

## Original article

## Excess Weight in Spain: Current Situation, Projections for 2030, and Estimated Direct Extra Cost for the Spanish Health System



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## ABSTRACT

**Introduction and objectives:** Excess weight promotes the development of several chronic diseases and decreases quality of life. Its prevalence is increasing globally. Our aim was to estimate the trend in excess weight between 1987 and 2014 in Spanish adults, calculate cases of excess weight and its direct extra costs in 2006 and 2016, and project its trend to 2030.

**Methods:** We selected 47 articles in a systematic literature search to determine the progression of the prevalence of overweight, nonmorbid obesity, and morbid obesity and average body mass index between 1987 and 2014. We projected the expected number of cases in 2006, 2016, and 2030 and the associated direct extra medical costs.

**Results:** Between 1987 and 2014, the prevalence of overweight, obesity, and morbid obesity increased by 0.28%/y ( $P = .004$ ), 0.50%/y ( $P < .001$ ) and 0.030%/y ( $P = .006$ ) in men, and by 0.10%/y ( $P = .123$ ), 0.25%/y ( $P = .078$ ), and 0.042%/y ( $P = .251$ ) in women. The mean body mass index increased by 0.10 kg/m<sup>2</sup>/y in men ( $P < .001$ ) and 0.26 kg/m<sup>2</sup>/y in women (significantly only between 1987 and 2002,  $P < .001$ ). We estimated 23 500 000 patients with excess weight in 2016, generating 1.95 billion €/y in direct extra medical costs. If the current trend continues, between 2016 and 2030, there will be 3 100 000 new cases of excess weight, leading to 3.0 billion €/y of direct extra medical costs in 2030.

**Conclusions:** Excess weight in Spanish adults has risen since the creation of population registries, generating direct extra medical costs that represent 2% of the 2016 health budget. If this trend continues, we expect 16% more cases in 2030 and 58% more direct extra medical costs.

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## Exceso de peso en España: situación actual, proyecciones para 2030 y sobrecoste directo estimado para el Sistema Nacional de Salud

## RESUMEN

**Introducción y objetivos:** El exceso de peso potencia algunas enfermedades crónicas y reduce la calidad de vida, y su prevalencia crece en todo el mundo. El objetivo es estimar la evolución del exceso de peso entre 1987 y 2014 en población española adulta, calcular los casos de exceso de peso y sus sobrecostes médicos directos en 2006 y 2016, y proyectar su tendencia a 2030.

**Métodos:** Se seleccionaron 47 artículos en una búsqueda bibliográfica sistemática para determinar la progresión de las prevalencias de sobrepeso, obesidad y obesidad mórbida y del índice de masa corporal promedio entre 1987 y 2014. Con estos datos, se estimó el número de casos en adultos españoles en 2006, 2016 y 2030 y sus sobrecostes directos.

**Resultados:** Entre 1987 y 2014, las prevalencias de sobrepeso, obesidad y obesidad mórbida aumentaron el 0,28%/año ( $p = 0,004$ ), el 0,50%/año ( $p < 0,001$ ) y el 0,030%/año ( $p = 0,006$ ) en los varones y el 0,10%/año ( $p = 0,123$ ), el 0,25%/año ( $p = 0,078$ ) y el 0,042%/año ( $p = 0,251$ ) en las mujeres. El índice de masa corporal aumentó 0,10 puntos/año en varones ( $p < 0,001$ ) y 0,26 en mujeres (significativamente solo

## Palabras clave:

Sobrepeso

Obesidad

Obesidad mórbida

Revisión bibliográfica sistemática

Sobrecostes médicos

Previsión

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entre 1987–2002,  $p < 0,001$ ). Se estimaron 23.500.000 casos de exceso de peso en 2016, cuyo sobrecoste médico directo supuso 1.950.000.000 euros/año. De mantenerse la tendencia, entre 2016 y 2030 aparecerán 3.100.000 nuevos casos de exceso de peso, y se alcanzará en 2030 un sobrecoste médico directo de unos 3.000.000.000 euros/año.

**Conclusiones:** El exceso de peso en los adultos en España aumenta desde que existen registros, y en 2016 supuso un sobrecoste directo del 2% del presupuesto sanitario. Con esta tendencia, en 2030 se habrá incrementado un 16% el número de casos y un 58% su sobrecoste sanitario directo.

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## Abbreviations

BMI: body mass index

## INTRODUCTION

Excess weight is a priority concern in public health because it raises mortality (increased 7% to 20%, 45% to 94%, and 176% by overweight, obesity, and morbid obesity, respectively)<sup>1</sup> and is the fourth preventable factor that most impairs quality of life.<sup>2</sup> The prevalence of excess weight has risen since data were first recorded: in 2014, obesity was present in 10.8% of men and 14.9% of women worldwide, and these figures are expected to jump to 18% and 21%, respectively, by 2025.<sup>3</sup>

In Spain, excess weight has been analyzed in methodologically heterogeneous population studies, and the trend has only been described in national health surveys, which observed an increase in overweight and obesity of 1.8% and 8.5%, respectively, between 1987 and 2012.<sup>4</sup> Likewise, although the individual direct extra medical costs of excess weight are known,<sup>5</sup> there is no estimate of the total extra costs for our health system.

This purpose of the study was: *a*) to determine the trend of excess weight and average body mass index (BMI) in the general Spanish adult population; *b*) to estimate the prevalence and number of cases of overweight, obesity, and morbid obesity in 2006, 2016, and 2030, and *c*) to estimate total direct extra costs thereof.

## METHODS

### Design

The study design consisted of a systematic review search and estimate of trends over time.

### Search Criteria

We examined primary literature sources published since 1985 describing the prevalence of excess weight, obesity, or morbid obesity or average BMI (quotient between weight in kg and the square of height in meters) in representative samples of the general Spanish adult population. The study considered overweight to be BMI  $\geq 25$  and  $< 30$ , nonmorbid obesity to be BMI  $\geq 30$  and  $< 40$ , and morbid obesity to be BMI  $\geq 40$ .

The selection of sources is described in [Figure 1](#). PubMed and Embase were searched for articles that contained *body mass index*, *BMI*, *overweight*, words that started with *obes* in the title or abstract, or *obesity* or *overweight* as MeSH Terms, *Spain* in the title, abstract, or affiliations or *Spanish* in the title or abstract, and *prevalence* in the title, abstract, or as MeSH Term (search performed on 6 March 2017). Only studies including the following were

considered: *a*) general Spanish adult population ( $\geq 16$  years, excluding populations that were only working populations); *b*) results reported by sex; *c*) participants' age range, and *d*) year of examination. Two of the authors (A. Hernández and J. Marrugat) reviewed the search titles ( $n = 873$ ) and classified them as relevant or irrelevant. The abstracts of articles with titles classified as relevant by at least 1 author ( $n = 201$ ) were reviewed using the same criterion, and 131 articles were obtained for a full-text review. A review of the literature references cited in these series provided an additional 18 references ( $n = 149$ ). Any discrepancies were resolved by consensus. When aggregate studies of previous series were identified, the data were collected from the individual studies if possible. When several publications were found for the same study, the publication with more participants or more detailed information was retained.

