

1 INCREASE IN REGULAR LEISURE-TIME PHYSICAL ACTIVITY IN SPANISH ADULTS
2 BETWEEN 1987 AND 2017

3 **Rubén López-Bueno^{1,2}, PhD, Lee Smith³, PhD, Mark A.Tully⁴, PhD, Jae Il Shin⁵, PhD,**
4 **Joaquín Calatayud^{6,2}, PhD, Guillermo F. López-Sánchez⁷, PhD, Lars L. Andersen², PhD,**
5 **José A. Casajús⁸, PhD.**

6 ¹Department of Physical Medicine and Nursing, University of Zaragoza, Zaragoza, Spain

7 ²National Research Centre for the Working Environment, Copenhagen, Denmark

8 ³Cambridge Centre for Sport and Exercise Science, Anglia Ruskin University, Cambridge,
9 United Kingdom

10 ⁴Institute of Mental Health Sciences, School of Health Sciences, Ulster University,
11 Newtownabbey, United Kingdom

12 ⁵Department of Pediatrics, Yonsei University College of Medicine, Seoul, Republic of Korea

13 ⁶Exercise Intervention for Health Research Group (EXINH-RG), Department of
14 Physiotherapy, University of Valencia, Valencia, Spain

15 ⁷Faculty of Sport Sciences, University of Murcia, Murcia, Spain

16 ⁸Faculty of Health Sciences, University of Zaragoza, Zaragoza, Spain

17 **Correspondence:**

18 Rubén López-Bueno. rlopezbu@unizar.es

19 Department of Physical Medicine and Nursing, University of Zaragoza, no number, Domingo
20 Miral, Zaragoza, 50009, Spain. Tel: +34 9767 61719; fax: +34 9767 61720

INTRODUCTION

The impacts of non-communicable chronic diseases on both mortality and disability in Spain have grown following worldwide trends.¹ A total of 92.8% of all deaths are due to non-communicable chronic diseases, in which ischemic heart disease, Alzheimer disease and related dementias, stroke, chronic obstructive pulmonary disease, and lung cancer account for the major part.² On the other hand, physical activity is considered a cornerstone to preserving good health and well-being throughout life. Prior research has identified physical activity as a preventive factor for mortality in a dose-response fashion. This preventive effect has been observed even with a low volume of physical activity or regardless of the intensity-level.³ Also, further research has demonstrated that the domain of leisure-time physical activity (LTPA) reduces risk of all-cause mortality and specific mortality due to cardiovascular disease and cancer conditions.⁴ Furthermore, a recent meta-analysis involving the aforementioned domain demonstrated a reduction in risk of chronic conditions such as myocardial infarction, cardiovascular disease, heart failure, stroke, type 2 diabetes, colon cancer, and breast cancer.⁵

In addition, whereas prevalence of different volumes and intensity levels have been widely examined among several different populations worldwide, less is known about the frequency of physical activity. Performing physical activity every week is recommended by the World Health Organization (WHO) for adults,⁶ thus examining this specific pattern through national population-based research can provide new insights regarding how physical activity is performed as well as cross-national comparisons. Observing frequency has relevance since physical activity has been observed to be mainly comprised of short (i.e., less than 5 minutes) instead of weekly long-bouts among adults.⁷ Changes in frequency of physical activity can also indicate a change in health status; for instance, the reduction in physical activity after a

stroke is not mainly due to a decrease in the time spent being active within each bout but to a decrease in the frequency of bouts.⁸ Also, adults achieving WHO recommended levels of physical activity (i.e. ≥ 150 minutes in moderate-intensity or ≥ 75 minutes in vigorous-intensity) through more frequent sessions of LTPA (i.e. ≥ 3 sessions) associated with lower risk for all-cause, cardiovascular, and cancer mortality than the so-called ‘weekend warriors’, individuals performing weekly LTPA once or twice during the weekend, who also achieved the referred WHO physical activity guidelines and importantly reduced such mortality risks in comparison to inactive adults.⁹

To date, research regarding physical activity trends from countries such as Spain has been conducted partially, comprising regional or very specific population analyses during periods involving a temporal framework between 10 to 20 years up to the year 2008.^{10–12} Furthermore, Spain is a case in point among the European Union countries since it ranks on average in the last Eurobarometer on sport and physical activity.¹³ Therefore, the present study aimed at estimating a broader and actualized trend of regular LTPA among the general population of Spanish adults utilizing representative data from the Spanish National Health Survey. We hypothesized relevant variations of regular LTPA over the examined period.

