

Television Viewing, Computer Use, Time Driving and All-Cause Mortality: The SUN Cohort

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Background—Sedentary behaviors have been directly associated with all-cause mortality. However, little is known about different types of sedentary behaviors in relation to overall mortality. Our objective was to assess the association between different sedentary behaviors and all-cause mortality.

Methods and Results—In this prospective, dynamic cohort study (the SUN Project) 13 284 Spanish university graduates with a mean age of 37 years were followed-up for a median of 8.2 years. Television, computer, and driving time were assessed at baseline. Poisson regression models were fitted to examine the association between each sedentary behavior and total mortality. All-cause mortality incidence rate ratios (IRRs) per 2 hours per day were 1.40 (95% confidence interval (CI): 1.06 to 1.84) for television viewing, 0.96 (95% CI: 0.79 to 1.18) for computer use, and 1.14 (95% CI: 0.90 to 1.44) for driving, after adjustment for age, sex, smoking status, total energy intake, Mediterranean diet adherence, body mass index, and physical activity. The risk of mortality was twofold higher for participants reporting ≥ 3 h/day of television viewing than for those reporting < 1 h/d (IRR: 2.04 [95% CI 1.16 to 3.57]).

Conclusions—Television viewing was directly associated with all-cause mortality. However, computer use and time spent driving were not significantly associated with higher mortality. Further cohort studies and trials designed to assess whether reductions in television viewing are able to reduce mortality are warranted. The lack of association between computer use or time spent driving and mortality needs further confirmation. (*J Am Heart Assoc.* 2014;3:e000864 doi: 10.1161/JAHA.114.000864)

Key Words: death • prospective cohort study • sedentary behavior • sedentary time • sitting time

The benefits of a physically active lifestyle are well known.^{1,2} Epidemiologic research has traditionally focused on the effects of physical activity on morbidity and mortality.³ Early research conceptualized the absence of moderate-to-vigorous physical activities as a “sedentary lifestyle”. However, sedentary lifestyles deserve special and separate consideration because too much time spent sitting down is distinct from too little physical activity. In fact, high levels of sedentary behaviors can coexist with high levels of physical activity.⁴

Television viewing⁵ and sedentary time⁶ were found in 2 different meta-analyses to be associated with an increased risk of diabetes, cardiovascular disease, and total mortality. Several studies reported that sitting time during leisure,⁷ total sitting time,⁸ or television viewing⁹ were associated with increased mortality, regardless of physical activity levels. Moreover, Matthews et al¹⁰ found that television viewing and overall sitting time were positively associated with all-cause mortality after adjustment for physical activity.

Adults in the United States spend more than half of their waking hours in sedentary pursuits,¹¹ such as television viewing, computer use, or driving.¹² Altenburg et al¹³ found among Dutch adults (18 to 28 years) that television viewing, but not computer use, was directly associated with triglycerides levels and insulin concentrations. Pinto Pereira et al¹⁴ reported in British adults (44 to 45 years) that television viewing was adversely associated with biomarkers for cardiovascular disease. However, sitting time at work showed no association in women and only a weak association in men.

Several studies^{5,6,15} have addressed the association between television viewing (or total sedentary time) and mortality. However, few studies have assessed this association independently from physical activity levels. Thus, our objective was to assess the association between different

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types of sedentary behaviors (television viewing, computer use, and time driving) and all-cause mortality in a prospective cohort study of Spanish university graduates.

Methods

Study Population

The design, methods, and objectives of the SUN Project (“Seguimiento Universidad de Navarra”, University of Navarra follow-up) have been described previously.¹⁶ Briefly, the SUN Project is a multi-purpose prospective cohort study designed to assess associations of diet or lifestyle with the incidence of several diseases and mortality. Information is collected through self-administered questionnaires sent by mail every 2 years. The recruitment of participants, all of them university graduates, started in December 1999. The design is that of a dynamic cohort so the recruitment is permanently open.

