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## Abstract

Home and leisure accidents are one of the main causes of mortality due to other causes than aging, and have a high impact on health systems. However, to date, the number of studies associated with measuring their socioeconomic impact is very limited, unlike those associated with other causes such as traffic accidents or work accidents. Our objective is to analyze the long-term care needs associated with home and leisure accidents (HLA) in Spain. We conclude that the care needs derived from these causes increase with age of people, with a high incidence in all those situations in which people see their mobility limited. The high socio-economic costs that result (approximately 781 million euros in 2016 in Spain for expenses in long-term care, 0.07% of the Gross Domestic Product) highlight the need to implement preventive policies. Taking into account the budgetary constraints that the public systems can have to address all costs, the development of insurance products that help to cover these specific situations could be justified.

JEL CODES: I13, J14, H51, H53

KEYWORDS: Social care, expenditure on long-term care, preventive actions

## 1. Introduction

The relationship between home and leisure accidents and permanent injuries is a field that has not been practically studied. Unlike the analysis of the impact of other types of accidents, such as traffic accidents or accidents at work, accidents occurring at home and in the performance of leisure, cultural and sports activities, have been relegated in the field of research in the background, mainly due to the lack of databases with rigorous information to be able to carry out sufficiently deep analyzes. However, two facts make the need to advance in this field of study increasingly evident. On the one hand, aging of population, for which, as we will see later, a high correlation between having an advanced age and suffering accidents at home is demonstrated. On the other, the change in the habits of life of people, increasingly motivated by the performance of sports and leisure activities, in this case, with higher accident rates in the younger population when we refer to sport, that are also extended to the older population when we include other types of leisure and cultural activities.<sup>1</sup> The increase in the number of people exposed to this type of risk, and the physical and socio-economic consequences that

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<sup>1</sup> For example, a highest number of leisure trips made by the elderly in Spain is observed as a consequence of different policies implemented by the IMSERSO (Ministry of Health, Social Services and Equality) to improve welfare in this age group.

may arise, reveals the need to work more intensively in the generation of databases that allow deepening in the analysis of this type of accidents, not only in Spain but also in all countries.

In this study we define HLA to any unintended event that causes physical and/or psychological injuries to someone, being the person inside his home or in the external dependencies of the property, or doing a recreational, leisure, sport or educational activity. Therefore, suicides, self-harm, traffic accidents, work accidents or acts of violence are not included.

According to the European Union, about 24.6 million people have suffered home and leisure accidents in Europe between 2012 and 2014 (EuroSafe, 2016), and the DADO report (Spanish Ministry of Health, Social Services and Equality, 2011) indicates HLA as the fourth cause by mortality rate in this region, after heart disease, cancer and cerebrovascular diseases. In addition, according to the World Health Organization, 63% of all unintentional injuries occur at home, in sports or during leisure time (World Health Organization, 2009). This organization projects the rate of fatality of home and leisure injuries in the European Union as double that the rate of traffic accidents, and more than ten times the rate of workplace accidents (EuroSafe, 2006). In Norway, Lund and Bjerkdal (2001) allocate to domestic and leisure activities 20% of all accidents, being the ratio between disability pensions and mortality according to this cause 1:2.7 in the age group from 15 to 64 years. In terms of prevention, Keall et al. (2015) show as modifications at home to prevent domestic injuries help reduce specific bodily damages by 39%, and injuries attributed to falls who need medical attention by 26%.

Studies examining the relationship between HLA and suffering permanent injuries and disability are very rare. Recently, Kiliç et al. (2017) have studied the impact of severe domestic injuries as a cause of disability in Turkey, showing that the risk of suffering this type of injury and become disabled is respectively four and six times higher in children under five years. However, studies in which home accidents are associated to the elderly population are more frequent, due mainly to falls produced at home (Spanish Ministry of Health, Social Services and Equality, 2011; Heywood and Turner, 2007; De Vicente and García, 2013; Riskcenter, 2014). In our work we define disability as difficulty performing the basic daily life activities (moving, eating, going to the toilet,...) including instrumental and functional activities, as answering the phone or take care of the financial control at home. These disabilities are considered permanent, understanding as such those that affect the person during periods of more than a year and are irreversible (sequelae affects the individual along his remaining life).

Several studies analyze the effects of home and leisure accidents in terms of hospital costs, medical and administrative expenses (Hopkin and Simpson, 1996; Veisten et al., 2009; among others). Other works analyze their social impact on early mortality, reduction of productivity and social costs attributable to disability (Veisten and Nossun, 2007). In Spain, it is estimated that the total cost derived from injuries associated with domestic and leisure accidents was 746 million euros in 1999 (Polinder et al., 2004), but in this study costs associated to long term care after the accident were not included. Despite the existence of public coverage for different levels of disability in this country according to the Law of Dependency (Law 39/2006), the high costs derived from the aid provided by third parties may be not fully covered and people can be interested in hiring additional insurance to cover this risk.

In Spain, *the Injury Prevention Program: Detection of Domestic Accidents and Leisure 2011-DADO 2011*- carried out by the Ministry of Health, Equality and Social Policies in the framework of an initiative launched by the European Parliament and the Council of the European Union in 1999, is probably the most relevant source of information when it

comes to study the characteristics or profile of home and leisure accidents. In the program information is obtained on the sociodemographic characteristics of the victims, the characteristics of the accidents and the injuries produced in a total of 7,751 domestic and leisure accidents.<sup>2</sup> On the other hand, Mateos et al. (2012) study different sociodemographic characteristics (age, sex, time, place, type and cause of the accident) in a representative sample of 2,889 HLA accidents registered in 88 primary health centers of Castilla y León,<sup>3</sup> standing out as the most frequent accidents those that occur at home, on working days, and being falls the most common cause. This same conclusion is also observed in the study carried out by De Vicente and García (2013) for the older population, this time based on the study conducted on a sample of 1,067 individuals over 65 years old who live at the family home. The main objective for the authors was to determine the characteristics of the elderly people homes in Spain, identifying those situations that may have the greatest influence in producing home accidents. Falls are the most frequent type of accident appearing in 36% of the households analyzed.