METHODS

Study population and survey

The Spanish National Health Survey, a survey assessing general health carried out in a collaboration between the Ministry of Health, Social Services, and Equality and the National Statistics Institute. Since 1987, it has continuously surveyed a nationally representative three-stage stratified sample (i.e., considering census sections, households, and individuals) of the

civilian noninstitutionalized Spanish population in 2 to 6 years cycles comprising two different surveys: one for adults (i.e., 15 years of age or over) and other for minors (i.e., under 15 years of age). The samples were distributed throughout all Spanish regions assigning both a uniform part and other variable parts in proportion to the size of the region and accounting for the type of respondent, study characteristics, and information from previous surveys. Within each stratum, sections were selected with proportional size probability. In each section, households were selected with equal probability by systematic sampling, prior arrangement by the size of the household. Thereupon, an equal probability of eligibility was guaranteed to all potential participants in the household through the random Kish method. Finally, previously arranged computer-assisted personal interviews were conducted by trained interviewers in the homes of selected participants, who provided written consent to participate. The complete anonymized data series from all the survey rounds are publicly available from an institutional web server. For this study, only data of adults from those surveys including the same question regarding LTPA were retrieved. Thus, data from 1987, 1993, 1995, 1997, 2001, 2011, and 2017 rounds were included. The average response-rate for these rounds was 70%, and the main reasons for not responding to the survey were absence, empty dwelling, refusal, or inability to answer. Information regarding the sociodemographic characteristics, occupational physical activity, and LTPA from each data survey was combined into a single data set.

In the present study, age groups were set in accordance with prior research.¹⁴ Participants were grouped in the following age bands: 16 through 17 years; 18 through 30 years; 31 through 49 years; 50 through 64 years; and 65 through 75 years. Because not all the analyzed surveys included population aged 15 years, participants of that age were excluded from the study (n = 309). Also, due to the high prevalence of diseases and treatments, the population

over 75 years was excluded ($n = 9,770$).¹⁵ Trends in LTPA were presented using an estimated prevalence of regular LTPA. All trends were examined by age, sex, working status, and occupational physical activity level, which were the only potential confounders consistently assessed across the included survey rounds. This study was conducted using the Observational Routinely-collected health Data (RECORD) Statement.¹⁶ The study was performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments and received the approval of the Ethics Committee of Research in Humans of the University of Valencia (ID 1510464).

Regular Leisure-Time Physical Activity

Regular LTPA was assessed through one consistent single-item question included in all survey rounds: “Which one of the following choices better describe the frequency of your leisure-time physical activity?”. Possible answers consisted of six possible choices: 1) “I do not exercise. I spend my leisure-time almost completely in a sedentary way (reading, watching TV, cinema, etc.)”; 2) “I occasionally perform any physical activity or sport (walking, cycling, gardening, soft aerobics, recreational activities involving a light effort, etc.)”; 3) “I perform physical activity several times a month (sports, aerobics, running, swimming, team games, etc.)”; 4) “I perform sport or physical training several times a week.”; 5) “Does not know.”; and 6) “Refused to answer”. In the analyses, responses 1 and 2 were categorized as no regular LTPA, and responses 3 and 4 were categorized as regular LTPA. Responses 5 and 6 were both considered as missing values. Single-item questions regarding physical activity have shown strong reproducibility when using Spearman’s rank correlation coefficients ($r = 0.72-0.82$), as well as a strong agreement when meeting physical activity recommendations ($\kappa = 0.63$; 95% CI 0.54-0.72).¹⁷