Up to December 2012, the project had enrolled 21 593 participants. Among them, 20 572 completed the baseline questionnaire before March 2010 and were eligible for longitudinal analyses to warrant a minimum follow-up time of 2 years. Participants who reported diabetes, cardiovascular disease, or cancer at baseline (n=1202), those with missing data for television viewing, computer use, or driving (n=4980), and participants lost to follow-up (n=1106) were excluded from the present analyses. Thus, our final sample included 13 284 participants.

The study was approved by the Institutional Review Board of the University of Navarra. Voluntary response to the initial self-administered questionnaire was considered to imply informed consent.

Sitting Time Assessment

The baseline questionnaire included items to assess television viewing, computer use or driving. Each of these 3 items was quantified in 12 categories (ranging from never to >9 h/d). These exposures were measured separately for weekdays and weekends. Time spent during weekdays was multiplied by 5 and the time spent during weekends by 2, and results were summed and divided by 7 to calculate the participants’ total time per day. The validation study of this questionnaire found that the Spearman correlation coefficient between the energy expenditure estimated through the ratio sedentary lifestyle: physical activity in the questionnaire and that obtained by an objective method (triaxial accelerometer) was -0.578 (95% CI -0.754 to -0.325).¹⁷

Outcome Assessment

Our primary end point was death from any cause. If participants did not answer any of the 5 repeated mailings

with the follow-up questionnaires, they were contacted by e-mail or telephone. Most deaths (>85%) were identified from reports by the next of kin, work associates, and postal authorities. The National Death Index was checked every 6 months to identify deceased cohort members. National Death Index is a responsibility of the National Institute of Statistics of the Spanish Government. It is a central index that collects information of any death registered in Spain. Taking into account all these sources of information, we considered that follow-up ascertainment for the deceased participants was complete.

Assessment of Covariates

The baseline questionnaire inquired information about medical history, lifestyle, sociodemographic factors, and anthropometric measurements. Physical activity was ascertained at baseline through a 17-item questionnaire.¹⁷ Time spent in each activity in hours per week was multiplied by its typical energy expenditure, expressed in metabolic equivalent tasks (METs), then summed over all activities to yield a METs-h/wk score for each participant.¹⁸ This score correlated with energy expenditure measured by a triaxial accelerometer in a validation study (Spearman correlation coefficient 0.507 (95% CI 0.232 to 0.707)).¹⁷ Regarding smoking habits, participants were classified as nonsmokers, quitters, or current smokers. Dietary habits at baseline were assessed using a 136-item semiquantitative food-frequency questionnaire previously validated in Spain.¹⁹ Adherence to the Mediterranean dietary pattern was appraised combining 9 items (fruits and nuts, vegetables, fish, legumes, cereals, dairy products, meat, and meat products, alcohol, and the ratio monounsaturated fatty acids/saturated fatty acids).²⁰ Self-reported weight and height, and body mass index (BMI) calculated from them, were previously validated in a subsample of this cohort.²¹

Statistical Analysis

We summarized continuous variables by their mean and standard deviation (SD), and categorical variables using percentages. To estimate incidence rate ratios (IRRs) and their 95% confidence intervals (CI), across increasing categories of sitting time (or other sedentary activities) and mortality, we fitted Poisson regression models with robust standard errors. For all analyses, we considered participants with the lowest exposure time at baseline as the reference category. We conducted tests of linear trend across increasing categories of sedentary activities by assigning medians for the time spent in each activity within each category and treating this variable as a continuous one. Poisson regression models were also fitted to examine the association between

each type of sedentary behavior as a continuous variable and total mortality. As a sensitivity analysis we repeated these models using Cox proportional hazards regression.

We fitted a crude univariable model, an age- and sex-adjusted model and a multivariable model adjusted also for, smoking, total energy intake (kcal/d), Mediterranean diet adherence, baseline BMI (kg/m²) and leisure-time physical activity (METs-h/wk). To assess correlations of continuous variables we calculated Pearson correlation coefficients. Deaths occurring over time were described using Nelson-Aalen survival curves. We used inverse probability weighting to adjust the Nelson-Aalen curves for potential confounders.

All *P* values were 2 tailed, and significance was set at *P*<0.05.

