



Short Communication

Television viewing time among statin users and non-users. The Polish Norwegian Study (PONS)☆

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ABSTRACT

Sedentary behavior has emerged as an independent cardiovascular disease risk factor. Uncertainty exists about the behaviors of statin users, who may exhibit either a healthy adherer or a false reassurance effect. We conducted this study in order to assess and compare TV viewing among statin users and nonusers.

We used data from a cross-sectional study of 12,754 participants, from south-east Poland, age 45 to 64 years in 2010–11. Statin use during last 30 days was recorded by trained nurses. Participants reported time spent viewing TV/week.

There were 1728 (13.5%) statin users of which 628 (36.34%) had cardiovascular diseases. The prevalence of viewing TV ≥ 21 h/week was higher among statin users (29.72%) compared to non-users (23.10%) and remained 15% higher after adjusting for age, sex, education, smoking, chronic obstructive pulmonary disease and other chronic diseases (prevalence ratio, PR 1.15, 95% CI 1.06 to 1.25). We found a similar pattern in both those with and without prevalent cardiovascular disease.

In conclusion, we found a higher prevalence of prolonged TV-viewing among statin users than non-users. Future studies are needed to explore innovative behavioral interventions and patient counseling strategies to reduce TV viewing among statin users.

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1. Introduction

A physically active lifestyle and statin use represent key components of the antihyperlipidemic therapy in primary and secondary cardiovascular prevention (Stone et al., 2014; Piepoli et al., 2016). Sedentary behavior has emerged as a cardiovascular disease (CVD) risk factor, independent of physical activity (Thorp et al., 2011; Young et al., 2016). The need to specifically address sedentary behavior has been recently recognized by American Heart Association and the European Society of Cardiology (Piepoli et al., 2016; Young et al., 2016). While sedentary time includes various behaviors (e.g. recreational or work-related screen time, travel time), television viewing represents the main discretionary and modifiable component. Prolonged TV viewing has unfavorable, independent effects on various health outcomes (Young et al., 2016; Grøntved and Hu, 2011). For instance, studies suggest that each additional 2 h per day in TV viewing independently increases the risk of diabetes by 20%–56% and the risk of coronary events by 17%–23%

(Young et al., 2016; Keadle et al., 2015a). Viewing TV >3 h vs. <1 h/day has been reported to double the risk of all-cause mortality, (Young et al., 2016) while the lowest mortality risk was observed in those who consistently watched TV <21 h/week (Keadle et al., 2015b).

In spite of this body of evidence, uncertainty exists about the sedentary behaviors among those receiving cardiovascular prevention drugs. Thus, statin users may exhibit a healthy adherer effect (Dwyer-Lindgren et al., 2013; Simpson et al., 2006) translated into less sedentary behaviors or conversely may display a false reassurance phenomenon, with lower motivation for sustaining a healthy lifestyle (Redberg, 2014; Sugiyama et al., 2014) and a more pronounced sedentary behavior. Prolonged TV viewing represents one of the hallmarks of sedentary behavior, and its prevalence among statin users is little known. We conducted this study with the aim of comparing the prevalence of prolonged television viewing between statin users and nonusers.

2. Materials and methods

The Polish Norwegian Study (PONS) is a prospective community-based investigation of risk factors for chronic diseases, conducted in the Kielce region of south-east Poland (Manczuk et al., 2015). The recruitment into PONS study was based on a broad media campaign. Study participants were recruited from the general populations of two

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geographically distinct regions, one urban and one rural, both containing a diverse but stable mix of long-term residents. The study enrolled 13,172 men and women, age 45–64 years in 2010–11. Standardized questionnaires collected information on demographics, medical history and lifestyle factors. Statin use during the past 30-day period was determined at the time of clinic visit by nurses who inspected participants' medication bottles. TV watching was assessed based on the question: "On average, how much time per week do you spend at home, watching TV?" The response choices were categorized in groups of 5–10 h/week. We treated this variable as categorical and as binary (<20 and ≥21 h/week). The 21 h/week cutoff was chosen to reflect literature-based estimated TV viewing time associated with the lowest mortality (Keadle et al., 2015b). Metabolic equivalents of task (METs/week) were calculated for the activities reported in the International Physical Activity Questionnaire. Diet was assessed by a food frequency questionnaire. Poor diet was defined according to the American Heart Association healthy eating criteria. History of CVD was defined by any self-reported diagnosis of coronary heart disease, heart failure, or stroke. A diagnosis of hypertension was not included in this definition. This analysis is based on the cross-sectional, baseline data of the PONS study, from which we excluded participants with incomplete information on relevant covariates ($n = 418$, 0.3%). The analytic sample included 12,754 participants. Informed consent was obtained from each participant and the study was approved by the Ethics Committee of the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw, Poland.