122

123 **Covariates**

124 Self-reported sociodemographic characteristics used consistently in all the survey rounds
 125 included age, sex, and working status (working, and not working). Data on occupational
 126 physical activity were retrieved from the aforementioned surveys, which consistently used the
 127 same question: “Which one of these choices better describe your primary activity during the
 128 last 12 months (at work, educational institution, household, etc.)?”, and possible answers
 129 comprised six options: 1) “Sitting most of the time.”, 2) “Standing up most of the time,
 130 without much movement or efforts.”, 3) “Walking, carrying any weight, frequent
 131 movements.”, 4) “Heavy work, tasks that require a lot of physical effort”, 5) “Does not
 132 know.”; 6) “Refused to answer.”. In the analyses, answers 1 and 2 were categorized as no
 133 occupational physical activity, whereas answers 3 and 4 were categorized as occupational
 134 physical activity. Responses 5 and 6 were considered as missing values. Prior research has
 135 identified significant differences among levels of physical activity regarding age, sex,
 136 working status, and occupational physical activity.^{14,18,19}

137

138 **Statistical analyses**

139 Statistical analyses of individual data were performed with STATA version 16.1 (Stata Corp,
 140 Texas, USA) from April 9 to May 5, 2020. Survey analysis procedures were conducted to
 141 account for sample weights, stratification, and clustering of the complex sampling design and
 142 to make the sample representative of the Spanish Census civilian noninstitutionalized
 143 population. Estimates on crude weighted prevalence and 95% Confidence Intervals (CIs) of
 144 regular LTPA (monthly or weekly) were calculated by age survey and age subgroup.
 145 Although a first visual inspection of age-related prevalence showed a not perfect linear trend

(Figure 1), overall crude linear trends in regular LTPA were evaluated using linear regression models across survey years, which also served to estimate regression coefficients (β) and 95% CIs for every year change. P for trends were calculated using the survey year as a continuous variable, whereas absolute differences in the estimated prevalence of regular LTPA were calculated by comparing the 2017 survey with the 1987 baseline survey (i.e., the first round of the National Health Survey). Additionally, crude trends in regular LTPA (monthly or weekly) were visually illustrated.

Multivariable logistic regression adjusted for survey year, sociodemographic features (sex, age, and working status), and lifestyle (occupational physical activity) were used to model prevalence of regular LTPA and estimate odds ratios (ORs). Sensitivity analyses for regular LTPA trends in relation to sex, and estimated ORs only using surveys with additional control variables such as Body Mass Index and educational attainment were conducted. Individuals with missing data in any of the examined variables (32.3%) were excluded from the analyses. All statistical tests were 2-sided and statistical significance was set at $p < 0.05$.

RESULTS

A total of 114,813 participants on average aged 43.9 years (SD 16.7) (51.8% women) were included in the study. The sample size per survey ranged from 5,991 to 27,252 participants. Unweighted sample sizes in the 2017 survey overall and for each age group by sociodemographic and lifestyle characteristics are displayed in Table 1. The weighted sample size for each survey included in the study is presented in the supplement (eTable 1). The estimated prevalence of regular LTPA in the 2017 survey is displayed in Table 2 for each specific subgroup; 51.8% (95% CI, 46.9% to 56.8%) for participants aged 16 and 17 years,

39.9% (95% CI, 37.8% to 42.0%) for participants aged 18 to 30 years, 30.4% (95% CI, 29.3% to 31.5%) for participants aged 31 to 49 years, 19.4% (95% CI, 18.3% to 20.4%) for participants aged 50 to 64 years, and 13.0% (95% CI, 11.9% to 14.2%) for those aged 65 to 75 years.

Figure 1 illustrates the trend for prevalence of regular LTPA for all age groups throughout the survey years; except for the 2001 survey, in which regular LTPA remained stable, the overall trend is consistent towards higher prevalence. Such prevalence remained higher in an age-response fashion (i.e., younger participants showed higher prevalence of regular LTPA than older participants) throughout all the survey years. Compared with the 1987 survey, the 2017 estimated prevalence of regular LTPA was steadily increasing over time in all age groups (p for trend <0.001) (Table 2). The larger regular LTPA difference between the 1987 and the 2017 survey was found for groups of participants aged 18 to 30 years (24.0%; 95% CI 21.8% to 26.2%) and 31 to 49 years (24.2%, 95% CI 22.9% to 25.4%). Prevalence and P for trend regarding sex throughout the survey years showed a similar increasing tendency (p for trend <0.001). See eTable 2 in the supplement.