Results

During a median of 8.2 years of follow-up we registered 97 deaths from all causes in this young and healthy cohort (the expected number of deaths would be 128 in a sample of the general Spanish population with the same size, sex, and age distribution). Table 1 shows descriptive statistics according to the average number of daily hours of television viewing, computer use and time spent driving. Of the 13 284 participants, 61.6% were women. Mean age was 37 years. Participants spent at baseline a mean (SD) of 1.6 (1.3) h/d watching television, 2.1 (2.1) h/d using computers and 0.9 (1.2) h/d driving. The correlation coefficient between the time

spent in television viewing and using a computer was 0.07 (95% CI: 0.05 to 0.08); it was 0.20 (95% CI: 0.18 to 0.21) between television viewing and driving; and it was 0.12 (95% CI: 0.10 to 0.14) between using a computer and driving. Correlations between physical activity and television viewing, using a computer and driving were −0.04 (95% CI: −0.06 to −0.03), 0.003 (95% CI: −0.01 to 0.02) and 0.01 (95% CI: −0.01 to 0.03), respectively.

Television viewing time was positively associated with all-cause mortality after adjustment for age, sex, smoking, total energy intake, Mediterranean diet adherence, BMI, computer use, and time spent driving (Figure 1). Participants reporting ≥3 h/d of television viewing had a twofold higher risk of mortality than those reporting <1 h/d (IRR 2.04; 95% CI: 1.16 to 3.57) (Table 2). When television viewing was analyzed as a continuous variable, the IRR per each additional 2 h/d of television watching was 1.40 (95% CI: 1.06 to 1.84). The time spent using a computer or driving were not significantly associated with mortality (Table 2). When the time spent using a computer and driving were analyzed as continuous variables, the IRRs per each additional 2 h/d were 0.96 (95% CI: 0.79 to 1.18) and 1.14 (95% CI: 0.90 to 1.44), respectively. A higher amount of total sedentary behaviors (the sum of television viewing, computer use, and driving) was directly associated with total mortality after multivariable adjustment (Table 3). When total sedentary behavior was analyzed as a continuous variable, the IRR per each additional 2 h/d of exposure was 1.17 (95% CI: 1.03 to 1.33)]. There were no

Table 1. Baseline Characteristics of Participants According to Television Viewing, Computer Use and Driving at Baseline: Figures are Means and Standard Deviations (SD) Unless Otherwise Stated, The SUN Project 1999–2010

	Television		Computer		Driving	
	<1 h/d	≥3 h/d	<1 h/d	≥3 h/d	0 h/d	≥2 h/d
N	4539	1631	5902	3959	1908	1277
Age, y	37.1 (11.0)	35.8 (12.1)	37.2 (11.9)	35.5 (9.6)	32.1 (11.7)	36.4 (10.7)
Female, %	61.6	67.0	71.0	54.7	82.3	53.5
BMI, kg/m ²	23.1 (3.3)	23.6 (3.6)	23.1 (3.5)	23.5 (3.5)	22.2 (3.2)	24.0 (3.6)
Physical activity, METs-h/wk	22.0 (23.8)	19.1 (21.7)	20.6 (22.2)	20.5 (22.3)	20.0 (22.3)	21.9 (25.5)
Total energy intake, kcal/d	2543 (890)	2611 (1129)	2555 (957)	2545 (919)	2635 (1018)	2634 (923)
Mediterranean diet (0 to 9 score)	4.2 (1.8)	4.1 (1.7)	4.3 (1.8)	4.1 (1.8)	4.2 (1.8)	4.2 (1.8)
Smoking						
Never, %	52.8	45.9	48.3	50.3	56.8	46.8
Current, %	20.0	27.7	23.8	24.0	24.8	26.4
Television viewing, h/d	0.5 (0.2)	4.1 (1.5)	1.6 (1.2)	1.7 (1.5)	1.8 (1.5)	2.2 (2.1)
Computer use, h/d	2.0 (2.1)	2.3 (2.3)	0.3 (0.3)	5.0 (1.3)	2.0 (2.3)	2.6 (2.5)
Car driving, h/d	0.8 (1.2)	1.3 (2.0)	0.8 (1.1)	1.1 (1.5)	0 (0)	3.7 (2.2)

BMI indicates body mass index; MET, metabolic equivalent task.