A total of 47 articles were included in the review. These articles were then used to extract the prevalences of overweight, obesity, and morbid obesity as well as average BMI, year of data collection, and whether weight and height data were reported by patients or collected by health professionals. The mean age of participants was also calculated or estimated. The quality of the articles was analyzed, according to whether or not the article expressly defined the following: *a*) volunteers' age and location; *b*) sampling method; *c*) recruitment response rate reported as  $\geq 70\%$ ; *d*) anthropometric information for excluded participants; *e*) definition of overweight, obesity, and morbid obesity; *f*) exact methodology used to measure weight and height; *g*) instrumentation used to determine weight and height, and *h*) measures taken to reduce any observation bias.<sup>6</sup> A broader explanation of these aspects is given in the "Determination of Study Quality" section of the [supplementary data](#).

### Statistical Analysis

The trends of excess weight over time were calculated using multivariate linear regression models: the prevalences of excess weight or average BMI (separated by sex) were the dependent variables, the year of data collection and the mean age of the individuals were the independent variables, and the contribution of each study was weighted according to sample size.<sup>7</sup> For each dependent variable, we studied whether or not the use of patient-reported weight and height data in each study (as a categorical variable) significantly affected model behavior. Likewise, we assessed whether or not the inclusion of nonlinear trends reached statistical significance; when this occurred, possible inflection points were estimated by the break point method.<sup>8</sup> Previous trends were depicted by weighting each study equally according to sample size (greater size, larger plot point).<sup>9</sup> These analyses were performed using R Software (version 3.4.1).<sup>10</sup>

### Prevalences and Cases of Excess Weight in 2006, 2016, and 2030

The prevalences of overweight, obesity, and morbid obesity in 2006 and 2016 were calculated as described above, and the mean

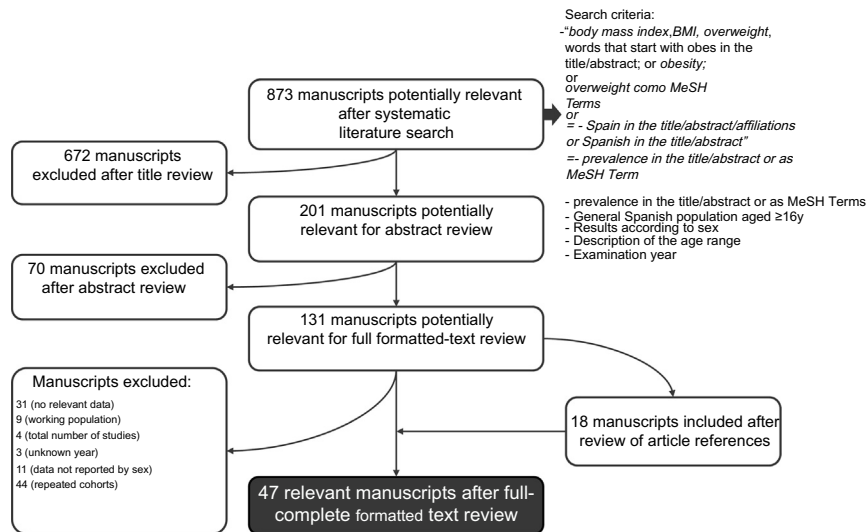


Figure 1. Literature search strategy.

age of the Spanish adult population was estimated for each year from the National Statistics Institute data<sup>11</sup> (see "Methods" in the [supplementary data](#)). For projections up to 2030, 2 scenarios were considered: *a*) the current trend persists and *b*) the prevalences of excess weight holds steady at 2016 values.

The cases of excess weight were calculated by applying the previous prevalences to populations of men and women aged  $\geq 16$  years in 2006 and 2016 and the projections for 2030.<sup>12</sup>

### Approximate Estimate of Total Direct Extra Medical Costs

Mora et al.<sup>5</sup> estimated that direct extra costs due to excess weight in Spain (considering excess costs in these patients due to primary care, specialist, and emergency visits; hospitalizations; laboratory, radiologic, and other types of diagnostic tests; and pharmaceutical prescriptions) were €43.49, €115.13, and €145.64 per year for men and €60.73, €142.95, and €170.07 per year for women with overweight, nonmorbid obesity, and morbid obesity, respectively (compared with persons of normal weight, with the euro value in 2010 taken as a reference).<sup>5</sup> The above parameters were adjusted for inflation from 2006 to 2010 (7.91%) and from 2010 to 2016 (5.92%) based on the Consumer Price Index,<sup>13</sup> assuming a stable macroeconomic situation with a theoretical annual inflation of 2% from 2016 to 2030<sup>14</sup> and multiplying by the number of cases previously calculated to estimate the approximate total direct extra costs. A broader explanation of these aspects and the exact values of direct extra costs per person in 2006, 2016, and 2030 is given in the "Methods" section of the [supplementary data](#) and [Table 1 of the supplementary data](#), respectively.

## RESULTS

The articles considered provide data from 51 studies conducted between 1987 and 2014 ([Table 1](#)),<sup>4,15–60</sup> which included 149 955 men and 167 159 women. The prevalences of overweight, obesity, and morbid obesity and average BMI appeared in 36, 46, 11, and 29 studies, respectively. The studies were of variable quality (35% were low; 57%, medium; and 8%, high) ([Table 2 of the supplementary data](#)).

From 1987 to 2014, the prevalences of overweight, total obesity, and morbid obesity increased by + 0.28% per year ( $P = .004$ ), + 0.50% per year ( $P < .001$ ), and + 0.030% per year ( $P = .006$ ) in men and by + 0.10% per year ( $P = .123$ ), + 0.25% per year ( $P = .078$ ), and + 0.042% per year ( $P = .251$ ) in women ([Figure 2](#)). None of the above trends exhibited significant nonlinear behavior or break points ( $P > .05$ ). The equations of these progressions are shown in [Table 3 of the supplementary data](#).

Average BMI values rose linearly between 1987 and 2014 in men (+0.10 per year;  $P < .001$ ), with no significant break point, and increased between 1987 and 2002 in women (+0.26 per year;  $P < .001$ ) and did not drop significantly between 2002 and 2014 (–0.14 per year;  $P = .265$ ) ([Figure 3](#)).

There was no difference in the behavior of either trend according to whether weight and height data were reported by patients or were collected by health professionals ( $P > .05$  in all cases).