A significantly higher estimated prevalence of regular LTPA was observed for most of the age groups after multivariable adjustment among males (Table 3). Compared with females, the OR for males substantially and continuously decreased across age groups from a significant 3.76 (95% CI, 3.27 to 4.32) in males aged 16 and 17 years to a non-significant OR = 1.01 (95% CI, 0.88 to 1.17) in males aged 65 to 75 years. Compared with their non-working counterparts, the OR for working participants showed an inverted U-shaped trend with the group of participants aged 31 to 49 years showing the highest OR values: 1.72 (95% CI, 1.60

to 1.85). In contrast, the OR for occupational physical activity presented a U-shaped trend when compared with their inactive counterparts across age groups; active participants aged 31 to 49 years showed a significantly lower OR when compared with those inactive (OR = 0.84, 95% CI, 0.78 to 0.91). Additionally, for estimated adjusted ORs regarding education and body mass index in which obese and higher educational attainment consistently showed significantly lower and higher ORs respectively for regular LTPA as regards their correspondent counterparts, see eTable 3 in the supplement. Besides, a reduction of prevalence for the regular LTPA category correspondent to “sitting most of the time” showed an overall reduction over the examined period; the reduced tendency was highly consistent over time for most of age subgroups except for the 16-17 years’ subgroup which increased these prevalence levels from 2001 (eTable 4).

DISCUSSION

The prevalence of regular LTPA among Spanish adults steadily and significantly increased from 1987 to 2017 in all age groups examined. Our study revealed lower prevalence values consistently linked to older participant groups in a dose-response fashion within each of the seven surveys examined; sex, working status, or occupational physical activity did not substantially vary these findings. These results endorse those found by Mielgo-Ayuso et al.¹⁴ regarding the importance of age when determining physical activity patterns among the Spanish population. Also, there is mixed evidence from other studies estimating regional trends for the amount of LTPA of Spanish adults since they showed a decline as well as an increase during the assessed periods from the nineties to the noughties,^{10,20} although other study comprising data about frequency of LTPA (i.e., once a month or more) in the elderly Spanish population during the period 1987-2006 observed a notable increase.¹² Additional analyses concerning sex consistently showed women exhibiting lower prevalence of regular

LTPA throughout all surveys used in the present study, which has been observed in prior research involving Spanish adult and elderly populations.¹²⁻¹⁵ Interestingly, the increasing trend or regular LTPA has probably been accompanied by a reduction of sedentary time for most of the age subgroups, which strengthens the notion of a more active and less sedentary Spanish population during leisure in the last decades, although the turning point observed for the 16-17 years' subgroup from 2001 deserves closer examination and further research.

A simultaneous general tendency towards increasing less active occupations and reducing more active occupations might have led to a different use of discretionary time with more active activities; recent research has suggested higher levels of work-related fatigue from physically demanding jobs is associated with lower levels of LTPA (i.e. weekly amount of LTPA).²¹ Hence a reduction in physically demanding jobs could have contributed to increasing the amount and the frequency of LTPA, because workers have less fatigue from work and therefore more energy in leisure time.²² Another possible reason for this finding might be attributable to a higher awareness of the physical activity benefits over health, since raising awareness about this issue has been observed to increase LTPA among adults.²³

As regards to higher increase of prevalence of regular LTPA observed in younger subgroups, this could be partly attributed to the exposure of younger generations to campaigns promoting physical activity. Moreover, changes towards lower occupational physical activity levels may have contributed towards both new physical activity behaviors and attitudes among leisure-time in younger generations.

Studies comprising adult populations from different European countries have also observed increasing trends of LTPA over the last decades. For example, Borodulin et al. observed an increase in the prevalence of LTPA between 1972 and 2002 in Finnish adults, indicating that the onset of the increasing LTPA trend could stem from earlier than observed in the present study.²⁴ Similarly, Petersen et al. identified an increasing trend for Danish adults between 1987 and 2005,²⁵ which points at a consistent tendency in this geographical area over the examined period; in contrast with our study, trends of LTPA prevalence have shown the highest increase for Danish adults aged 65 years or over, which might be explained by historical, cultural, and socioeconomic differences.²⁵ Furthermore, a systematic review on the topic involving most studies with adult populations from the United States, Canada, and Australia indicates a far-reaching scope of the LTPA increasing trend during the eighties, nineties and noughties decades. Such observed tendency is possibly linked to changes in the standard of living associated to this temporal frame, which involves higher levels of leisure-time, and lower levels of both occupational and commuting physical activity.^{24,26} Our study strengthens and updates the existing evidence regarding an increasing trend of LTPA identified in specific geographical areas worldwide, supports the notion that this is a widespread trend over the last decades, and comprises a more extended period in which such trend can be observed.