In a similar way that in Alemany et al. (2013), and unlike previous works, our main objective in this research is to analyze the effects of injuries resulting from home and leisure accidents in long-term care (LTC) in Spain. We obtain information from the Disability, Personal Autonomy and Situations of Dependence Survey (*Encuesta sobre Discapacidad, Autonomía Personal y Situaciones de Dependencia, EDAD 2008*) conducted by the Spanish National Institute of Statistics to assess information about disabilities, dependence, ageing and the population's health status. Since 2006 the Spanish Law 39/2006 of 14 December has promoted the provision of personal care for dependent persons and offers long-term care to citizens who cannot perform basic activities of daily life without the help of a third party. As we mentioned in the previous paragraph, HLA injuries are one of the most important injuries in Spain and less studied, where 5 of every 100 Spanish people suffer a home or leisure accident per year, according to the report DADO, 2011.<sup>4</sup>

In our study we analyze: (a) the chronic impairment attributable to HLAs; (b) the prevalence of dependence attributable to HLAs among adults aged 18 years and older;<sup>5</sup> (c) degrees of injury severity associated with the dependence attributable to HLAs ; (d) the annual cost of LTC associated with HLAs and the proportion of the country's GDP destined to it. Finally we compare distributions of impairment, age and degree of severity for those presenting disabilities attributable to HLAs, and those with disabilities attributable to other causes (including road traffic injuries). We select the less restrictive definition for suffering a limitation

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<sup>2</sup> Based on 206,588 interviews in 74,514 Spanish households.

<sup>3</sup> Castilla y Leon is a big region located in the center of Spain.

<sup>4</sup> The DADO report does not include the study of the disability that such injuries can generate but a global analysis of this type of accidents can be found, with a descriptive analysis of their main characteristics according to different sociodemographic variables (age, sex, cause of the accident, places where they occur, days of the week, seasonality, affected parts of the body, rates and average duration of hospitalization, among other concepts). It does not include estimations of economic costs that HLA produce.

<sup>5</sup> The number of people with disabilities due to these causes below that age has not been included in the analysis. Note that the *EDAD* survey itself indicates the difficulty of considering permanent disability situations for younger individuals, referring more to the concept of "limitation" than to the concept of "dependence" in this case. In our context the concept of dependence refers to the need of support from a third person along all the individual life. In any case the percentage of dependents aged <18 is low – just 2.44% -.

(sight, hearing, communication, etc.) attributable to HLAs, in that we consider an individual to be dependent if any of the disabilities suffered (and included on the assessment scale) is related to home and leisure injuries.<sup>6</sup>

## 2. Methods

The Disability, Personal Autonomy and Situations of Dependence Survey (*Encuesta sobre Discapacidad, Autonomía Personal y Situaciones de Dependencia*, EDAD 2008) is a national survey conducted by the Spanish National Institute of Statistics to assess information about disabilities, dependence, ageing and the population's health status. Participants are interviewed after having been randomly selected via a multistage sampling process. Questions are answered by adults living in the chosen households or those working at selected institutions with information about the health of the remaining household members or institutionalized individuals. In an initial stage (November 2007 to February 2008), 260,000 people belonging to 96,000 different family households were interviewed; in a second stage (May 2008 to July 2008), 11,100 people were interviewed at 800 public and private institutions (centres for senior citizens, centres for the disabled, psychiatric hospitals and long-stay geriatric units). A disability survey (EDAD-disabilities) was included to gather detailed information about people with disabilities.

The EDAD-disabilities survey collected information about health conditions and functional and sensory limitations associated with disabilities from family members in the participating households and from the institutionalized individuals themselves. An impairment was considered chronic (permanent health defect) if the participant had first noticed it more than one year before the interview. Causes of impairment ranged from disease, congenital malformation, birth defects, traffic accidents, occupational accidents, home accidents, leisure-related accidents, diseases related to usual occupation, or other causes.

Functional and sensory limitations were grouped into eight categories: (1) Sight, (2) Hearing, (3) Communication, (4) Learning and knowledge application and task development, (5) Mobility, (6) Self-care – ADL (activities of daily living; i.e. bathing or showering, dressing, eating, using the toilet, etc.), (7) IADL (instrumental activities of daily living; i.e. shopping, preparing meals, using the telephone, managing money, etc.) and (8) Interpersonal relationships. Individuals presenting limitations in one or more of the eight categories were asked what their main health problem was and, in each case, to identify the principal cause (including home and leisure accidents).

In this research, we selected those individuals from the sample who explicitly reported that at least one of their functional and sensory disabilities was attributable to HLAs. We then quantified their long-term care needs (or the degree of dependence shown), using the dependence valuation index published with Spanish legislation,<sup>7</sup> which examines the presence or otherwise of various disabilities and their severity. The indicator allows the degree of dependence of the disabled individuals to be classified and provides an accurate

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<sup>6</sup> According to Shults et al. (2004), but in the context of road traffic injuries, estimated prevalence rates could be 20% lower if they consider a road traffic injury disability to have occurred when the individual attributes all limitations to crash-related injuries.

<sup>7</sup> RD 504/2007, April 20, approved the scale for evaluating situations of dependence established by Law 39/2006, of December 14, Promotion of Personal Autonomy and Care for Dependents (B.O.E nº 96, 21 April 2007).

determination of the amount of long-term care and permanent personal support required by each dependent.

To quantify the degree of dependence, the Spanish Law provides for the use an LTC index that considers 26 disabilities directly related to the eight functional and sensory categories (see above). These disabilities are defined in Table 1.

**Table 1**  
Types of disability considered in the dependence indicator

1. Has major difficulties when having to pay visual attention or maintain hearing attention.	14. Has major difficulties controlling or performing activities related with defecation without help or supervision.
2. Has major difficulties when learning to read, write, count (or calculate) copy or handle utensils.	15. Has major difficulties when dressing or undressing without help or supervision.
3. Has major difficulties doing simple tasks without help or supervision.	16. Has major difficulties when drinking or eating without help or supervision.
4. Has major difficulties doing complex tasks without help or supervision.	17. Has major difficulties when organizing, doing and moving everyday purchases without help or supervision.
5. Has major difficulties maintaining body in the same position without help or supervision.	18. Has major difficulties when preparing food without help or supervision.
6. Has major difficulties changing body position without help or supervision.	19. Has major difficulties when taking care of daily housework without help or supervision.
7. Has major difficulties walking or moving in house without help or supervision.	20. Has major difficulties when applying medical prescriptions without help or supervision.
8. Has major difficulties walking or moving outside house without help or supervision.	21. Has major difficulties avoiding dangers of daily life without any help or supervision.
9. Has major difficulties using means of transport as passenger without help or supervision.	23. Has major difficulties creating or maintaining family relationships.
10. Has major difficulties driving vehicles without help or supervision.	24. Has major difficulties when creating and maintaining sentimental relationships or sexual relationships.
11. Has major difficulties cleaning or drying different body parts without help or supervision.	25. Has major difficulties creating and maintaining relationships with friends, neighbors or peers.
12. Has major difficulties performing basic body care activities, without help or supervision.	26. Has major difficulties creating and maintaining relationships with subordinates, equal position or superiors.
13. Has major difficulties controlling or performing activities related with urination without help or supervision.	