2.1. Statistical analysis

All continuous variables were checked for normality using quantile-quantile plots. Normally distributed variables were expressed as means and standard deviations, and were compared using the independent t -test. Skewed data were presented as medians and interquartile ranges, and were compared using the Kruskal-Wallis test. Categorical variables were expressed as percentages and were compared with the chi-square test. We compared the prevalence of watching TV for ≥21 h/week among statin users versus non-users by calculating prevalence ratios (PR) and 95% confidence intervals using Poisson regression models with robust standard error estimates. The aim of our study was to estimate the prevalence of prolonged TV-viewing among statin users and non-users, and not to explain this behavior. Thus, we performed minimal adjustment, including in our models only a select number of covariates. In addition to age and sex, we additionally adjusted for education and smoking as proxies for socio-economic level, and for COPD, cardiovascular disease and other chronic diseases, as such conditions, if severe, could favor a sedentary lifestyle. In order to emphasize the importance of health promotion messages in both primary and secondary cardiovascular prevention, we performed a secondary analysis, stratified by the presence of cardiovascular disease. All statistical analyses were performed with SAS 9.3 software (SAS Institute, Cary, NC).

3. Results

Our study population included 12,754 men and women age 45–64, among which 1728 (13.5%) used statins. Compared to nonusers, statin users were older, had higher prevalence of obesity, CVD, hypertension, diabetes, chronic obstructive pulmonary disease (COPD) and lower prevalence of smoking, poor diet and glucose control (Table 1).

Comparing statin users to nonusers, the prevalence of viewing TV <1 h/week, 2–10 h/week, 11–20 h/week and ≥21 h/week were 1.6% vs 2.7%, 27.7% vs. 33.6%, 40.9% vs 40.6% and 29.7% vs. 23.1%, respectively. After adjustment for age, sex, education, smoking, prevalent CVD, COPD and other chronic diseases, the prevalence of viewing TV ≥21 h/week remained 15% higher among statin users compared to nonusers (PR 1.15, 95% CI 1.06–1.25) (Table 2).

Table 1
Study population characteristics by statin use^a. The PONS Study, 2010–2011.

Characteristic	Statin users	Non-users	<i>p</i> -value
Age, mean (SD) (years)	58.29 (4.55)	55.27 (5.38)	<0.0001
Less than higher education	74.25	69.78	<0.0001
Residence, rural	33.91	38.76	0.0001
Gender, men	31.13	34.21	0.0120
Smoking, current	16.55	20.56	<0.0001
Obesity (BMI ≥ 30 kg/m ²)	38.48	29.04	<0.0001
High WHR (>102 cm men, >88 cm women)	52.49	40.07	<0.0001
Poor AHA diet	33.74	41.19	<0.0001
LDL, mean (SD), mg/dL	106.40 (34.41)	130.12 (32.57)	0.0024
HDL, mean (SD), mg/dL	56.67 (14.19)	59.31 (14.74)	0.0384
Hypertension ^b	66.09	33.02	<0.0001
Blood pressure control (<120/90 mmHg)	54.63	54.12	0.6912
Diabetes ^c	13.60	4.86	<0.0001
Glucose control <100 mg/dL	57.41	68.41	<0.0001
Cardiovascular diseases	36.34	10.81	<0.0001
Chronic obstructive pulmonary disease	1.39	0.64	0.0031
Cancer	3.76	3.42	0.7419
Other chronic diseases	52.08	38.89	<0.0001
Aspirin for cardiovascular prevention	34.61	8.74	<0.0001
Doctor visit within last 12 months	94.16	77.26	<0.0001
Hospitalization within last 5 years	49.31	35.91	<0.0001
Total physical activity, METs/week, Log mean (SD)	7.97 (0.9)	8.11 (0.9)	<0.0001
Total physical activity, METs/week, Median (IQR)	3000.00 (3630)	3489.59 (4726)	<0.0001
Viewing TV ≥21 h/week	29.72	23.10	<0.0001

^a Figures are percentages, unless otherwise indicated.