A key limitation of the present study is that LTPA was self-reported by participants, which can lead to an information bias difficult to estimate.²⁷ Furthermore, the possibility that a social-desirability bias overestimating levels of regular LTPA in the more recent rounds of the Spanish National Health Survey is plausible; in fact, factors linked to self-perceived identity in relation to exercise have been previously identified as causes for physical activity measurement bias when using questionnaires, a phenomenon that could be more common in

recent times.²⁸ Furthermore, even though the possibility of a systematic information bias that might importantly vary prevalence values is plausible,²⁹ trends would remain similar, thus we assume a uniform information bias. Future research should delve into type of physical activities performed to better understand the observed LTPA trend.

CONCLUSIONS

This study documents a substantial increase in self-reported regular LTPA among the adult Spanish population during the period from 1987 to 2017. Particularly, younger groups and men consistently presented higher prevalence levels than their older counterparts. It is necessary to continue promoting physical activity among the overall adult population and concentrate efforts to reducing both generational and gender gaps.

ACKNOWLEDGMENTS

None of the authors have a direct or indirect commercial financial incentive associated with publishing this article. All authors agree to be accountable for all aspects of the work. All authors made a substantial contribution to the design, the drafting, and the revising of the manuscript and have read and approved the final version. No financial disclosures were reported by the authors of this paper.

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version.

REFERENCES

1. Haro JM, Tyrovolas S, Garin N, et al. The burden of disease in Spain: results from the global burden of disease study 2010. *BMC Med.* 2014;12(1):236. doi:10.1186/s12916-014-0236-9
2. Soriano JB, Rojas-Rueda D, Alonso J, et al. The burden of disease in Spain: Results from the Global Burden of Disease 2016. *Med Clínica (English Ed.* 2018;151(5):171-190. doi:10.1016/j.medcle.2018.05.043
3. Ekelund U, Tarp J, Steene-Johannessen J, et al. Dose-response associations between accelerometry measured physical activity and sedentary time and all cause mortality: systematic review and harmonised meta-analysis. *BMJ.* 2019;366:l4570. doi:10.1136/bmj.l4570
4. Arem H, Moore SC, Patel A, et al. Leisure time physical activity and mortality: A detailed pooled analysis of the dose-response relationship. *JAMA Intern Med.* 2015;175(6):959-967. doi:10.1001/jamainternmed.2015.0533
5. Raza W, Krachler B, Forsberg B, Sommar JN. Health benefits of leisure time and commuting physical activity: A meta-analysis of effects on morbidity. *J Transp Heal.* 2020;18(May):100873. doi:10.1016/j.jth.2020.100873
6. WHO. *Global Recommendations on Physical Activity for Health.* Geneva; 2014.
7. Luzak A, Heier M, Thorand B, et al. Physical activity levels, duration pattern and adherence to WHO recommendations in German adults. *PLoS One.* 2017;12(2):1-15. doi:10.1371/journal.pone.0172503
8. Alzahrani MA, Ada L, Dean CM, et al. Duration of physical activity is normal but frequency is reduced after stroke : an observational study. *J Physiother.* 2011;57(1):47-