Source: RD 504/2007.

The LTC index for a person  $i$ ,  $S_i$ , is calculated applying the following formula,

$$S_i = \sum_{j=1}^{26} D_j C_j P_j \quad (1)$$

where variable  $D_j$  is a dichotomous variable with a value of 1 if individual  $i$  suffers the disability  $j$  and 0 in all other cases ( $i = 1, \dots, N; j = 1, \dots, 26$ );  $C_j$  is a categorical variable that takes a value of 0.9 if the need for support  $j$  is moderate, 0.95 if it is severe and 1 if it is full; and variable  $P_j$  consider weighting factors established for disability  $j$  according to the individual's age and whether the individual suffers a mental illness.<sup>8</sup>

The LTC index ranges between 0 and 100. If the score is between 25 and 50, the individual will have a moderate dependency (Grade 1) and require help at least once a day; if the score is

<sup>8</sup> Weighting factors vary according disability types, individual's age (grouped in intervals: <3 years old, between 3 and 6, between 7 and 10, between 11 and 17 and finally 18 years or more) and the presence or otherwise of mental illness.

between 50 and 75, the dependence is considered severe (Grade 2) and the individual will require help more than once a day, although non permanently. If the score is over 75, the individual has full dependence (Grade 3) and require permanent help. Finally, if the score is under 25, then the individual suffers some impairment but the severity is considered low and the Law establishes that the individual does not require the help of a third person (Grade 0).

We calculate national prevalence estimates by incorporating the EDAD 2008 sample weights. Prevalence estimates were calculated using the 2008 Spanish Census estimates for population aged 18 years or older (INE, 2009). The analysis was conducted using SAS software (SAS Institute, 1999). To estimate the prevalence of dependence (and the need for LTC) attributable to HLAs, we first have to calculate the score for each individual according to formula (1). We refer to HLAs-dependence when an impairment is attributable to a home or leisure accident. Finally we estimate the cost incurred by dependent people as a result of their HLA, and compare these costs and those attributable to other causes (comparisons with costs for RTIs as they appear in Alemany et al. (2013) are also presented). To undertake this calculation we employ the same LTC-need scenarios used in previous studies provided by geriatricians and social workers (Artís et al., 2007, Ayuso and Guillen, 2011). In this work prices update to 2016 has been included.

Table 2 shows the average cost (per hour or per year) for formal long-term care services provided in Spain. Table 3 specifies needs of care associated with each of the formulated scenarios. An individual with a moderate degree of dependence can be expected to require home help for three hours per day; those with a severe degree of dependence need to receive support in a day care centre and home help for one hour per day (and, hence, will incur a lower average expected cost than moderate dependents, as the same caregiver can visit several patients); and those with full disability need constant supervision that can only be provided in a nursing home. Resolution of July 13, 2012 of the Spanish secretary of state for social services and equality determines that public coverage will be reach a maximum of 20 hours/month for people with moderate dependence; between 21 and 45 hours/month for people with severe dependence; and between 46 and 70 hours/month for people with full dependence. In this sense, copayment to be assumed by the dependent person can reach a high amount.

**Table 2**

Annual and per hour cost of LTC in Spain (in euros)

	Year 2008	Year 2016
Home help – public welfare services (per hour)	12.71	14.21
Day care for dependent individuals – public welfare services	7,873.32	8,802.37
Residential placement for dependent- public welfare services	17,295.60	19,336.48

Source: Based on data from IMSERSO (2008). Updated to year 2016 according to the 2008-2016 Spanish RPI evolution (11.8%)

**Table 3**

Estimated annual LTC costs according to degree of dependence and LTC service type in euros

Dependence	LTC services	Annual individual cost 2008	Annual individual cost 2016
Moderate (Grade 1)	Home care service (3h/day)	13,917.45	15,559.71
Severe (Grade 2)	Day care centre and home service (1h/day)	12,512.47	13,988.94
Full (Grade 3)	Nursing home	17,295.60	19,336.48

Source: Based on data from IMSERSO (2008). Updated to year 2016 according to the 2008-2016 Spanish CPI evolution.

### 3. Results

#### 3.1. Estimated prevalence of dependence derived from home and leisure accidents. Comparison with the rest of causes

According to EDAD 2008 and the estimated Spanish population for people aged 18+ (INE, 2009), the prevalence of disabilities when considering all causes is about 9.7%, a figure that falls to 0.23% if only HLAs are considered.<sup>9</sup> However, this figure is higher than the one derived from traffic accidents, estimated at 0.17% (Alemany et al., 2013). In absolute numbers we speak of 3,787,446 dependents of 18 or older, 86,237 of which are for presenting some disability caused by home and leisure accidents. For traffic accidents this figure falls to 65,697 people.

Table 4 presents the estimated prevalence of each of the 26 impairments included in the LTC index for every 100 disabled individuals when considering all possible causes of disability and for every 100 disabled individuals when considering only home and leisure-related causes. Figure 1 presents a graphical comparison between the two rates, where a high incidence of HLA in mobility and physical effort impairments is observed.<sup>10</sup> Of those disabled as a result of HLAs, 59.82% (home) and 45.39% (leisure), respectively, have major difficulties walking or moving outside their home unaided (type 8). Similarly, 56.06% and 42.22% respectively face problems when travelling as a passenger or means of transport without any help (type 9); 43.35% and 39.33% have difficulties changing their body posture without help or supervision (type 6); 42.77% and 32.85% have difficulties walking and moving in their house without supervision (type 7), and 40.88% and 33.26% have difficulties maintaining the body in the same position (type 5).

Similarly, individuals also present problems to perform their own self-care. 48.63% (home) and 34.19% (leisure) have major difficulties cleaning or drying different body parts without help (type 11); 38.02% and 33.66% have problems performing basic body care activities (type 12), and 36.00% and 31.01% have difficulties when dressing or undressing without help (type 15).

In some cases estimated prevalence is more accentuated only for home accidents or for leisure ones. Thus, the major difficulties when undertaking daily housework activities (type 19), avoiding dangers of daily life (type 21) or applying medical prescriptions without

<sup>9</sup> The Spanish population aged 18 years and older is estimated at 38,124,396 according to the 2008 Spanish Population Census (INE, 2009).

<sup>10</sup> Note that this conclusion is also supported by the DADO report (Spanish Ministry of Health, Social Services and Equality, 2011) that indicates fractures and dislocations as the injuries that have the highest incidence in sequelae for the victim.

help (type 20) arise as a consequence of domestic accidents (55.54%, 53.25% and 32.70%, respectively). In contrast, major difficulties driving a vehicle (type 10) or drinking or eating without help (type 16) are observed when people have suffered leisure accidents (28.28% and 10.67%, respectively). For the remaining impairments (communication and others) prevalence rates are lower than those derived from other causes.