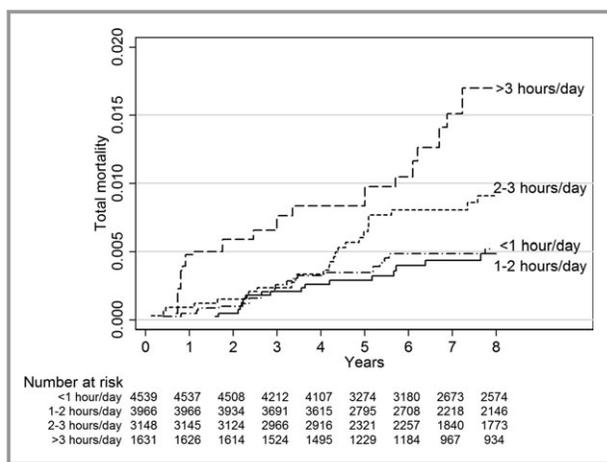


Figure 1. Nelson-Aalen estimates of total mortality according to categories of baseline television viewing. Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake (continuous), Mediterranean diet adherence (continuous), baseline body mass index (continuous), physical activity (quartiles), computer use (continuous), time driving (continuous), using inverse probability weighting.

significant interactions between television viewing (continuous) and sex, baseline body mass index, or physical activity. (Figure 2).

During 8.2 years of follow-up, 19 deaths occurred due to cardiovascular disease, 46 occurred due to cancer, and 32 deaths were noncardiovascular/noncancer deaths. The IRRs for each additional 2 h/d of television viewing were 1.44 (95% CI: 0.87 to 2.41) for cardiovascular mortality, 1.21 (95% CI: 0.73 to 2.00) for cancer mortality and 1.55 (95% CI: 0.96 to 2.53) for noncardiovascular/noncancer mortality, after adjusting for age, sex, smoking, total energy intake, Mediterranean diet adherence, BMI, computer use, and time spent driving.

To check for reverse causality, we repeated the analyses after excluding deaths occurring in the first 3 years of follow-up (35 deaths excluded). The multivariable-adjusted IRRs for all-cause mortality across categories of television viewing were 1.16 (95% CI: 0.56 to 2.39), 1.75 (95% CI: 0.91 to 3.35), and 2.38 (95% CI: 1.19 to 4.74) for 1 to 2 h/d, 2 to 3 h/d, and ≥ 3 h/d, respectively, with <1 h/d as the reference category (P for linear trend=0.006). When television viewing was introduced as a continuous variable the multivariable-adjusted IRR per each additional 2 h/d was 1.48 (95% CI: 1.08 to 2.02).

Finally, as a sensitivity analyses we repeated the analysis further adjusting for snacking and consumption of sugar-sweetened beverages. The all-cause mortality IRRs for television viewing were of 1.09 (95% CI: 0.61 to 1.95), 1.45 (95% CI: 0.84 to 2.50), and 2.19 (95% CI: 1.23 to 3.91) for 1 to 2 h/d, 2 to 3 h/d and ≥ 3 h/d, respectively, with <1 h/d as the reference category (P for linear trend=0.006). When

television viewing was introduced as a continuous variable the IRR per each additional 2 h/d of exposure was 1.46 (95% CI: 1.10 to 1.93).

Discussion

In this prospective cohort study we assessed different types of sedentary behaviors and found that television viewing and total sitting time were associated with higher risks of all-cause mortality after adjusting for physical activity and other potential confounders. These 2 associations showed a direct monotonic dose-response linear trend with mortality. We did not find any association between computer use or time spent driving and all-cause mortality.