- 312 51. doi:10.1016/S1836-9553(11)70007-8
- 313 9. O'Donovan G, Lee IM, Hamer M, Stamatakis E. Association of “weekend warrior”
314 and other leisure time physical activity patterns with risks for all-cause, cardiovascular
315 disease, and cancer mortality. *JAMA Intern Med.* 2017;177(3):335-342.
316 doi:10.1001/jamainternmed.2016.8014
- 317 10. Meseguer CM, Galán I, Herruzo R, Rodríguez-Artalejo F. Trends in Leisure Time and
318 Occupational Physical Activity in the Madrid Region, 1995–2008. *Rev Española*
319 *Cardiol (English Ed.* 2011;64(1):21-27. doi:10.1016/j.rec.2010.06.010
- 320 11. Alonso-Blanco C, Palacios-Ceña D, Hernández-Barrera V, Carrasco-Garrido P,
321 Jiménez-García R, Fernández-de-las-Peñas C. Trends in leisure time and work-related
322 physical activity in the Spanish working population, 1987-2006. *Gac Sanit.*
323 2012;26(3):223-230. doi:10.1016/j.gaceta.2011.07.027
- 324 12. Palacios-Ceña D, Alonso-Blanco C, Jiménez-García R, et al. Time trends in leisure
325 time physical activity and physical fitness in elderly people: 20 year follow-up of the
326 Spanish population national health survey (1987-2006). *BMC Public Health.*
327 2011;11(1):799. doi:10.1186/1471-2458-11-799
- 328 13. European Commission. *Special Eurobarometer 472 Report Sport and Physical Activity*
329 *Fieldwork.* Brussels; 2018. doi:10.2766/483047
- 330 14. Mielgo-Ayuso J, Aparicio-Ugarriza R, Castillo A, et al. Physical Activity Patterns of
331 the Spanish Population Are Mostly Determined by Sex and Age: Findings in the
332 ANIBES Study. Carpenter DO, ed. *PLoS One.* 2016;11(2):e0149969.
333 doi:10.1371/journal.pone.0149969
- 334 15. Fernandez-Navarro P, Aragonés MT, Ley V. Leisure-time physical activity and

- prevalence of non-communicable pathologies and prescription medication in Spain.
PLoS One. 2018;13(1):1-13. doi:10.1371/journal.pone.0191542
16. Benchimol EI, Smeeth L, Guttman A, et al. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Med*. 2015;12(10):1-22. doi:10.1371/journal.pmed.1001885
17. Milton K, Bull FC, Bauman A. Reliability and validity testing of a single-item physical activity measure. *Br J Sports Med*. 2011;45(3):203-208.
doi:10.1136/bjsm.2009.068395
18. Van Domelen DR, Koster A, Caserotti P, et al. Employment and physical activity in the U.S. *Am J Prev Med*. 2011;41(2):136-145. doi:10.1016/j.amepre.2011.03.019
19. van Tienoven TP, Deyaert J, Harms T, Weenas D, Minnen J, Glorieux I. Active work, passive leisure? Associations between occupational and non-occupational physical activity on weekdays. *Soc Sci Res*. 2018;76(August):1-11.
doi:10.1016/j.ssresearch.2018.08.012
20. Román-Viñas B, Serra-Majem L, Ribas-Barba L, et al. Trends in physical activity status in Catalonia, Spain (1992-2003). *Public Health Nutr*. 2007;10(11 A):1389-1395.
doi:10.1017/S1368980007000997
21. Bláfoss R, Micheletti JK, Sundstrup E, Jakobsen MD, Bay H, Andersen LL. Is fatigue after work a barrier for leisure-time physical activity? Cross-sectional study among 10,000 adults from the general working population. *Scand J Public Health*. 2019;47(3):383-391. doi:10.1177/1403494818765894
22. Centre for Economics and Business Research. *The Economic Cost of Physical Inactivity in Europe*. London; 2015.

23. Williamson J. Awareness of Physical Activity Health Benefits can Influence Participation and Dose. *Sport Med Rehabil J*. 2016;1(1):1-7.
24. Borodulin K, Laatikainen T, Juolevi A, Jousilahti P. Thirty-year trends of physical activity in relation to age, calendar time and birth cohort in Finnish adults. *Eur J Public Health*. 2008;18(3):339-344. doi:10.1093/eurpub/ckm092
25. Petersen CB, Thygesen LC, Grønbaek M, Tolstrup JS, Helge JW. Time trends in physical activity in leisure time in the Danish population from 1987 to 2005. *Scand J Public Health*. 2010;38(2):121-128. doi:10.1177/1403494809357098
26. Knuth AG, Hallal PC. Temporal trends in physical activity: A systematic review. *J Phys Act Heal*. 2009;6(5):548-559. doi:10.1123/jpah.6.5.548
27. Garriguet D, Colley RC. A comparison of self-reported leisuretime physical activity and measured moderate-to-vigorous physical activity in adolescents and adults. *Heal Reports*. 2014;25(7):3-11.
28. Brenner PS, DeLamater JD. Social Desirability Bias in Self-reports of Physical Activity: Is an Exercise Identity the Culprit? *Soc Indic Res*. 2014;117(2):489-504. doi:10.1007/s11205-013-0359-y
29. Olds TS, Gomersall SR, Olds ST, Ridley K. A source of systematic bias in self-reported physical activity: The cutpoint bias hypothesis. *J Sci Med Sport*. 2019;22(8):924-928. doi:10.1016/j.jsams.2019.03.006