**Table 4**

Estimated impairment prevalence rate for Spanish adults with disability, due to any cause and to HLAs.

Type of impairment*	Prevalence per 100 disabled individuals related to any cause	Prevalence per 100 disabled individuals related to home accidents	Prevalence per 100 disabled individuals related to leisure accidents
IMP 1. Has major difficulties when having to pay visual attention or maintain hearing attention.	7.07	2.21	2.26
IMP 2. Has major difficulties when learning to read, write, count (or calculate) copy or handle utensils.	10.83	2.53	4.13
IMP 3. Has major difficulties doing simple tasks without help or supervision.	7.93	1.90	3.40
IMP4. Has major difficulties doing complex tasks without help or supervision	13.21	2.46	4.90
IMP5. Has major difficulties maintaining body in the same position without help or supervision.	26.89	40.88	33.26
IMP6. Has major difficulties changing body position without help or supervision.	28.73	43.35	39.33
IMP7. Has major difficulties walking or moving in house without help or supervision.	23.21	42.77	32.85
IMP8. Has major difficulties walking or moving outside house without help or supervision.	42.67	59.82	45.39
IMP9. Has major difficulties using means of transport as passenger without help or supervision.	40.3	56.06	42.22
IMP10. Has major difficulties driving vehicles without help or supervision.	11.26	7.94	28.28
IMP11. Has major difficulties cleaning or drying different body parts without help or supervision.	32.13	48.63	34.19
IMP12. Has major difficulties performing basic body care activities, without help or supervision.	30.91	38.02	33.66
IMP13. Has major difficulties controlling or performing activities related with urination without help or supervision.	18.34	13.97	10.81
IMP14. Has major difficulties controlling or performing activities related with defecation without help or supervision.	12.49	10.78	11.76
IMP15. Has major difficulties when dressing or	25.52	36.00	31.01

undressing without help or supervision.			
IMP16. Has major difficulties when drinking or eating without help or supervision.	9.51	8.08	10.67
IMP17. Has major difficulties when organizing, doing and moving everyday purchases without help or supervision.	21.79	10.16	7.32
IMP18. Has major difficulties when preparing food without help or supervision.	16.89	9.00	7.38
IMP19. Has major difficulties when taking care of daily housework without help or supervision.	48.14	55.54	42.89
IMP20. Has major difficulties when applying medical prescriptions without help or supervision.	30.01	32.70	22.30
IMP21. Has major difficulties avoiding dangers of daily life without any help or supervision.	42.71	53.25	39.30
IMP22. Has major difficulties showing affection, respect or transmitting feelings.	6.43	0.97	6.68
IMP23. Has major difficulties creating or maintaining family relationships.	8.45	1.83	1.38
IMP24. Has major difficulties when creating and maintaining couple sentimental relationships or sexual relationships.	8.74	2.71	0.89
IMP25. Has major difficulties creating and maintaining relationships with friends, neighbours or peers.	8.86	2.13	3.54
IMP26. Has major difficulties creating and maintaining relationships with subordinates, equal position or superiors.	10.59	2.86	3.54

\*Highest prevalence rates associated with HLAs regarding other causes are shaded. The percentage of missing and no responses is lower than 2.8 in all disabilities.

**Figure 1.** Comparison between estimated impairment prevalence rates for Spanish adults with a disability due to any cause and due to HLAs. For definition of impairments (IMP) see Table 4.

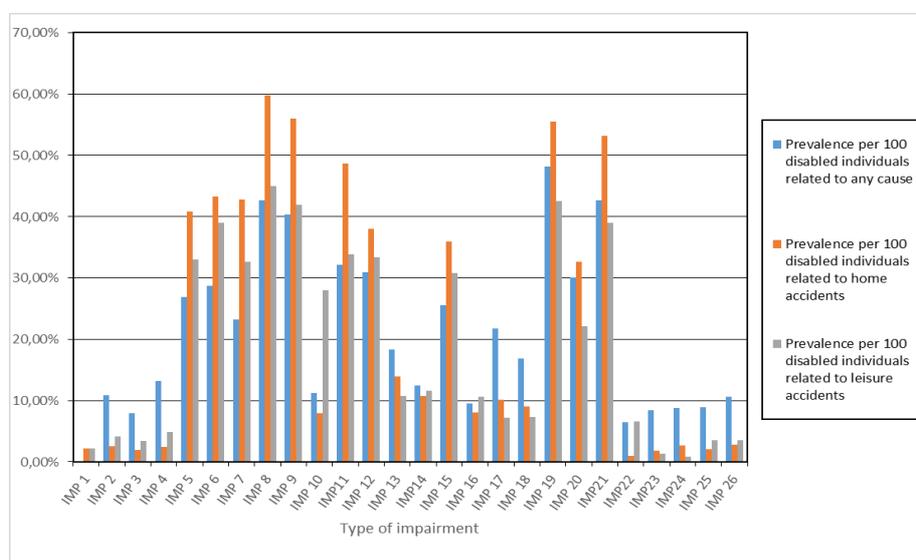


Table 5 presents the estimated number of dependent people related to HLAs and the rest of causes by age intervals in Spain according EDAD 2008 (total Spanish population by age

intervals is also presented). In Table 6 the estimated rates of prevalence for HLA-dependence, and rates of dependence for all other disabilities arranged by age intervals are presented. The graphic representation of these rates appears in Figure 2. As we can observe (Table 5) the number of dependents related to leisure accidents is higher for younger people, especially up to 34 years, where it can reach five times the number of dependents from home accidents. This behavior is evidenced in the estimated prevalence rates presented in Table 6. It is approximately up to 54 years that the prevalence rate for leisure accidents is higher than the corresponding one for domestic accidents. However, from this age the prevalence rates for home accidents begin to increase exponentially, even above all other causes. These results confirm previous research results, pointing accidents at home as one of the leading causes of disability in the elderly (De Vicente and Garcia, 2013; Riskcenter, 2014). Leisure accidents also show an increase with age but with a notably lower incidence in older population than domestic accidents. Unlike results observed for traffic accidents (Alemany et al., 2013) where the highest prevalence rates were observed between the ages of 25 and 54 and after the age of 75, here an exponential behavior is observed especially for home accidents.