From 2006 and 2016, more than 3.1 million new cases of excess weight appeared ([Table 2](#)), which increased direct extra costs of this disease by €524 million per year up to €1.95 billion in 2016, 2% of the health budget (€95.722 billion according to the latest estimate).<sup>61</sup>

If the current trend persists, in 2030 there will be about 27.2 million adults with excess weight, with direct extra costs of about €3.08 billion per year ([Table 3](#)). This would be approximately an additional 3.1 million cases (and additional €440 million per year of extra costs) compared with the scenario in which the disease stabilizes at 2016 values. Assuming a linear increase, cumulative extra costs between 2016 and 2030 in the worst case scenario would rise to €3.081 billion.

## DISCUSSION

Excess weight is increasingly prevalent among Spanish adults: the data collected indicate that overweight, obesity, and morbid obesity rose significantly in men between 1987 and 2014, whereas obesity increased only slightly in women. The average BMI increased linearly and significantly in men over this period and in women only until 2002. These data are consistent with the rise in overweight and obesity of 1.8% and 8.5% described in national

**Table 1**  
Characteristics of Studies Included in the Systematic Review Search

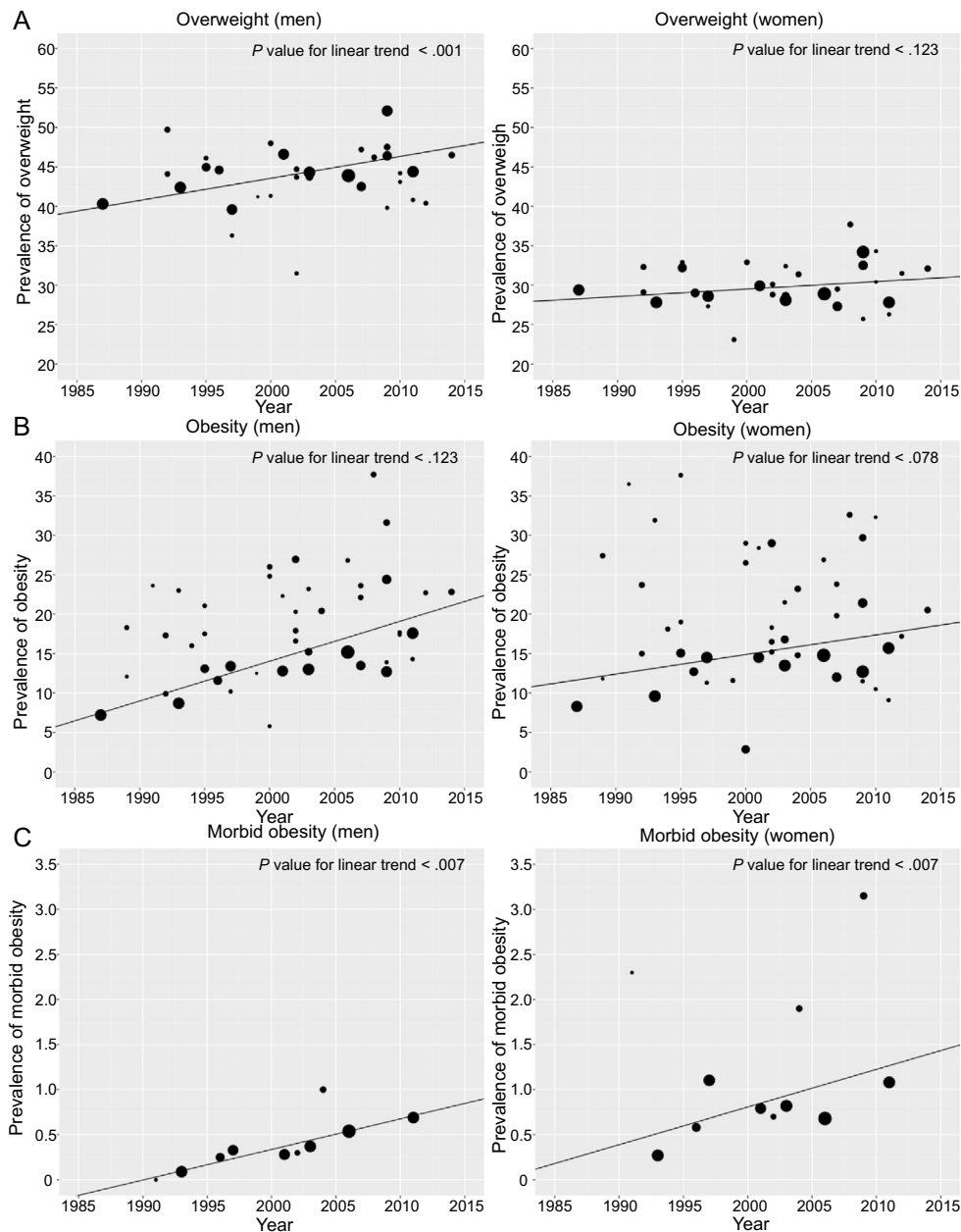
Cohort Name	Year	Study region	Age	N	Overweight	Obesity	Morbid obesity	BMI	Quality	Patient-reported height/weight
ENPE study <sup>15</sup>	2014	Spain	25-64	3966	Yes	Yes	No	Yes	High	No
ANIBES study <sup>16</sup>	2012	Spain	18-65	1655	Yes	Yes	No	Yes	Medium	No
General population of Basque Country <sup>17</sup>	2011	Basque Country	≥ 18	828	No	No	No	Yes	Low	No
LisRisk-ERANET study <sup>18</sup>	2011	Basque Country	17-96	1081	Yes	Yes	No	Yes	Low	Yes
National Health Survey 2011 <sup>4</sup>	2011	Spain	> 18	21 007	Yes	Yes	Yes	No	Medium	Yes
DOXA study <sup>19</sup>	2010	Spain	≥ 18	964	Yes	Yes	No	No	Low	Yes
Nutrition Survey of the Valencian Community <sup>20</sup>	2010	Valencian Community	16-90	828	Yes	Yes	No	No	Low	No
Di@bet.es study <sup>21</sup>	2009	Spain	≥ 18	5047	Yes	Yes	Yes	No	Medium	No
OBEX study <sup>22</sup>	2009	Balearic Islands	18-55	1081	Yes	Yes	No	No	High	No
ENRICA study <sup>23</sup>	2009	Spain	≥ 18	12 036	Yes	Yes	No	Yes	Medium	No
European Health Interview Survey for Spain (EHIS) <sup>24</sup>	2009	Spain	20-82	21 486	Yes	Yes	No	Yes	Low	Yes
Pharmacies, city of Barcelona <sup>25</sup>	2009	Catalonia	18-65	650	No	No	No	Yes	Low	No
HERMEX study <sup>26</sup>	2008	Extremadura	25-79	2833	Yes	Yes	No	Yes	Medium	No
IMAP study <sup>27</sup>	2007	Andalusia	18-80	2270	Yes	Yes	No	Yes	Medium	No
Health Survey of Madrid 2007 <sup>28</sup>	2007	Community of Madrid	≥ 15	12 190	Yes	Yes	No	No	Low	Yes
PREDIMERC study <sup>29</sup>	2007	Community of Madrid	30-74	2268	No	Yes	No	Yes	Medium	No
Primary care centers, Community of Madrid <sup>30</sup>	2006	Community of Madrid	31-70	1344	No	Yes	No	Yes	Medium	No
National Health Survey 2006 <sup>4,31</sup>	2006	Spain	≥ 16	29 476	Yes	Yes	Yes	No	Medium	Yes
Health Survey of Catalonia 2006 <sup>32</sup>	2006	Catalonia	≥ 15	15 926	No	No	No	Yes	Low	Yes
EROCAP study <sup>33</sup>	2004	Spain	≥ 18	7202	No	No	No	Yes	Low	No
General population of Castile and León <sup>34</sup>	2004	Castile and León	≥ 15	4012	No	Yes	Yes	No	Low	No
General population of Galicia (SERGAS selection) <sup>35,36</sup>	2004	Galicia	≥ 18	2884	Yes	Yes	No	Yes	Medium	Yes
CANTHABRIA study <sup>37</sup>	2003	Cantabria	≥ 18	1197	Yes	Yes	No	No	Low	No
National Health Survey 2003 <sup>4,38</sup>	2003	Spain	≥ 16	21 650	Yes	Yes	Yes	No	Medium	Yes
Health Survey of Andalusia 2003 <sup>39</sup>	2003	Andalusia	≥ 16	6708	Yes	Yes	No	No	Low	Yes
Health Survey of Catalonia 2002 <sup>40</sup>	2002	Catalonia	18-74	1104	Yes	Yes	No	Yes	Low	No
CDC (Canary Island Cohort) study <sup>41</sup>	2002	Canary Islands	18-75	6729	No	Yes	No	Yes	Medium	No
General population of Cádiz <sup>42</sup>	2002	Andalusia	≥ 15	2640	Yes	Yes	Yes	No	Medium	No
Nutritional Survey of Catalonia 2002 <sup>43</sup>	2002	Catalonia	18-75	2060	Yes	Yes	No	No	Medium	No
National Health Survey 2001 <sup>38,44</sup>	2001	Spain	≥ 20	17 593	Yes	Yes	Yes	No	Medium	Yes
General population of Segovia <sup>45</sup>	2001	Castile and León	35-74	809	No	Yes	No	Yes	Low	No
REGICOR-2000 study <sup>46,47</sup>	2000	Catalonia	25-74	2540	Yes	Yes	No	Yes	Medium	No
CORSAIB study <sup>48</sup>	2000	Balearic Islands	35-74	1685	No	Yes	No	Yes	Medium	No
General population of Pamplona <sup>49</sup>	2000	Chartered Community of Navarre	18-65	782	Yes	Yes	No	No	Low	Yes
ENIB survey <sup>22</sup>	1999	Balearic Islands	18-55	1089	Yes	Yes	No	No	High	No
Cardiovascular Risk Survey of the Valencian Community <sup>50</sup>	1999	Valencian Community	18-66	716	No	No	No	Yes	Low	No
General population of Girona <sup>51</sup>	1997	Catalonia	15-65	18 022	Yes	Yes	Yes	No	Medium	No
PAN-EU, Spanish arm <sup>52</sup>	1997	Spain	≥ 15	1000	Yes	Yes	No	Yes	Medium	Yes
National Health Survey 1995-1997 <sup>4,38,44</sup>	1996	Spain	≥ 20	9950	Yes	Yes	Yes	No	Medium	Yes
SEEDO 2000 study <sup>53</sup>	1995	Spain	25-60	9885	Yes	Yes	No	Yes	Medium	No
REGICOR-1995 study <sup>46,47</sup>	1995	Catalonia	25-74	1480	Yes	Yes	No	Yes	Medium	No
General population of Talavera de la Reina <sup>54</sup>	1995	Castile-La Mancha	25-74	1330	No	Yes	No	Yes	Medium	No
Health and Nutrition Survey of the Valencian Community 1994 <sup>55</sup>	1994	Valencian Community	≥ 15	1772	No	Yes	No	Yes	High	Yes
National Health Survey 1993 <sup>4,38</sup>	1993	Spain	> 18	21 061	Yes	Yes	Yes	Yes	Medium	Yes
General population of Albacete <sup>56</sup>	1993	Castile-La Mancha	> 18	1322	No	Yes	No	No	Low	No
Health Survey of Murcia 1992 <sup>57</sup>	1992	Region of Murcia	18-65	3087	Yes	Yes	No	No	Medium	No