Figure 1

Temporal trends of regular leisure-time physical activity in Spanish adult during 1987 and 2017 by age groups (Prevalence and 95% Confidence Intervals).

Table 1 Sample Size for Regular Leisure-Time Physical Activity in the Spanish Population by Sociodemographic and Lifestyle Characteristics, Spanish National Health Survey 2017^a

No. of Participants by Age Subgroup (Weighted %)					
	16-17 y	18-30 y	31-49 y	50-64 y	65-75 y
Overall	386	2,136	7,170	5,747	3,407
Weighted <i>N</i>	905,225	6,177,606	13,725,829	9,409,068	4,807,228
Sex					
Female	194 (50.3)	1,108 (51.9)	3,717 (51.8)	3,000 (52.2)	1,857 (54.5)
Male	192 (49.7)	1,028 (48.1)	3,453 (48.2)	2,747 (47.8)	1,550 (45.5)
Working status					
Not working	383 (99.2)	1,165 (54.5)	1,691 (23.6)	2,482 (43.2)	3,298 (96.8)
Working	3 (0.8)	971 (45.5)	5,479 (76.4)	3,265 (56.8)	109 (3.2)
Occupational Physical Activity^b					
Active	11 (2.8)	349 (16.3)	1,484 (20.7)	1,081 (18.8)	326 (9.5)
Inactive	375 (97.2)	1,787 (83.7)	5,686 (79.3)	4,666 (81.2)	3,081 (90.5)

^aParticipant characteristics were presented by age group: 16-17 years, 18-30 years, 31-49 year, 50-64 years, and 65-75 years. All estimates were weighted to be nationally representative.

^bOccupational Physical Activity level was defined by most of the occupational time sitting or standing without frequent movements (inactive) or walking, carrying any weight, frequent movements, or hard work that requires high physical effort (active).

Table 2 Crude weighted trends among the Spanish population, Spanish ational Health Survey 1987-2017^{a,b}

Regular Leisure-Time Physical Activity (Several times a month or a week), Weighted % (95% CI)										
Age, y	1987	1993	1995	1997	2001	2011	2017	β (95% CI) ^c	P for Trend ^c	2017 vs. 1987
										survey, Difference (95 % CI)
Trends in regular Leisure-Time Physical Activity across survey years										
16-17	28.0(25.7-30.3)	39.8(36.5-43.1)	44.2(38.1-50.2)	44.5(38.4-50.7)	42.6(39.0-46.3)	50.2(44.5-55.8)	51.8(46.9-56.8)	0.8(0.7-1.0)	p<.001	23.8(18.3-29.3)
18-30	15.9(15.1-16.7)	24.7(22.9-26.5)	27.0(24.9-29.1)	28.4(26.2-30.6)	27.3(26.0-28.5)	35.8(33.9-37.6)	39.9(37.8-42.0)	0.8(0.7-0.8)		p<.001
31-49	6.3(5.7-6.8)	10.5(9.3-11.6)	11.4(10.0-12.8)	14.1(12.6-15.6)	14.0(13.1-14.8)	25.1(24.1-26.1)	30.4(29.3-31.5)	0.8(0.8-0.9)	p<.001	
50-64	1.9(1.6-2.2)	4.3(2.9-5.6)	5.8(4.5-7.1)	6.5(5.1-7.8)	6.7(5.9-7.4)	14.0(13.0-14.9)	19.4(18.3-20.4)	0.6(0.5-0.6)		p<.001

65-	0.7(0.4-	1.9(1.2-	2.2(1.2-	3.3(2.0-	3.7(3.0-	8.8(7.8-	13.0(11.9-	0.4(0.4-	p<.001	12.4(11.2-
75	0.9)	2.6)	3.2)	4.5)	4.3)	9.8)	14.2)	0.5)		13.5)

Note: Boldface indicates statistical significance (p<0.05)

^aSample sizes for individual cells ranged from 256 to 8073 and can be found in eTable 1 in the Supplement.