**Table 5**

Estimated number of dependents related to HLAs and other causes arranged by age intervals. Estimated Spanish population by age intervals in 2008

Age	Home accidents	Leisure accidents	Other causes	Total Spanish population
18-24	163	834	59,981	3,816,105
25-34	250	1,160	167,272	7,851,085
35-44	1,550	3,558	281,358	7,643,398
45-54	2,163	2,917	400,965	6,223,823
55-64	4,138	3,545	538,136	4,957,060
65-74	13,193	3,685	680,615	3,805,822
75-84	22,582	5,576	958,227	2,889,063
+85	18,138	2,786	522,283	938,040
Total	62,176	24,063	3,608,837	38,124,396

Source: Based on EDAD 2008 and estimated Spanish population by age intervals according to National Institute of Statistics (INE, 2009).

**Table 6**

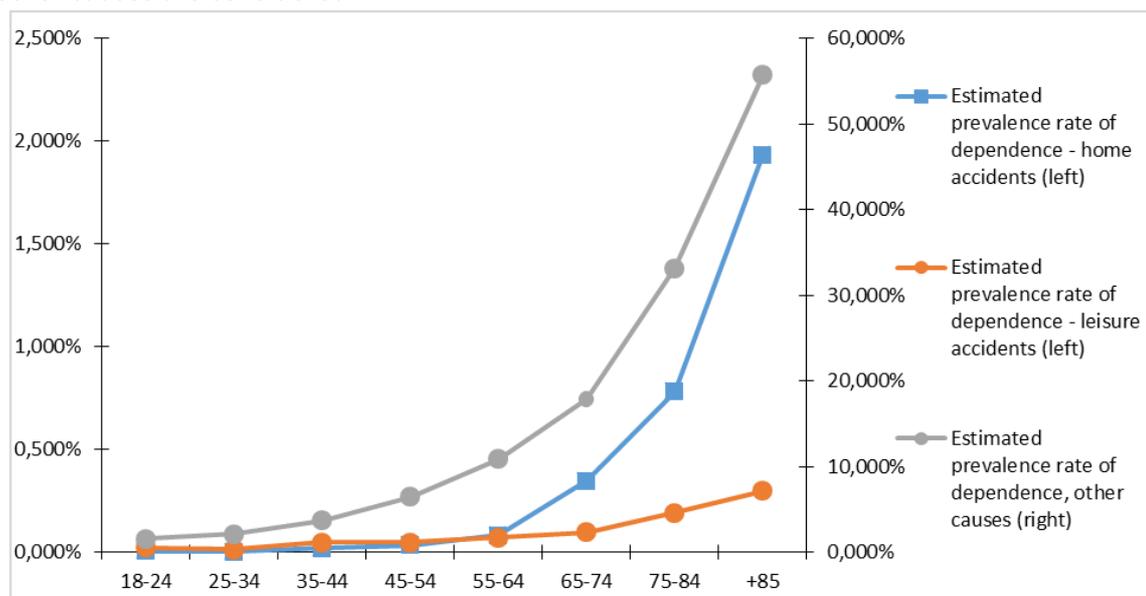
Estimated prevalence of dependence when impairments are attributable to HLAs and when attributable to other causes, arranged by age intervals

Age	Estimated prevalence of dependence- home accidents	Estimated prevalence of dependence- leisure accidents	Estimated prevalence of dependence – other causes
18-24	0.004%	0.022%	1.572%
25-34	0.003%	0.015%	2.131%
35-44	0.020%	0.047%	3.681%
45-54	0.035%	0.047%	6.442%
55-64	0.083%	0.072%	10.856%
65-74	0.347%	0.097%	17.884%
75-84	0.782%	0.193%	33.167%
+ 85	1.934%	0.297%	55.678%

Source: Based on EDAD 2008 and formula (1). Estimated Spanish population by age intervals according to National Institute of Statistics (INE, 2009)

**Figure 2**

Estimated prevalence of dependence in the Spanish adult population when HLAs and other causes are considered



Source: Based on Table 6 herein. Left-hand scale: estimated prevalence of dependence attributable to HLAs; right-hand scale: estimated prevalence of dependence attributable to other causes

### 3.2. Prevalence rates of dependence from HLAs by degrees of severity. Comparison to other causes

Results according to the four degrees of dependence (Grades 0, 1, 2 and 3), as defined in Section 2, when the disability is attributable to HLAs and when it is attributable to other causes are presented in Table 7 and Figure 3, where we present a comparison of the prevalence of each degree of dependence among the Spanish disabled population.

Table 7 shows our results according to the four degrees of dependency discussed (grades 0, 1, 2 and 3), when the disability is attributed to domestic accidents, to leisure accidents, and when it is attributed to the rest of the causes, by age intervals. A comparison of the prevalence rates obtained at the graphic level can be seen in Figure 3.

Results show a big impact of home and leisure accidents on the severity of dependence, generally with higher prevalence rates in any grade compared to the rest of causes (except Grade 2 for leisure accidents, see last column Table 7). However, important differences are observed when the analysis is done by age intervals. Thus, while the incidence of home accidents on long-term care needs is very low up to 35 years,<sup>11</sup> leisure accidents have a strong incidence in the prevalence of the most severe dependence (Grade 3) up to 24 years (24.22%). For the 25-34 age group, 47.07% of dependent people for leisure accidents present a moderate degree of dependence (Grade 1) and 16.72% severe dependence (Grade 2), figures significantly higher than those corresponding to the rest of causes, of 10.87% and 6.33%, respectively. According these levels of severity observed in young people as a consequence of leisure accidents, and the need for long-term assistance, we can already foresee, as we will discuss in the next section, a high impact on long-term care costs.

<sup>11</sup> Note that the used sample derived from the Survey EDAD 2008, representative of the Spanish population, reflects zero prevalence rates for the different degrees of severity in some age ranges.

Incidence of home accidents is mainly observed from 45 years in moderate and severe grades (Grades 1 and 2, respectively). For example, in the 45-54 age group the prevalence is 20.62% for moderate dependence and 24.73% for severe dependence, compared to 13.99% and 5.58% respectively for the rest of causes. It is in the population over 65 years when needs for long-term care are more evident. In fact, after age 75, practically 70% of the dependent population related to have suffered an accident at home needs help from third parties, compared to 42% dependent by other causes. In addition, there is a very strong growth for the full dependence (Grade 3) that increases from 2.48% between 65-74 years of age, up to 28.49% for people over 85 years.

Clearly we conclude a remarkable incidence of leisure accidents in the dependence for the young and adult Spanish population, and a higher incidence of home accidents in the older population.