**Table 1** (Continued)

Characteristics of Studies Included in the Systematic Review Search

Cohort Name	Year	Study region	Age	N	Overweight	Obesity	Morbid obesity	BMI	Quality	Patient-reported height/weight
Nutritional Survey of Catalonia 1992 <sup>43</sup>	1992	Catalonia	18–75	2641	Yes	Yes	No	No	Medium	No
Guía study <sup>58</sup>	1991	Canary Islands	≥ 30	691	Yes	Yes	Yes	No	Medium	No
General population of Catalonia <sup>59</sup>	1989	Catalonia	≥ 15	704	No	Yes	No	Yes	Medium	No
General population of Catalonia <sup>60</sup>	1989	Catalonia	35–64	2021	Yes	Yes	No	Yes	Medium	No
National Health Survey 1987 <sup>44</sup>	1987	Spain	≥ 20	20 040	Yes	Yes	No	Yes	Medium	Yes

BMI, body mass index.

**Figure 2.** Trend for prevalences of overweight (A), obesity (B), and morbid obesity (C) and linear trend analysis in epidemiologic studies in Spanish adults between 1987 and 2014.

health surveys between 1987 and 2012,<sup>4</sup> although they differ from the pattern of BMI increase reported by other studies.<sup>3</sup> Possible explanations for this weight gain are that, during the study period, the Spanish population: a) acquired less healthy dietary patterns

(higher intake of cookies, industrial pastries, dairy desserts, juice, and soft drinks); reduced their fruit intake at home; and dramatically increased eating out<sup>62</sup>; b) continued to follow a moderately sedentary lifestyle,<sup>63</sup> or c) experienced an increase in

**Table 2**

Estimate of Cases of Overweight and Nonmorbid and Morbid Obesity in Spanish Adults and Their Additional Direct Cost (2006, 2016)