^b Hypertension was defined as a systolic blood pressure ≥ 140 mmHg, or diastolic blood pressure ≥ 90 mmHg, or self-reported hypertension diagnosis or use of antihypertensive medications.

^c Diabetes was defined as fasting glucose ≥ 126 mg/dL, or self-reported diagnosis of diabetes, or use of antidiabetic medication.

Further adjustment for total physical activity did not change these estimates. We did not detect an effect modification by sex. Statin users had lower median METs/week of total physical activity than non-users (adjusted median difference of −217.57 METs/week, 95% CI of −380.62 to −54.51 METs/week). In a subgroup analysis by CVD status, we observed the same pattern of a higher prevalence of prolonged TV viewing among statin users than non-users.

More statin users than nonusers (14.72% vs. 8.29%) invoked their physical health status as the reason for being sedentary (PR 1.78, 95% CI 1.56 to 2.03). This relation persisted after adjusting for age, sex, prevalent CVD, COPD and other chronic diseases (PR 1.16, 95% CI 1.01 to 1.33). Fewer statin users invoked lack of time (19.9% vs. 27.7%) and similar numbers invoked "no mood to exercise" (45%) or lack of perceived need (7.7%).

In contrast to physical activity, other behaviors were more favorable among statin users than non-users. Poor AHA diet was found among 33.7% of statin users and 41.2% of non-users. The prevalence of smoking was 16.6% among statin users and 20.6% among non-users.

Table 2
Prevalence ratios (95% CI) of watching TV ≥ 21 h/week, comparing statin users to non-users in full sample and stratified by cardiovascular disease history status. The PONS Study, 2010–11.

	All, <i>N</i> = 12,754	CVD history, <i>N</i> = 1820	No CVD history, = 10,934
Non-statin users	1 (Reference)	1 (Reference)	1 (Reference)
Model 1*	1.17 (1.08 to 1.27)	1.23 (1.06 to 1.43)	1.13 (1.02 to 1.25)
Model 2**	1.15 (1.06 to 1.25)	1.22 (1.06 to 1.41)	1.12 (1.01 to 1.25)

* Model 1 adjusted for age and sex.

** Model 2 additionally adjusted for education, smoking, prevalent CVD (except in models stratified by CVD), COPD and other chronic diseases.

4. Discussion

We found that statin users had a higher prevalence of prolonged TV viewing than non-statin users, independent of and in addition to lower levels of physical activity. Our findings suggest that statin users, with or without established cardiovascular diseases tend to have a poor adherence to clinical and public health recommendations for a physically active lifestyle.

While a plethora of studies have addressed various potential side effects of statin use on physiologic markers of muscle impairment, few studies compared sedentary behaviors among statin users and non-users. Our findings are consistent with those found in a population of older men (mean age 72 years) using device-based measurements of total physical activity (Lee et al., 2014). Similar to a brief report, (Thomsen et al., 2013) we found a slightly lower prevalence of poor diet among statin users than non-users. These findings suggest that different mechanisms may be influencing different lifestyle behaviors. Our study expands these previous findings into a middle-age population of men and women. Our study has several strengths. In contrast to total physical activity measures expressed as METs/time period (either self-reported or device-measured) or to other measures (such as sitting time), a domain-specific behavior (TV watching) has important advantages: 1) it is better captured by self-reports (Rosenberg et al., 2015) and 2) it provides the behavioral context needed for targeting focused interventions (Young et al., 2016). Further, our data collection spanned a 16-month time window and thus our results are unlikely to be significantly influenced by seasonality. Other strengths of our study include large sample size, information on multiple covariates and community-based recruitment.

Our study has several limitations. Inherent to self-reported data, the information is subject to recall bias and the relations detected may be underestimated. However, evidence suggests that self-reported TV viewing time is usually accurate (Young et al., 2016). Our study was designed as a long-term study and not as a representative sample of the population. However, comparisons with other national studies reveal that the distribution of CVD risk factors is similar. While TV-viewing time in our study was collected as a categorical variable, a continuous scale would have offered a more detailed exploration of this behavior. No data were collected on the duration of statin treatment and long-term adherence.