**Table 7**

Prevalence of the degree of dependence (LTC) among the Spanish disabled adult population, when the disability is attributable to HLAs and when it is attributable to other causes, arranged by age intervals

	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
Impairments are attributable to home accidents									
Grade 0	100%	100%	81.48%	54.65%	74.19%	57.06%	31.50%	15.44%	37.59%
Grade 1	-	-	10.00%	20.62%	17.54%	21.40%	35.18%	31.75%	28.71%
Grade 2	-	-	-	24.73%	8.26%	19.06%	18.19%	24.31%	19.15%
Grade 3	-	-	8.52%	-	-	2.48%	15.13%	28.49%	14.55%
Impairments are attributable to leisure accidents									
Grade 0	75.78%	36.21%	80.61%	63.28%	47.33%	78.89%	53.71%	27.92%	58.70%
Grade 1	-	47.07%	15.04%	7.82%	32.44%	17.01%	36.89%	35.16%	25.45%
Grade 2	-	16.72%	-	-	-	4.10%	9.40%	15.82%	5.44%
Grade 3	24.22%	-	4.36%	28.90%	20.23%	-	-	21.10%	10.41%
Impairments are attributable to other causes									
Grade 0	65.95%	74.87%	79.05%	77.43%	78.29%	69.61%	58.56%	39.73%	65.43%
Grade 1	15.28%	10.87%	11.09%	13.99%	13.40%	16.35%	19.58%	19.73%	16.31%
Grade 2	9.10%	6.33%	5.84%	5.58%	5.31%	7.72%	11.48%	16.66%	9.23%
Grade 3	9.67%	7.93%	4.02%	3.00%	2.99%	6.32%	10.38%	23.88%	9.03%

Source: Based on EDAD 2008 and formula [1]. Grade 0 – no help needed from third person; Grade 1 - moderate dependence; Grade 2 - severe dependence; Grade 3 - full dependence.

**Figure 3**

Comparison of the prevalence of the degree of dependence among the Spanish disabled adult population (disabilities attributable to home accidents in upper graph; disabilities attributable to leisure accidents in intermediate graph; and disabilities attributable to other causes in lower graph), arranged by age intervals



### 3.3. Total annual LTC costs for individuals with disabilities attributable to HLAs and those with impairments attributable to other causes

Based on the estimated prevalence of the degrees of dependence in the Spanish disabled adult population, we estimated the total annual 2008 LTC costs (year of the survey) and the corresponding 2016 LTC costs (by updating costs according to the evolution of the Spanish CPI as it is published by the Spanish National Institute of Statistics) for individuals with disabilities attributable to HLAs and those with impairments

attributable to other causes (Table 8).<sup>12</sup> We find that when home accidents are included (upper lines Table 8) these costs rise to approximately 554 million euros in 2008 (619 million euros in 2016), and 145 million euros (162 million in 2016) when we consider leisure accidents. These represent 0.05% and 0.01% of the Spanish GDP for 2008, respectively (0.06 and 0.02 of the Spanish GDP for 2016).<sup>13</sup> The impact of domestic accidents is higher than leisure accidents (as expected, due to the highest number of dependents related to accidents at home). It is also be noted that this impact is also higher than that derived from other causes of special relevance in Spain, as RTIs (according to Alemany *et al.*, 2013, the road traffic LTC cost was estimated in 388 million euros in 2008, a 30% lower than home accident costs). For leisure accidents the impact is also very relevant, although lower than that derived from domestic and RTI accidents.

The highest percentage of home accidents was suffered by individuals older than 65 years. LTC needs for this cause account for 2.52% of total costs by individuals in the 65-74 age group, reaching a 3.71% for people in the 75-84 age interval and a 4.55% for people over 85 years. Therefore, a greater impact is observed when the person ages. On the contrary, LTC needs for leisure accidents are higher for young and adult people accounting for 1.60% of total costs by individuals in the 25-34 age group and 1.69% for people in the 55-64 age interval. After age 65 LTC cost for this cause is notably lower (less than 0.6% in all cases).

The results are also very conclusive when analyzed according to the degree of dependence. Thus, Grade 3 individuals with a disability attributable to leisure accidents in the 18-24 age group account for 3.37% of annual LTC costs, while this figure reaches almost 6.54% for individuals in the 45-54 age group. These percentages correspond approximately to 3.54 million euros for the former and 14.58 million euros for the latter (3.91 and 16.30 million euros in 2016). Grade 3 individuals with a disability attributable to home accidents in the 75-84 age group account for 3.32% of annual LTC costs and 3.96% in age group 85+ (59.1 and 89.38 million euros in 2008, respectively; 66.07 and 99.93 million euros in 2016).

Despite the influence of full dependence on total LTC costs, those associated with lower degrees of dependence should also be stressed. For example, Grade 1 individuals with a disability attributable to leisure accidents in the 25-34 age group account for 2.92% (approximately 7.6 million euros in 2008; 8.5 million euros in 2016) of the annual estimated LTC costs. Grade 1 individuals associated to home accidents in the 75-84 age group account for 4.02% (110.6 million euros in 2008; 123.6 million euros in 2016).

Total estimated LTC costs attributable to leisure accidents account for 145 million euros in 2008 (162 million euros in 2016). Total estimated LTC costs attributable to home accidents account for 553.9 million euros in 2008 (619.3 million euros in 2016). Both figures indicate the high relevance of HLAs as cause of LTC needs.

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<sup>12</sup> Note that in the calculations we have not included Grade 0 because no public coverage is recognized for this level. However, we should not forget that in this situation people also suffer dependence (although with a low severity) and some needs of help could appear. Specific insurance coverage for this kind of accidents would be welcomed.

<sup>13</sup> The estimated 2008 LTC costs to any cause for the adult Spanish population represented 1.7% of GDP. In 2016 is estimated in 1.9% of GDP, approximately.

**Table 8**

2008 estimated annual LTC costs by dependence levels when the disability is attributable to HLAs and when it is attributable to other causes in the Spanish population older than 18 years (results in millions of euros). Updated 2016 estimated annual LTC cost in parenthesis.