^bWeighted estimates and 95% CIs were estimated for each survey year. All estimates were weighted to be nationally representative.

^cThe estimate β , 95% CI, and P for trend were calculated using linear regression that included the year of each National Health Survey as a continuous variable. The estimate β can be interpreted as the average annual percentage point change of prevalence.

Table 3 Weighted logistic regression models of regular Leisure-Time Physical Activity, adjusted for sociodemographic features and occupational physical activity, Spanish National Health Survey 1987-2017^a

Odds Ratio (95%CI)^b					
Regular Leisure-Time Physical Activity (Several times a month or a week)					
Age subgroup	16-17 y	18-30 y	31-49 y	50-64 y	65-75 y
No.	4,292	26,109	39,426	28,328	16,658
Age^c	0.77(0.68-0.88)	0.93(0.93-0.94)	0.97(0.96-0.97)	0.97(0.96-0.98)	0.93(0.91-0.96)
Sex					
Female	1(reference)	1(reference)	1(reference)	1(reference)	1(reference)
Male	3.76(3.27-4.32)	3.76(3.51-4.02)	1.85(1.74-1.97)	1.19(1.09-1.30)	1.01(0.88-1.17)
Work					
Not working	1(reference)	1(reference)	1(reference)	1(reference)	1(reference)
Working	0.37(0.29-0.48)	0.78(0.73-0.83)	1.72(1.60-1.85)	1.55(1.41-1.70)	0.98(0.65-1.47)
Occupational Physical Activity^d					
No	1(reference)	1(reference)	1(reference)	1(reference)	1(reference)

Yes	1.40(1.10- 1.79)	0.92(0.85- 1.00)	0.84(0.78- 0.91)	0.94(0.83- 1.06)	2.44(2.01- 2.97)
Survey					
1987	1(reference)	1(reference)	1(reference)	1(reference)	1(reference)
1993	1.71(1.41- 2.06)	1.76(1.56- 1.98)	1.75(1.50- 2.03)	2.34(1.60- 3.41)	2.89(1.62- 5.13)
1995	2.12(1.59- 2.82)	1.95(1.72- 2.22)	1.95(1.65- 2.30)	3.27(2.44- 4.37)	3.27(1.71- 6.26)
1997	1.98(1.49- 2.63)	2.11(1.86- 2.40)	2.52(2.15- 2.94)	3.70(2.80- 4.89)	4.93(2.73- 8.92)
2001	1.85(1.52- 2.27)	2.06(1.88- 2.25)	2.37(2.12- 2.66)	3.67(2.96- 4.54)	5.78(3.59- 9.30)
2011	2.35(1.79- 3.07)	3.21(2.89- 3.56)	4.99(4.49- 5.55)	8.20(6.77- 9.94)	14.05(8.95- 22.06)
2017	2.82(2.21- 3.61)	3.93(3.51- 4.40)	6.45(5.81- 7.17)	11.80(9.79- 14.21)	21.92(14.04- 34.29)
P for	<.001	<.001	<0.05	<.001	<.001
Trend^e					

Note: Boldface indicates statistical significance ($p < 0.05$)

^aParticipant characteristics were presented by age subgroup: 16-17 years, 18-30 years, 31-49 year, 50-64 years, and 65-75 years. All estimates were weighted to be nationally representative.

^bFor categorical variables, the odds ratios (ORs) represent the change in odds expected in each category in relation to the reference group.

^cThe ORs in this row represent the change in odds expected from a 1-year increase in age within this age group.

^dFor Occupational Physical Activity definitions, see Table 1 footnotes.

^e*P* for Trend over survey was calculated using the National Health Survey years as a continuous variable.