Our study has several clinical and public health implications. Health care professionals, preventive medicine and public health practitioners need to emphasize the benefits of physical activity not only in general population but also among statin users. The fact that statin users have more frequent contacts with health care professionals than non-statin users suggests that the clinical encounter represents an important window of opportunity. Patient counseling efforts need to incorporate evidence regarding the benefits of physical activity. For instance, a large body of evidence suggests that a physically active lifestyle can be as effective as treatment with statins (Naci and Ioannidis, 2015) and that the two treatments combined confer more health benefits than either therapy alone (Kokkinos et al., 2013). Patient counseling and ultimately patient behavior need to reflect the fact that the pharmacological treatment is complementary to, and not a substitute, of a physically active lifestyle.

TV viewing remains the leisure activity that occupies most discretionary time among middle-aged adults in many developed countries (Young et al., 2016). For instance, in the USA, average TV viewing is 20 h/week, with >50% of the population spending >14 h/week (Young et al., 2016; U.S. Department of Labor and Bureau of Labor Statistics, 2015). In Europe, market reports place Poland among the top three European countries, with averages of 28 h/week of TV viewing (Office of Communication, Ofcom, 2015). While different reports use different methods of reporting TV-viewing time, they consistently show a high prevalence of this sedentary behavior in many populations. These findings suggest that interventions targeting this risk factor have potentially

considerable public health impact. Such interventions may need to specifically address TV-related sedentary behavior, independent of targeting overall physical activity. Indeed, increasing the level of moderate-intensity physical activity was shown to eliminate the increased risk of death associated with high sitting time, but did not completely eliminate the increased risk associated with high TV-viewing time (Ekelund et al., 2016). While some interventions have been developed to target computer screen time among children, there is a need to develop innovative, more effective strategies to address prolonged TV viewing and other sedentary behaviors among adults.

The aim of our study was to document the prevalence of prolonged TV-viewing among statin users and non-users, and not to explain this behavior. The determinants of sedentary behavior are multifactorial and complex, including factors such as knowledge, health literacy, perceptions, attitudes, socio-economic and social environmental factors. Attempting to partition the role of these factors in determining sedentary lifestyle would require future studies.

While our findings do not support the “healthy adherer effect”, future studies are needed to further explore the potential for a “false reassurance” phenomenon or other reasons for the lack of compliance of statin users with a physically active lifestyle. While statins have been reported to impair muscle function, such side effects are rare and unlikely to impact the sedentary lifestyle at population level (Stone et al., 2014; Piepoli et al., 2016). Future studies need to consider the complex, multifactorial nature of behavioral change, including both individual and environmental factors. Detailed studies are needed to explore attitudes and perceptions about sedentary behaviors and to identify predictors of lifestyle-changes initiation and maintenance among statin users.

5. Conclusion

We found a higher prevalence of prolonged TV-viewing among statin users than non-users. Our findings suggest that statin users tend to display sedentary lifestyle behaviors, in spite of their increased need for a physically active lifestyle. Future studies are needed to explore innovative behavioral interventions and patient counseling strategies to reduce TV viewing among statin users.

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References

- Dwyer-Lindgren, L., Freedman, G., Engell, R.E., et al., 2013. Prevalence of physical activity and obesity in US counties, 2001–2011: a road map for action. *Popul. Health Metrics* 11:7. <http://dx.doi.org/10.1186/1478-7954-11-7>.
- Ekelund, U., Steene-Johannessen, J., Brown, W.J., et al., July 2016. Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women. *Lancet* [http://dx.doi.org/10.1016/S0140-6736\(16\)30370-1](http://dx.doi.org/10.1016/S0140-6736(16)30370-1).
- Grøntved, A., Hu, F.B., 2011. Television viewing and risk of type 2 diabetes, cardiovascular disease, and all-cause mortality: a meta-analysis. *JAMA* 305 (23):2448–2455. <http://dx.doi.org/10.1001/jama.2011.812>.
- Keadle, S.K., Moore, S.C., Sampson, J.N., Xiao, Q., Albanes, D., Matthews, C.E., 2015a. Causes of death associated with prolonged TV viewing: NIH-AARP diet and health study. *Am. J. Prev. Med.* 49 (6):811–821. <http://dx.doi.org/10.1016/j.amepre.2015.05.023>.