Because television viewing is likely to be associated with snacking and consumption of sugar-sweetened beverages,²² a possible explanation for the association that we have found could be a difference in energy intake during television viewing. However, the associations between television viewing and mortality were adjusted for total caloric intake and hardly changed after adjustment for snacking and consumption of sugar-sweetened beverages. A second alternative non-causal explanation for our results might be reverse causation, because patients with a chronic disease may continue watching television but stop using computers or driving. However, there are several reasons to think that reverse causation is not a major confounder in this cohort. First, this is a young and basically healthy cohort. Besides, participants with baseline diabetes, cardiovascular disease or cancer were excluded from all the analyses. Finally, when deaths occurring in the first 3 years of follow-up (deaths that were more likely to be related to a latent disease at baseline) were excluded, the results did not significantly change. A third possible explanation for the differences in mortality found between television viewing and computer use is that computer use has increased in Spain during the last years,²³ and for this reason baseline questionnaires may not reflect the total “average” exposure. This change in computer use may have produced a misclassification of exposure. Though possible, it is however very unlikely that such a misclassification may explain the present results. Furthermore, television viewing hardly has changed in Spain during the years when the follow-up of this cohort took place.²³ A fourth explanation for these results could be a difference in energy expenditure. Among the 3 activities that we assessed, energy expenditure during driving may be higher than during computer use or television viewing.¹⁸ But also using the computer may lead to a higher energy expenditure than television viewing, because computer use may require some muscle activity. In this way our results are consistent with those reporting that low-intensity non-exercise activities are inversely associated with

Table 2. Association Between Time Spent in Television Viewing, Computer Use and Driving and Total Mortality, The SUN Project 1999–2010

Television Viewing	<1 h/d	1 to 2 h/d	2 to 3 h/d	≥3 h/d	P Trend
N	4539	3966	3148	1631	
Unadjusted cumulative incidence of deaths, %	0.57	0.55	0.86	1.35	
Age-, sex- adjusted	1 (Ref.)	1.02 (0.58 to 1.77)	1.47 (0.86 to 2.48)	2.31 (1.34 to 4.00)	0.002
Multivariable-adjusted*	1 (Ref.)	1.01 (0.57 to 1.78)	1.36 (0.80 to 2.30)	2.01 (1.16 to 3.50)	0.011
Multivariable-adjusted†	1 (Ref.)	1.05 (0.59 to 1.87)	1.44 (0.85 to 2.43)	2.04 (1.16 to 3.57)	0.008
Computer Use	<1 h/d	1 to 2 h/d	2 to 3 h/d	≥3 h/d	P Trend
N	5902	1696	1727	3959	
Unadjusted cumulative incidence of deaths, %	0.83	0.88	0.52	0.73	
Age-, sex- adjusted	1 (Ref.)	1.11 (0.62 to 1.98)	0.69 (0.34 to 1.41)	1.10 (0.68 to 1.78)	0.94
Multivariable-adjusted*	1 (Ref.)	1.13 (0.63 to 2.00)	0.72 (0.35 to 1.47)	1.12 (0.68 to 1.82)	0.97
Multivariable-adjusted‡	1 (Ref.)	1.13 (0.64 to 2.02)	0.73 (0.36 to 1.48)	1.05 (0.64 to 1.72)	0.92
Time Driving	0 h/d	0 to 1 h/d	1 to 2 h/d	≥2 h/d	P Trend
N	1908	7467	2632	1277	
Unadjusted cumulative incidence of deaths, %	0.79	0.60	0.87	1.10	
Age-, sex- adjusted	1 (Ref.)	0.50 (0.27 to 0.92)	0.70 (0.35 to 1.42)	0.94 (0.44 to 1.98)	0.20
Multivariable-adjusted*	1 (Ref.)	0.56 (0.31 to 1.04)	0.79 (0.39 to 1.58)	1.02 (0.48 to 2.15)	0.19
Multivariable-adjusted§	1 (Ref.)	0.61 (0.33 to 1.12)	0.83 (0.41 to 1.70)	0.93 (0.43 to 2.01)	0.39

Values are incidence rate ratios; 95% confidence intervals in parenthesis.

*Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake (continuous), Mediterranean diet adherence (continuous).

†Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake, Mediterranean diet adherence (continuous), baseline body mass index (continuous), physical activity (quartiles), computer use (continuous) and driving (continuous).