	2006						2016						Differences	
	Mean Age, y	Prevalences, %	Population, N	Cases, n	Annual EC per person, €	Total annual EC, €	Mean age, y	Prevalences, %	Population, N	Cases, n	Annual EC per person, €	Total annual EC, €	New Cases, n	Increase in Annual EC, €
	2006	2016	2006-2016											
<i>Overweight (BMI 25.0-29.9)</i>														
Men	45.2	45.3	18 214 203	8 243 748	40.05	330 162 107	48.4	48.0	18 957 273	9 105 178	46.06	419 384 499	861 430	89 222 392
Women	46.5	30.1	19 022 087	5 723 746	55.93	320 129 114	49.5	31.0	20 023 208	6 215 204	64.33	399 824 073	491 458	79 694 959
Total				13 967 494		650 291 221				15 320 382		819 208 572	1 352 888	168 917 351
<i>Nonmorbid obesity (BMI 30.0-39.9)</i>														
Men	45.2	17.4	18 214 203	3 171 093	106.02	336 199 280	48.4	22.1	18 957 273	4 193 349	121.95	511 378 911	1 022 256	175 179 631
Women	46.5	15.9	19 022 087	3 020 707	131.64	397 645 869	49.5	18.0	20 023 208	3 596 168	151.41	544 495 797	575 461	146 849 928
Total				6 191 800		733 845 149				7 789 517		1 055 874 708	1 597 717	322 029 559
<i>Morbid obesity (BMI ≥ 40.0)</i>														
Men	45.2	0.53	18 214 203	96 535	134.12	12 947 274	48.4	0.87	18 957 273	164 928	154.26	25 441 793	68 393	12 494 519
Women	46.5	0.98	19 022 087	186 416	156.62	29 196 474	49.5	1.39	20 023 208	278 323	180.14	50 137 105	91 907	20 940 631
Total				282 951		42 143 748				443 251		75 578 898	160 300	33 435 150
Total				20 442 245		1 426 280 118				23 553 150		1 950 662 178	3 110 905	524 382 060

BMI, body mass index; EC, extra cost.

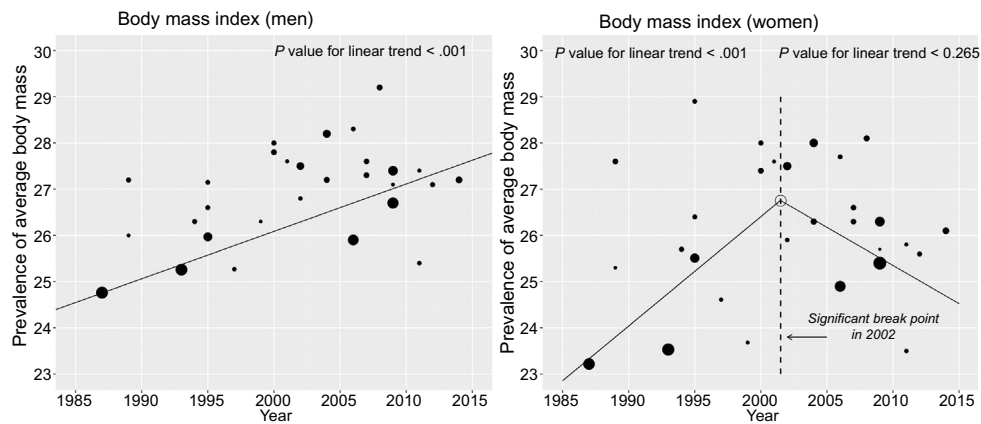
**Table 3**

Estimate of Cases of Overweight and Nonmorbid and Morbid Obesity in Spanish Adults in 2030 and Their Additional Direct Cost if Excess Weight Progresses at Current Rates or Holds Steady at 2016 Levels

	2030: At current trend						2030: With prevalence of excess weight at 2016 Values						Differences	
	Mean age, y	Prevalences, %	Population, N	Cases, n	Annual EC per person, €	Total annual EC, €	Prevalences, %	Population, N	Cases, n	Annual EC per person, €	Total annual EC, €	New cases, n	Increase in annual EC, €	
<i>Overweight (BMI 25.0-29.9)</i>														
Men	52.9	51.9	19 340 260	10 037 595	60.78	610 085 024	48.0	19 340 260	9 289 127	60.78	564 593 139	748 468	45 491 885	
Women	53.7	32.4	20 644 317	6 682 565	84.88	567 216 117	31.0	20 644 317	6 407 996	84.88	543 910 700	274 569	23 305 417	
Total				16 720 160		1 177 301 141			15 697 123		1 108 503 839	1 023 037	68 797 302	
<i>Nonmorbid obesity (BMI 30.0-39.9)</i>														
Men	52.9	28.7	19 340 260	5 552 589	160.91	893 467 096	22.1	19 340 260	4 278 066	160.91	688 383 600	1 274 523	205 083 496	
Women	53.7	20.8	20 644 317	4 302 276	199.79	859 551 722	18.0	20 644 317	3 707 719	199.79	740 765 179	594 557	118 786 543	
Total				9 854 865		1 753 018 818			7 985 785		1 429 148 779	1 869 080	323 870 039	
<i>Morbid obesity (BMI ≥ 40.0)</i>														
Men	52.9	1.34	19 340 260	259 159	203.54	52 749 223	0.87	19 340 260	168 260	203.54	34 247 640	90 899	18 501 583	
Women	53.7	1.98	20 644 317	408 757	237.69	97 157 451	1.39	20 644 317	286 956	237.69	68 206 572	121 801	28 950 879	
Total				667 916		149 906 674			455 216		102 454 212	212 700	47 452 462	
Total				27 242 941		3 080 226 633			24 138 124		2 640 106 830	3 104 817	440 119 803	

BMI, body mass index; EC, extra costs.





**Figure 3.** Trend for body mass index between 1987 and 2014, linear trend analysis, and break point determination in epidemiologic studies in Spanish adults.

employment levels, working hours, and purchasing power (particularly before the financial recession that began in 2009), which would have encouraged less traditional dietary standards or more sedentary lifestyles.<sup>64</sup>

Excess weight leads to considerably higher direct extra medical costs because these patients use health care more often (mainly due to more primary care, specialist, and emergency medical visits; more hospitalizations; more laboratory, radiologic, and diagnostic tests, and more drug prescriptions), both due to the excess weight itself and due to its multiple associated comorbidities.<sup>5,65</sup> According to our estimates, these direct extra medical costs were approximately €1.95 billion in 2016 (2% of the annual health budget), consistent with those described for other health systems (0.7%–2.8%).<sup>66</sup> Because direct medical expenses account for about half the total extra cost of obesity in other European systems (which also consider higher costs due to possible sick leave, loss of productivity and performance, the cost of time invested by other health system workers, etc),<sup>67</sup> the total extra cost due to excess weight could be around €3.9 billion for 2016. It was estimated that these were approximately €2.5 billion by the late 1990s<sup>65</sup> and, therefore, a cost increase of €1.4 billion per year within the next 15 to 20 years is plausible.

