22), 1482.

RD 174/2011, de 11 de febrero de 2011. Por el que se aprueba el baremo de valoración de la situación de dependencia establecido por la Ley 39/2006, de 14 de diciembre, de Promoción de la Autonomía Personal y Atención a las personas en situación de dependencia. BOE 42 de 18 de febrero de 2011.

Resolución de 13 de julio de 2012, de la Secretaría de Estado de Servicios Sociales e Igualdad, por la que se publica el Acuerdo del Consejo Territorial del Sistema para la Autonomía y Atención a la Dependencia para la mejora del sistema para la autonomía y atención a la dependencia. *Boletín Oficial del Estado, 185*, de 3 de agosto de 2012.

Shang, Q., Wang, X., Qin, X. and Zhao, X. (2023). Pricing of joint Life Long-Term Care Insurance based on a Multistate Markov Model. *North American Actuarial Journal*. In press. https://doi.org/10.1080/10920277.2023.2208192

Shults, R. A., Jones, B. H., Kresnow, M., Langlois, J. A. and Guerrero, J. L. (2004). Disability among adults injured in motor-vehicle crashes in the United States. *Journal of Safety Research*. 35, 447-452.

Sole-Auro, A. and Crimmins, E.M. (2014). Who cares? A comparison of informal and formal care provision in Spain, England and the USA*. Ageing and Society*. 34(03), 495–517.

Spanish Ministry of Health, Social Policy and Equality (2011). *Programa de Prevención de Lesiones: Detección de Accidentes Domésticos y de Ocio (Infome DADO 2011*). Madrid. Ministerio de Sanidad.

Veisten, K. and Nossum, A. (2007). *What is the economic cost of injuries due to accidents at home, at school, in sports and other leisure activities in Norway?* Oslo. Institute of Transport Economics.

Veisten, K., Nossum, A. and Akhtar, J. (2009). Total costs of injury from accidents in the home and during education, sports and leisure activities: estimates for Norway with assessment of uncertainty. *European Journal of Health Economics*. 10(3), 337-346.

Walter, L.K. (2010). *Re-valuation of home accidents*. *Published Project Report PPR 483*. Berkshire. Transport Research Laboratory.

World Health Organization (2009). *Health in the European Union. Trends and Analysis.* United Kingdom. The European Observatory on Health Systems and Policies.

Xia, L., Chai, L., Zhang, H. and Sun, Z. (2022). Mapping the global landscape of Long-Term Care insurance research: A scientometric analysis*. International Journal of Environmental Research Public Health*. 19(12), 7425.

Zimmerman, K., Mzige, A. A., Kibatala, P. L., Museru, L. M. and Guerrero, A. (2012). Road traffic injury incidence and crash characteristics in Dar es Salaam: a population based study. *Accident Analysis and Prevention*. 45 (2), 204-210.