‡Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake, Mediterranean diet adherence (continuous), baseline body mass index (continuous), physical activity (quartiles), television viewing (continuous) and driving (continuous).

§Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake (continuous), Mediterranean diet adherence (continuous), baseline body mass index (continuous), physical activity (quartiles), television viewing (continuous) and computer use (continuous).

mortality^{24,25} and beneficially associated with cardiometabolic risk markers.²⁶ Finally, although we adjusted for a wide array of covariates, residual confounding might also be a possible explanation for our results, as it can be always the case in observational studies. However, a randomized trial

probably will be never conducted to assess this association, due to problems of ethics and feasibility.

The different associations with mortality found for television viewing, computer use or driving may be explained by differential effects of these activities on cardiometabolic risk

Table 3. Association Between Total Time Sitting Down (Television Viewing+Computer Use+Driving) and Total Mortality, The SUN Project 1999–2010

Time Sitting	<2 h/d	2 to 4 h/d	4 to 6 h/d	≥6 h/d	P Trend
N	2347	4185	3066	3686	
Unadjusted cumulative incidence of deaths, %	0.47	0.69	0.98	0.73	
Age-, sex- adjusted	1 (Ref.)	1.44 (0.74 to 2.81)	2.16 (1.11 to 4.21)	2.18 (1.11 to 4.28)	0.009
Multivariable-adjusted*	1 (Ref.)	1.45 (0.75 to 2.82)	2.04 (1.05 to 3.96)	2.06 (1.05 to 4.07)	0.023
Multivariable-adjusted†	1 (Ref.)	1.50 (0.77 to 2.91)	2.13 (1.09 to 4.14)	2.11 (1.07 to 4.15)	0.021

Values are incidence rate ratios; 95% confidence intervals in parenthesis.

*Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake (continuous), Mediterranean diet adherence (continuous).

†Adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake (continuous), Mediterranean diet adherence (continuous), baseline body mass index (continuous), physical activity (quartiles).

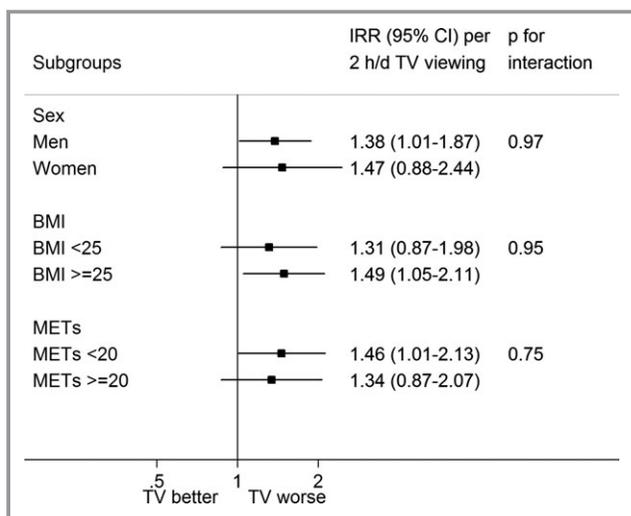


Figure 2. Results of subgroup analyses of television viewing and mortality. Adjusted incidence risk ratios per 2 hours of TV (television) viewing per day for mortality within specific subgroups. Squares denote incidence risk ratios; horizontal lines represent 95% confidence intervals. Incidence risk ratios were adjusted for age (continuous), sex, smoking history (never, current, quit), total energy intake (continuous), Mediterranean diet adherence (continuous), baseline body mass index (continuous), physical activity (continuous), computer use (continuous), time driving (continuous). BMI indicates body mass index; IRR, incidence risk ratio; MET, metabolic equivalent task; TV, television.

factors. A recent study conducted among Dutch adults¹³ reported that television viewing, but not computer use, was associated with detrimental changes in biomarkers. Another study²⁷ conducted in an Asian population reported that television screen time, but not computer use or reading time, was associated with worse cardio-metabolic biomarkers. Hu et al²⁸ reported among US women (30 to 55 years) that sitting at work or away from home or while driving, and especially television viewing, were significantly associated with increased risk of obesity and type 2 diabetes. Other time spent sitting at home (eg, reading, meal times, at desk) was significantly associated with increased risk of type 2 diabetes, but not with obesity. Matthews et al¹⁰ found among US adults (50 to 71 years) that television viewing had a stronger association with mortality than overall sitting time. However, the association between different sedentary behaviors and all-cause mortality was not assessed in these previous studies.