The growing prevalence of excess weight could rapidly become unsustainable. If the current trend continues, in 2030 there will be 27.2 million cases of excess weight (3.1 million more cases than if the trend remains steady at 2016 values). This progression could be tackled by multilevel interventions (applying taxes to unhealthy foods, promoting settings that discourage weight gain, implementing educational policies that enhance healthy lifestyles, and organizing better prevention systems),<sup>68</sup> such as has been undertaken in North Karelia, Finland.<sup>69</sup> New pharmacological strategies (eg, bupropion-naltrexone, liraglutide) could also be useful.<sup>70</sup> Apart from the health benefit, maintaining the prevalence of excess weight at current levels (already sufficiently high) would save about €3.0 billion by 2030. Considering that obesity prevention plans in Spain (such as the NAOS Strategy<sup>71</sup>) did not involve investments of such magnitude, these programs could be financially cost-effective in the short- to mid-term.

### Limitations and Strengths

Our review search has several limitations. First, it included studies of uneven methodological quality conducted in 3 different decades. This heterogeneity was partially corrected by using multivariate linear regression models and by weighting the studies according to sample size. Second, the review maximized the number of time points by including studies that enrolled

participants aged 15 to 17 years<sup>4,18,20,28,31,32,34,38,39,42,51,52,55,59</sup>, because these studies did not describe the use of other cutoff points or standards to quantify excess weight in this population, it was deduced that the studies used the same ones as for the adult population, which is not an ideal method. Third, excess weight did not increase significantly in women, probably due to greater dispersion in female prevalences. Fourth, an estimate of the mean age of Spanish adults was used to calculate the prevalences of excess weight because the National Institute of Statistics does not provide this information. Last, total extra cost due to this disease (considering all direct and indirect costs) could not be calculated, and only approximate direct extra medical costs could be estimated because there are no estimates of this parameter in the Spanish health system.

This study has several strengths. This is the first systematic literature search on excess weight trends conducted with all epidemiologic studies among the general Spanish adult population. In addition, it estimates the number of individuals who currently carry excess weight and then provides projections for 2030. Last, it contextualizes the social relevance of the problem by providing estimated figures of current and future direct extra costs.

### CONCLUSIONS

The prevalences of overweight, obesity, and morbid obesity have risen since records were first kept in Spain, although the incremental rise among women is not statistically significant. The result is a prevalence of more than 23 million persons with excess weight, with direct extra medical costs of almost 2% of the 2016 health budget. According to this trend, by 2030 there will be about 3.1 million new cases and extra costs of about €3.0 billion per year (more than 3% of the current health budget). Stabilizing excess weight at 2016 levels, which are already alarming, would save almost €3.0 billion by 2030.

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### CONFLICTS OF INTEREST

None declared.

### WHAT IS KNOWN ABOUT THE TOPIC?

- Excess weight is one of the factors most likely to increase the morbidity and mortality of chronic diseases, most likely to impair quality of life, and most likely to raise health costs.
- The prevalence of excess weight has risen worldwide since the start of record-keeping.

### WHAT DOES THIS STUDY ADD?

- The prevalences of overweight, obesity, and morbid obesity in Spain increased 0.28% per year ( $P = .004$ ), 0.50% per year ( $P < .001$ ), and 0.030% per year ( $P = .006$ ) in men and 0.10% per year ( $P = .123$ ), 0.25% per year ( $P = .078$ ), and 0.042% per year ( $P = .251$ ) in women, respectively.
- In 2016, there were 23.5 million cases of excess weight, leading to direct extra costs of €1.95 billion per year (2% of the health budget for 2016).
- Stabilizing the prevalence of excess weight at 2016 levels would prevent 3.1 million new cases and save €3.0 billion in cumulative direct extra costs by 2030.

### APPENDIX. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found in the online version, at <https://doi.org/10.1016/j.rec.2018.10.010>.