	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
Dependence attributable to home accidents*									
Grade 1	-	-	2.16	6.21	10.10	39.29	110.55	80.15	248.45
	(-)	(-)	(2.41)	(6.94)	(11.30)	(43.93)	(123.59)	(89.61)	(277.77)
Grade 2	-	-	-	6.69	4.28	31.46	51.39	55.18	149.00
	(-)	(-)	(-)	(7.48)	(4.78)	(35.17)	(57.47)	(61.69)	(166.59)
Grade 3	-	-	2.28	-	-	5.66	59.10	89.38	156.42
	(-)	(-)	(2.55)	(-)	(-)	(6.32)	(66.07)	(99.93)	(174.88)
Total (a.1)	-	-	4.44	12.90	14.38	76.40	221.03	224.71	553.87
	(-)	(-)	(4.96)	(14.42)	(16.08)	(85.42)	(247.13)	(251.23)	(619.25)
Dependence attributable to leisure accidents									
Grade 1	-	7.60	7.45	3.17	16.01	8.73	28.63	13.64	85.22
	(-)	(8.50)	(8.32)	(3.55)	(17.89)	(9.76)	(32.01)	(15.25)	(95.27)
Grade 2	-	2.43	-	-	-	1.89	6.56	5.52	16.39
	(-)	(2.71)	(-)	(-)	(-)	(2.11)	(7.33)	(6.17)	(18.33)
Grade 3	3.49	-	2.68	14.58	12.40	-	-	10.17	43.33
	(3.91)	(-)	(3.00)	(16.30)	(13.86)	(-)	(-)	(11.37)	(48.44)
Total (a.2)	3.49	10.03	10.13	17.75	28.41	10.62	35.18	29.33	144.93
	(3.91)	(11.21)	(11.32)	(19.85)	(31.76)	(11.87)	(39.34)	(32.79)	(162.04)
Dependence attributable to other causes									
Grade 1	127.57	253.06	434.36	780.50	1,003.75	1,548.53	2,610.91	1,434.22	8,192.91
	(142.62)	(282.92)	(485.62)	(872.60)	(1,122.20)	(1,731.25)	(2,919.00)	(1,603.46)	(9,159.67)
Grade 2	68.32	132.57	205.57	279.99	357.61	657.63	1,376.43	1,088.58	4,166.71
	(76.38)	(148.21)	(229.82)	(313.03)	(399.80)	(735.23)	(1,538.85)	(1,217.04)	(4,658.37)
Grade 3	100.30	229.41	195.73	208.26	278.60	744.26	1,720.00	2,157.33	5,633.89
	(112.13)	(256.48)	(218.83)	(232.83)	(311.47)	(832.09)	(1,922.95)	(2,411.90)	(6,298.68)
Total (b)	296.18	615.04	835.67	1,268.75	1,639.96	2,950.42	5,707.34	4,680.14	17,993.50
	(331.13)	(687.61)	(934.27)	(1,418.47)	(1,833.47)	(3,298.57)	(6,380.81)	(5,232.39)	(20,116.73)
Cost Total due to any cause (a. 1 + a.2 + b)									
	299.68	625.07	850.23	1,299.41	1,682.75	3,037.44	5,963.57	4,934.18	18,692.32
	(335.04)	(698.82)	(950.56)	(1,452.74)	(1,881.31)	(3,395.85)	(6,667.28)	(5,516.41)	(20,898.01)
Percentage of cost accidents domestic (a. 1) / total									
	-	-	0.52%	0.99%	0.85%	2.52%	3.71%	4.55%	2.96%
	(-)	(-)	(0.52%)	(0.99%)	(0.85%)	(2.52%)	(3.71%)	(4.55%)	(2.96%)
Percentage of cost accidents leisure (a.2) / total									
	1.17%	1.60%	1.19%	1.37%	1.69%	0.35%	0.59%	0.59%	0.79%
	(1.17%)	(1.60%)	(1.19%)	(1.37%)	(1.69%)	(0.35%)	(0.59%)	(0.59%)	(0.79%)

Percentage of cost total any cause (a1 + a2 + b)/GDP	0.027% (0.030%)	0.056% (0.063%)	0.076% (0.085%)	0.116% (0.130%)	0.151% (0.169%)	0.272% (0.305%)	0.534% (0.599%)	0.442% (0.495%)	1.675% (1.876%)
Percentage of cost accidents domestic/GDP	- (-)	- (-)	0.0004% (0.0004%)	0.001% (0.001%)	0.001% (0.001%)	0.007% (0.008%)	0.020% (0.022%)	0.020% (0.023%)	0.050% (0.056%)
Percentage of cost accidents leisure/GDP	0.0000% (0.0004%)	0.0010% (0.0010%)	0.0010% (0.0010%)	0.0020% (0.0018%)	0.0030% (0.0029%)	0.0010% (0.0011%)	0.0030% (0.0035%)	0.0030% (0.0029%)	0.0130% (0.0145%)
Percentage of cost Grade 1 (domestic) / total cost Grade 1 (all causes)	-	-	0.49%	0.79%	0.98%	2.46%	4.02%	5.25%	2.91%
Percentage of cost Grade 2 (domestic) / total cost Grade 2 (all causes)	-	-	-	2.34%	1.18%	4.55%	3.58%	4.80%	3.44%
Percentage of cost Grade 3 (domestic) / total cost Grade 3 (all causes)	-	-	1.14%	-	-	0.75%	3.32%	3.96%	2.68%
Percentage of cost Grade 1 ( Leisure ) / Cost Total Grade 1	-	2.92%	1.68%	0.40%	1.55%	0.55%	1.04%	0.89%	1.00%
Percentage of cost Grade 2 ( Leisure ) / Cost Total Grade 2	-	1.80%	-	-	-	0.27%	0.46%	0.48%	0.38%
Percentage of cost Grade 3 ( leisure ) / Cost Total Grade 3	3.37%	-	1.34%	6.54%	4.26%	-	-	0.45%	0.74%

Source: Based on data from IMSERSO (2008) and estimated rates of degrees of dependence (Table 7). Note that the costs for grade 0 are not considered since no public coverage exists in this case. \* No significant values have been found for individuals who have suffered home accidents with moderate, severe or full dependence in the youngest age ranges (18 to 34 years). Gross Domestic Product 2008 (2016): 1,116,207 (1,113,851) million euros.

#### 4. Discussion and conclusion

Research of the incidence that home and leisure accidents have on LTC needs is practically non-existent in the literature. Dependence suffered by individuals has been mainly analyzed from a global perspective, with few studies presenting results related with specific causes generating disability. To what we know some works (Shults et al., 2004; Zimmerman et al, 2012; Alemany et al., 2013 and so on) have analyzed factors additional to aging and health in the context of road traffic injuries, but analysis of other causes as HLAs are more less frequent.

In Spain, Law 39/2006 about promotion of personal autonomy and care for dependents guarantees a public coverage to citizens based on their severity of dependence, despite of the cause of disability. However, law itself recognizes copayment of LTC costs by individuals and situations where public payments are limited. In Spain the traditional network of informal services provided to the dependent by the family and friends is still very frequent (Rogero-García, 2009; Del Pozo and Escribano, 2012). Among other causes, changes in the family structures (above all, due to the small number of children) make it foresee that in the near future this care network will be much smaller, and studies that help to quantify the impact of LTC needs in the welfare state, as well as the development of preventive and coverage policies that help to guarantee them should be welcomed.