Our findings confirm the association between television viewing and mortality found in a meta-analysis⁵ of 3 prospective studies^{9,29,30} with a pooled relative risk of 1.13 (95% CI: 1.07 to 1.18) per 2 additional h/d of television viewing. Another meta-analysis, of 8 studies, addressed the association between sedentary time and death,⁶ observing a pooled HR of 1.49 (95% CI: 1.14 to 2.03) for the highest versus the lowest exposure. The 3 studies included in the first meta-analysis

were also included in the second one. With a single exception⁸ (mean age 42 years), all studies included in these meta-analyses had older participants (age>50 years). Thus, a novelty of our findings is to support also a direct association between television viewing and mortality in a relatively young cohort. There are fewer studies about computer use; 2 recent studies^{29,31} assessed the combined effect of television viewing and computer use on mortality. Only 1 of them²⁹ reported a significant direct association. Warren et al³² found that men riding in a car had higher rates of cardiovascular mortality, although these results were not comparable with ours because driving a car expends more energy than riding in a car.¹⁸ The classic and well-known study of Morris et al^{33,34} reported that London bus drivers were more likely than bus conductors to develop coronary heart disease, however in this case drivers were more sedentary than conductors and exposure to driving was longer than in our cohort.

Since our analyses were adjusted for leisure-time physical activity, our findings suggest that not only the promotion of physical activity but also the reduction in sedentary activities (especially television viewing) is a priority for the prevention of premature mortality. Other authors have also reported that prolonged sitting is a risk factor for all-cause mortality, independently of physical activity.^{7–10,30,35} In this cohort, the correlation between physical activity and television viewing was minimal ($r=-0.04$) and there was no correlation between physical activity and computer use or time spent driving. This very weak correlation found between television viewing and physical activity is consistent with previous studies.^{7,9,28} The metabolic pathways linking prolonged sitting times with clinical disease are unclear. Studies conducted in animal models have demonstrated a reduction in lipoprotein lipase activity.^{36,37} There is evidence of increases in C-reactive protein,²⁹ and altered carbohydrate metabolism in humans associated with sedentary lifestyles.³⁷

A strength of our study is the detailed assessment of specific sedentary behaviors.³⁸ Other strengths include its prospective design and the ability to carefully evaluate reverse causality and to adjust for several potential confounders. Besides, our cohort has a high retention rate. The main limitation is the use of self-reported information on exposure. All participants are university graduates and this fact contributes to a higher quality of their self-reported information. Furthermore, our questionnaire of physical activity and sedentary lifestyle had been previously validated.¹⁷ Also, other measurements, including the food-frequency questionnaire, weight, and BMI, had been previously validated.^{19,21} However, a limitation of our study is the low number of observed deaths. The observed mortality rate is lower than the mortality rate expected in the Spanish general population. According to data from Spanish Institute of Statistics³⁹ we would have expected approximately 128 deaths in a sample of this size from the

general Spanish population with this same distribution by sex and age. However, the higher educational level and the healthy worker effect may account for the lower mortality actually observed in the SUN cohort. Due to the low number of deaths, Poisson regressions were fitted. As a sensitivity analysis we also calculated a Cox regression and results hardly changed, the adjusted hazard ratio per 2 additional h/d of television viewing was 1.41 (95% CI 1.07 to 1.85).

In conclusion, consistently with previous studies, television viewing was associated with all-cause mortality in our cohort. These results support the need for further observational studies and randomized trials specifically designed to assess the impact of interventions aimed to reduce television viewing on total mortality. Further studies are needed to confirm the effect of computer use and driving on mortality, and to determine the exact biological mechanisms explaining these associations.

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Disclosures

None.

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