### REFERENCES

- Di Angelantonio E, Bhupathiraju SN, et al. Global BMI Mortality Collaboration. Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents. *Lancet*. 2016;388:776–786.
- GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388:1659–1724.
- NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet*. 2016;387:1377–1396.
- Basterra-Gortari FJ, Bes-Rastrollo M, Ruiz-Canela M, Gea A, Martínez-González M&au. Prevalence of obesity and diabetes in Spanish adults 1987–2012. *Med Clin (Barc)*. 2017;148:250–256.
- Mora T, Gil J, Sicras-Mainar A. The influence of obesity and overweight on medical costs: a panel data perspective. *Eur J Heal Econ*. 2015;16:161–173.
- Keane E, Kearney PM, Perry IJ, Kelleher CC, Harrington JM. Trends and prevalence of overweight and obesity in primary school aged children in the Republic of Ireland from 2002–2012: a systematic review. *BMC Public Health*. 2014;14:974.
- Bates D, Mächler M, Bolker B, Walker S. Fitting linear mixed-effects models using lme4. *J Stat Softw*. 2015;67:1–48.
- Muggeo VMR. Estimating regression models with unknown break-points. *Stat Med*. 2003;22:3055–3071.
- Hastie T. GAM: Generalized Additive Models. R package version 1.14–4. 2017. Available at: <https://cran.r-project.org/web/packages/gam/gam.pdf>. Accessed 17 Oct 2017.
- R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. 2014. Available at: <https://www.r-project.org/>. Accessed 9 Nov 2017.
- Instituto Nacional de Estadística. Edad media de la población española según sexo. 2016. Available at: <http://www.ine.es/jaxiT3/Datos.htm?t=3199>. Accessed 8 Aug 2017.
- Instituto Nacional de Estadística. Cifras de población residente en España. 2016. Available at: [http://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica\\_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981](http://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981). Accessed 5 Apr 2018.
- Instituto Nacional de Estadística. Índice de Precios al Consumo. 2017. Available at: <http://www.ine.es/jaxiT3/Tabla.htm?t=22553&L=0>. Accessed 18 Oct 2017.
- PriceWaterhouseCoopers. La economía española en 2033 (colección España 2033). 2013. Available at: <https://www.cuartopoder.es/wp-content/uploads/2013/12/Economia-espanola-en-2033.pdf>. Accessed 18 Oct 2017.
- Aranceta-Bartrina J, Pérez-Rodrigo C, Alberdi-Aresti G, Ramos-Carrera N, Lázaro-Masedo S. Prevalence of General Obesity and Abdominal Obesity in the Spanish Adult Population (Aged 25–64 Years) 2014–2015: The ENPE Study. *Rev Esp Cardiol*. 2016;69:579–587.
- López-Sobaler AM, Aparicio A, Aranceta-Bartrina J, et al. Overweight and general and abdominal obesity in a representative sample of Spanish adults: findings from the ANIBES Study. *Biomed Res Int*. 2016;2016:1–11.
- Aguayo A, Urrutia I, González-Frutos T, et al. Prevalence of diabetes mellitus and impaired glucose metabolism in the adult population of the Basque Country. *Spain Diabet Med*. 2017;34:662–666.
- Alegria-Lertxundi I, Rocandio Pablo A, Arroyo-Izaga M. Cheese consumption and prevalence of overweight and obesity in a Basque adult population: a cross-sectional study. *Int J Food Sci Nutr*. 2014;65:21–27.
- Gallus S, Lugo A, Murisic B, Bosetti C, Boffetta P, La Vecchia C. Overweight and obesity in 16 European countries. *Eur J Nutr*. 2015;54:679–689.
- Zubeldia Laurizurica L, Quiles Izquierdo J, Mañes Vinuesa J, Redón Más J. [Prevalence of hypertension and associated factors in population aged 16 to 90 years old in Valencia Region, Spain]. *Rev Esp Salud Publica*. 2016;90:E9.
- Marcuello C, Calle-Pascual AL, Fuentes M, et al. Evaluation of health-related quality of life according to carbohydrate metabolism status: a Spanish population-based study (Di@bet.es Study). *Int J Endocrinol*. 2012;2012:872305.
- Coll JL, Bibiloni MM, Salas R, Tur JA. Ten-Year Trends (2000–2010) of overweight and obesity prevalence among the young and middle-aged adult population of the Balearic Islands, a Mediterranean region. *Ann Nutr Metab*. 2015;67:76–80.
- Rodríguez-Fisac JL, Guallar-Castillón P, León-Muñoz LM, Graciani A, Banegas JR, Gutiérrez-Artalejo F. Prevalence of general and abdominal obesity in the adult population of Spain, 2008–2010: the ENRICA study. *Obes Rev*. 2012;13:388–392.
- Romo-Perez V, Souto D, Mota J. Walking, body mass index, and self-rated health in a representative sample of Spanish adults. *Cad Saude Publica*. 2016;32. pii: S0102-311X2016000100706.
- Via-Sosa MA, Toro C, Travé P, March MA. Screening premorbid metabolic syndrome in community pharmacies: a cross-sectional descriptive study. *BMC Public Health*. 2014;14:487.
- Félix-Redondo FJ, Baena-Díez JM, Grau M, Tormo MÁ, Fernández-Bergés D. Prevalencia de obesidad y riesgo cardiovascular asociado en la población general de un área de salud de Extremadura. *Estudio Hermex. Endocrinol Nutr*. 2012;59:160–168.
- Gomez-Huelgas R, Mancera-Romero J, Bernal-Lopez MR, et al. Prevalence of cardiovascular risk factors in an urban adult population from southern Spain. *IMAP Study. Int J Clin Pract*. 2011;65:35–40.
- Costa GR, Berjón MF, Mochales JA, Maleras RG, Laso AR, Vasallo MD. [Epidemiological features of comorbidity and its influence on the use of health services from Health Survey Madrid 2007, Spain]. *Rev Esp Salud Publica*. 2009;83:835–846.
- Gil Montalbán E, Zorrilla Torras B, Ortiz Marrón H, et al. Prevalencia de diabetes mellitus y factores de riesgo cardiovascular en la población adulta de la Comunidad de Madrid: estudio PREDIMERC. *Gac Sanit*. 2010;24:233–240.
- Rosado Martín J, Martínez López MÁ, Mantilla Morató T, et al. [Prevalence of diabetes in an adult population in the region of Madrid (Spain). The Madrid Cardiovascular Risk study]. *Gac Sanit*. 2012;26:243–250.
- Ortiz-Moncada R, Álvarez-Dardet C, Miralles-Bueno JJ, et al. Determinantes sociales de sobrepeso y obesidad en España 2006. *Med Clin (Barc)*. 2011;137:678–684.
- Pueyo MJ, Surís X, Larrosa M, et al. Importancia de los problemas reumáticos en la población de Cataluña: prevalencia y repercusión en la salud percibida, restricción de actividades y utilización de recursos sanitarios. *Gac Sanit*. 2012;26:30–36.
- De Francisco ALM, De la Cruz JJ, Cases A, et al. Prevalence of kidney insufficiency in primary care population in Spain: EROCAP study. *Nefrologia*. 2007;27:300–312.
- Escribano García S, Vega Alonso AT, Lozano Alonso J, et al. Obesity in Castile and Leon, Spain: Epidemiology and Association With Other Cardiovascular Risk Factors. *Rev Esp Cardiol*. 2011;64:63–66.
- Perez-Fernandez R, Mariño AF, Cadarso-Suarez C, et al. Prevalence, awareness, treatment and control of hypertension in Galicia (Spain) and association with related diseases. *J Hum Hypertens*. 2007;21:366–373.
- García-Mendizábal MJ, Carrasco JM, Pérez-Gómez B, et al. Role of educational level in the relationship between Body Mass Index (BMI) and health-related quality of life (HRQL) among rural Spanish women. *BMC Public Health*. 2009;9:120.