The Spanish benefits system of dependence takes into account the difficulties that an individual might face when undertaking a set of basic daily activities (the 26 impairments listed in Table 1) and their need for assistance in completing these activities. By means of a scale the disability severity is grouped into three categories (moderate, severe and full dependence) with different levels of help or service provision. Dependent people are classified in one of the three levels regardless of the cause of disability. Now we have been interested in analyzing as some specific causes impact on these long-term care needs and costs.

Previous works as Alemany et al. (2013) reveal the high impact that road traffic injuries have in the Spanish system of dependence. The aim now has been to quantify the impact of home and leisure accidents, for which changes in lifestyle of people (increase in sports activities, higher propensity to travel, increased cultural activities) and a higher longevity (elderly people suffering more home accidents as we have observed) could make predict an increase in LTC needs, if not preventive policies to stop this impact are developed.

Although the major limitation to perform this kind of analysis is the availability of databases, in 2008 the Spanish Institute of Statistics conducted a survey (both with institutionalized and non-institutionalized population) which included the objective of estimating the prevalence of dependency among disabled individuals recording the cause of the individual's disability that requires third person help. This allows us to calculate the prevalence of dependency in individuals with disabilities attributable to HLAs. If we include any cause (including therefore endogenous causes or those linked to aging) estimated prevalence rate of dependence in Spain is estimated at 9.7%, a figure that drops to 0.23% if we consider only home and leisure accidents (Spanish RTIs prevalence rate is estimated at 0.17%, see Alemany et al., 2013). But, in absolute terms HLAs victims constitute a sizable group of individuals with LTC needs along their lives (86,237 people in 2008 vs. 66,000 related to RTI).

Our results confirm that the incidence of HLAs in the Spanish prevalence rates of dependence is higher than that derived from traffic accidents. From our point of view more relevance need to be given to this type of accidents by public entities, in line with what is already done with traffic accidents, where awareness campaigns about road safety policies are much more frequent. Providing old and young people with more information

about consequences from home and leisure accidents respectively could probably help to reduce the physical and economic consequences that they provoke. Additionally, people could be aware of the LTC needs and look for additional coverage for this type of risk if it is necessary (for example by means of insurance).

The statistics compiled by official bodies (for example, the Spanish Ministry of Health, Social Policy and Equality in the *DADO Report - Injury Prevention Program: Detection of Domestic and Leisure Accidents 2011*) include information about some different sociodemographic variables of the victim (age, gender, employment situation...), type of accident (activity performed, accident site, time of day...), and injury suffered (part in the body that has been affected, type of healthcare, length of hospitalization... ). However they do not allow any conclusions to be drawn regarding the victims' LTC needs and this information can be crucial for both i) measuring the impact of HLAs on public budgets for dependence and ii) designing preventive policies that help to reduce rates of prevalence. In our study the annual cost of providing care to individuals disabled in home accidents is estimated at around 0.05% of Spain's GDP in 2008 (0.06% in 2016), while leisure accidents impact is estimated at around 0.01% of GDP (0.02% in 2016). Traffic accidents impact was estimated at around 0.04% of GDP in 2008 (Alemany et al., 2013) and, therefore, it is lower than the observed for domestic accidents.

For both, home and leisure accidents, the greatest functional limitations are observed in activities related to mobility and realization of physical effort. According to our estimates, more than half of people who have suffered a domestic accident (practically 60%) have difficulties walking or moving outside their house unaided, a figure also high in the case of having suffered a leisure accident (45% approximately). However, there are some limitations clearly related to one of the two causes. For example, people who have suffered home accidents have more difficulties in taking care of daily housework without help (around 56%) or applying medical prescriptions unaided (around 33%), while those who have suffered leisure accidents have more severe limitations in driving vehicles (practically 30%).

The incidence of home accidents in the prevalence of dependence is higher in the population over 65 years, while leisure accidents affect more significantly the young and adult population (up to 54 years). However, it is also important to highlight the increasingly incidence of leisure accidents in older people, probably as a result of changes in their lifestyle (increase in the number of trips, higher participation in cultural activities...). Prevalence of dependence derived from home accidents shows an exponential behavior with age, not observed for leisure accidents. The exponential behavior that we can observe for prevalence derived from all causes globally considered is not observed either in the context of RTIs where the impact is notably higher in individuals aged between 35 and 64 years (Alemany et al., 2013).

Results show a high impact of HLAs on the severity of victims' injuries, which varies with the individual age. If we consider all dependent people between 18 and 24 years that have suffered a leisure accident, 24.22% are Grade 3 (full dependency) compared to 9.67% associated with other causes. Between 45 and 54 years the prevalence rate for this most severe degree reaches 28.9% compared to 3.0% observed for the rest of causes. The incidence of leisure accidents in the inability for young and adult people to be part of the labor market should not be ignored. In the context of home accidents, there is a strong increase in the prevalence rates for the most severe dependence after 65 years, especially in the population aged 85 and over, with approximately the 28.5% of the Spanish disabled adult population being dependent for this cause.

Different studies have analyzed the economic impact of such accidents in terms of administrative costs and hospitalization (Hopkin and Simpson, 1996; Veisten and Nossun, 2007; Veisten et al., 2009; Walter, 2010) but, as far as we are concerned, we are not aware of any studies to date that have quantified the costs derived from long-term care (assistance

from a third party) when one of the causes of disability is a domestic accident or leisure. In this paper we present the estimated annual costs of long-term care derived from home and leisure accidents, which in aggregate terms are estimated at approximately 699 million euros in 2008 (781 million in 2016). Around 80% of this cost is related to home accidents that cause an impact on LTC needs higher than the observed for traffic accidents (estimated at approximately 400 million euros in 2008). Results alert us about the convenience of engaging more preventive measures, increasing public information about the consequences of this cause of disability. Previous studies (Heywood and Turner, 2007; Alemany et al., 2012; Riskcenter, 2014; Keall et al. 2015) demonstrate that the adoption of preventive measures in the home of the elderly (replacement of bathtubs for showers,...), or the provision of technical aids (elevators and rotating discs in the armchairs, adaptable beds, ...) help to increase their autonomy, reducing probability of suffering accidents and LTC needs. Lund and Bjerkedal (2001) indicate that between 20 and 60% of individuals with disabilities due to exogenous causes can significantly improve their level of dependence if they follow adequate rehabilitation. The high number of people who will reach advanced ages in Spain (as in some other countries in the world), as a consequence of an increasing longevity, make us to highlight the relevance of this type of accidents, also due to the high impact that can be expected in the budget for dependence, both at the public and individual level.

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