37. Aguilera-Zubizarreta E, Ugarte-Miota T, Muñoz-Cacho P, Vara-González L, Sanz-de Castro S, Grupo CANHTABRINTB. [Prevalence of overweight and obesity in Cantabria (Spain)]. *Gac Sanit*. 2008;22:461–464.
38. Basterra-Gortari FJ, Beunza JJ, Bes-Rastrollo M, Toledo E, García-López M, Martínez-González MA. Increasing Trend in the Prevalence of Morbid Obesity in Spain: From 1.8 to 6.1 per Thousand in 14 Years. *Rev Esp Cardiol*. 2011;64:424–426.
39. Escobar-Pujolar A. Determinantes sociales frente a estilos de vida en la diabetes mellitus de tipo 2 en Andalucía: ¿la dificultad para llegar a fin de mes o la obesidad? *Gac Sanit*. 2009;23:427–432.
40. Buckland G, Salas-Salvado J, Roure E, Bulló M, Serra-Majem L. Sociodemographic risk factors associated with metabolic syndrome in a Mediterranean population. *Public Health Nutr*. 2008;11:1372.
41. De León AC, Rodríguez JC, Coello SD, et al. [Lifestyle and treatment adherence of type 2 diabetes mellitus people in the Canary Islands]. *Rev Esp Salud Publica*. 2009;83:567–575.
42. Rodríguez-Martín A, Novalbos-Ruiz JP, Martínez-Nieto JM, Escobar-Jiménez L. Lifestyle factors associated with overweight and obesity among Spanish adults. *Nutr Hosp*. 2009;24:144–151.
43. Serra-Majem L, Ribas-Barba L, Salvador-Castell G, et al. Trends in the nutritional status of the Spanish population: results from the Catalan nutrition monitoring system (1992–2003). *Rev Esp Salud Publica*. 2007;81:559–570.
44. Salcedo V, Gutiérrez-Fisac JL, Guallar-Castillón P, Rodríguez-Artalejo F. Trends in overweight and misperceived overweight in Spain from 1987 to 2007. *Int J Obes*. 2010;34:1759–1765.
45. Martínez-Larrad MT, Fernández-Pérez C, González-Sánchez JL, et al. [Prevalence of the metabolic syndrome (ATP-III criteria). Population-based study of rural and urban areas in the Spanish province of Segovia]. *Med Clin (Barc)*. 2005;125:481–486.
46. Schröder H, Elosua R, Vila J, Martí H, Covas MI, Marrugat J. Secular Trends of Obesity and Cardiovascular Risk Factors in a Mediterranean Population. *Obesity*. 2007;15:557–562.
47. Grau M, Subirana I, Elosua R, et al. Trends in cardiovascular risk factor prevalence (1995–2000–2005) in northeastern Spain. *Eur J Cardiovasc Prev Rehabil*. 2007;14:653–659.
48. Rigo Carratalá F, Frontera Juan G, Llobera Cànaves J, Rodríguez Ruiz T, Borrás Bosch I, Fuentespina Vidal E. Prevalence of Cardiovascular Risk Factors in the Balearic Islands (CORSAB Study). *Rev Esp Cardiol*. 2005;58:1411–1419.
49. Elizondo-Armendáriz JJ, Guillén-Grima F, Aguinaga-Ontoso I. [Prevalence of physical activity and its relationship to sociodemographic variables and lifestyles in the age 18–65 population of Pamplona, Spain]. *Rev Esp Salud Publica*. 2005;79:559–567.
50. Guillén M, Corella D, Portolés O, González JL, Mulet F, Sáiz C. Prevalence of the methylenetetrahydrofolate reductase 677C >T mutation in the Mediterranean Spanish population. Association with cardiovascular risk factors. *Eur J Epidemiol*. 2001;17:255–261.
51. Fernández-Real JM, Sáez M, García-Rafanell JM, et al. [Ponderal evolution in the Girona population, 1989–1999]. *Rev Clin Esp*. 2003;203:57–63.
52. Martínez-González MA, Martín-Almendros MI, Gibney MJ, Kearney JM, Martínez JA. Perceptions about body weight and weight reduction in Spain. *Public Health Nutr*. 1999;2:557–563.
53. Aranceta J, Pérez-Rodrigo C, Serra-Majem L, et al. [Prevalence of obesity in Spain: results of the SEEDO 2000 study]. *Med Clin (Barc)*. 2003;120:608–612.
54. Segura-Fragoso A, Rius-Mery G. Cardiovascular risk factors in a rural population of Castilla-La Mancha. *Rev Esp Cardiol*. 1999;52:577–588.
55. Vioque J, Torres A, Quiles J. Time spent watching television, sleep duration and obesity in adults living in Valencia, Spain. *Int J Obes Relat Metab Disord*. 2000;24:1683–1688.
56. División-Garrote JA, Massó-Orozco J, Carrión-Valero L, et al. Evolución de la prevalencia de los factores de riesgo y del riesgo cardiovascular global en población mayor de 18 años de la provincia de Albacete (1992–94 a 2004–06). *Rev Esp Salud Publica*. 2011;85:275–284.
57. Martínez-Ros MT, Tormo MJ, Navarro C, Chirlaque MD, Pérez-Flores D. Extremely high prevalence of overweight and obesity in Murcia, a Mediterranean region in south-east Spain. *Int J Obes Relat Metab Disord*. 2001;25:1372–1380.
58. de Pablos-Velasco PL, Martínez-Martín FJ, Rodríguez-Pérez F. Prevalence of obesity in a Canarian community. Association with type 2 diabetes mellitus: the Guía Study. *Eur J Clin Nutr*. 2002;56:557–560.
59. Plans P, Pardell H, Salleras L. Epidemiology of cardiovascular disease risk factors in Catalonia (Spain). *Eur J Epidemiol*. 1993;9:381–389.
60. Banegas Banegas JR, Villar Alvarez F, Pérez de Andrés C, et al. [An epidemiological study on cardiovascular risk factors in 35–64 years old Spanish population]. *Rev Sanid Hig Publica (Madr)*. 1993;67:419–445.
61. Ministerio de Sanidad, Servicios Sociales e Igualdad. Informe Anual del Sistema Nacional de Salud. 2016. Available at: [https://www.msssi.gob.es/estadEstudios/estadisticas/sisInfSanSNS/tablasEstadisticas/InfAnualSNS2016/7Gast\\_Sanit.pdf](https://www.msssi.gob.es/estadEstudios/estadisticas/sisInfSanSNS/tablasEstadisticas/InfAnualSNS2016/7Gast_Sanit.pdf). Accessed 25 May 2017.
62. Martín-Cerdeño V. 1987–2007, dos décadas del Panel de Consumo Alimentario: evolución de los hábitos de compra y consumo en España. *Distrib Consum*. 2008;208–240.
63. Ministerio de Sanidad, Servicios Sociales e Igualdad. Tendencias de salud en 30 indicadores. 2015. Available at: [https://www.msssi.gob.es/estadEstudios/estadisticas/EncuestaEuropea/Tend\\_salud\\_30\\_indic.pdf](https://www.msssi.gob.es/estadEstudios/estadisticas/EncuestaEuropea/Tend_salud_30_indic.pdf). Accessed 5 Apr 2018.
64. Alonso-Pérez M, Furió-Blasco E. La economía española. *Cah Civilis Esp Contemp*. 2010. <http://dx.doi.org/10.4000/cccec.3212>.
65. Gabinete de Estudios Sociológicos Bernard Krief. Estudio prospectivo Delphi. Costes sociales y económicos de la obesidad y sus patologías asociadas (hipertensión, hiperlipidemias y diabetes). Madrid: Barnard Krief; 1999. Available at: <http://datos.bne.es/edicion/Mimo0001311932.html>. Accessed 25 May 2017.
66. Withrow D, Alter DA. The economic burden of obesity worldwide: a systematic review of the direct costs of obesity. *Obes Rev*. 2011;12:131–141.
67. Yates N, Teuner CM, Hunger M, et al. The economic burden of obesity in Germany: results from the population-based KORA studies. *Obes Facts*. 2016;9:397–409.
68. Sacks G, Swinburn B, Lawrence M. Obesity policy action framework and analysis grids for a comprehensive policy approach to reducing obesity. *Obes Rev*. 2009;10:76–86.
69. Vartiainen E, Laatikainen T, Peltonen M, et al. Thirty-five-year trends in cardiovascular risk factors in Finland. *Int J Epidemiol*. 2010;39:504–518.
70. Jones BJ, Bloom SR. The new era of drug therapy for obesity: the evidence and the expectations. *Drugs*. 2015;75:935–945.
71. AECOSAN (Agencia Española de Consumo Seguridad Alimentaria y Nutrición). Estrategia NAOS: estrategia para la Nutrición, Actividad Física y Prevención de la Obesidad. 2012. Available at: [http://www.aecosan.msssi.gob.es/AECOSAN/web/nutricion/seccion/estrategia\\_naos.htm](http://www.aecosan.msssi.gob.es/AECOSAN/web/nutricion/seccion/estrategia_naos.htm). Accessed 1 Nov 2017.