- Keadle, S.K., Arem, H., Moore, S.C., Sampson, J.N., Matthews, C.E., 2015b. Impact of changes in television viewing time and physical activity on longevity: a prospective cohort study. *Int. J. Behav. Nutr. Phys. Act.* 12:156. <http://dx.doi.org/10.1186/s12966-015-0315-0>.
- Kokkinos, P.F., Faselis, C., Myers, J., Panagiotakos, D., Doulas, M., 2013. Interactive effects of fitness and statin treatment on mortality risk in veterans with dyslipidaemia: a cohort study. *Lancet* 381 (9864):394–399. [http://dx.doi.org/10.1016/S0140-6736\(12\)61426-3](http://dx.doi.org/10.1016/S0140-6736(12)61426-3).
- Lee, D.S.H., Markwardt, S., Goeres, L., et al., 2014. Statins and physical activity in older men: the osteoporotic fractures in men study. *JAMA Intern. Med.* 174 (8): 1263–1270. <http://dx.doi.org/10.1001/jamainternmed.2014.2266>.
- Manczuk, M., Boffetta, P., Sartori, S., Hashim, D., Vatten, L.J., Zatonski, W.A., May 2015. Cohort profile: the Polish-Norwegian study (PONS) cohort. *Int. J. Epidemiol.* <http://dx.doi.org/10.1093/ije/dyv037>.
- Naci, H., Ioannidis, J.P.A., 2015. Comparative effectiveness of exercise and drug interventions on mortality outcomes: metaepidemiological study. *Br. J. Sports Med.* 49 (21): 1414–1422. <http://dx.doi.org/10.1136/bjsports-2015-f5577rep>.
- Office of Communication, Ofcom, 2015. The communications market report: international. <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr15/international/> (Accessed September 15, 2016).
- Piepoli, M.F., Hoes, A.W., Agewall, S., et al., 2016. 2016 European guidelines on cardiovascular disease prevention in clinical practice: the sixth joint task force of the European Society of Cardiology and other societies on cardiovascular disease prevention in clinical practice (constituted by representatives of 10 societies and by invited experts) developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). *Eur. Heart J.* 37 (29):2315–2381. <http://dx.doi.org/10.1093/eurheartj/ehw106>.
- Redberg, R.F., 2014. Statins and weight gain. *JAMA Intern. Med.* 174 (7):1046. <http://dx.doi.org/10.1001/jamainternmed.2014.1994>.
- Rosenberg, D.E., Lee, I.-M., Young, D.R., Prohaska, T.R., Owen, N., Buchner, D.M., 2015. Novel strategies for sedentary behavior research. *Med. Sci. Sports Exerc.* 47 (6): 1311–1315. <http://dx.doi.org/10.1249/MSS.0000000000000520>.
- Simpson, S.H., Eurich, D.T., Majumdar, S.R., et al., 2006. A meta-analysis of the association between adherence to drug therapy and mortality. *BMJ* 333 (7557):15. <http://dx.doi.org/10.1136/bmj.38875.675486.55>.
- Stone, N.J., Robinson, J.G., Lichtenstein, A.H., et al., 2014. American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. *J. Am. Coll. Cardiol.* 63 (25 Pt B):2889–2934. <http://dx.doi.org/10.1016/j.jacc.2013.11.002>.
- Sugiyama, T., Tsugawa, Y., Tseng, C.-H., Kobayashi, Y., Shapiro, M.F., 2014. Different time trends of caloric and fat intake between statin users and nonusers among US adults: gluttony in the time of statins? *JAMA Intern. Med.* 174 (7):1038–1045. <http://dx.doi.org/10.1001/jamainternmed.2014.1927>.
- Thomsen, R.W., Nielsen, R.B., Nørgaard, M., et al., 2013. Lifestyle profile among statin users. *Epidemiology* 24 (4):619–620. <http://dx.doi.org/10.1097/EDE.0b013e318296646>.
- Thorp, A.A., Owen, N., Neuhaus, M., Dunstan, D.W., 2011. Sedentary behaviors and subsequent health outcomes in adults: a systematic review of longitudinal studies, 1996–2011. *Am. J. Prev. Med.* 41 (2):207–215. <http://dx.doi.org/10.1016/j.amepre.2011.05.004>.
- U.S. Department of Labor, Bureau of Labor Statistics, 2015. American Time Use Survey Summary. (Data. <http://www.bls.gov/news.release/atus.nr0.htm>. Accessed September 15, 2016).
- Young, D.R., Hivert, M.-F., Alhassan, S., et al., 2016 Sep 27. Sedentary behavior and cardiovascular morbidity and mortality: a science advisory from the American Heart Association. *Circulation* 134 (13):e262–e279. <http://dx.doi.org/10.1161/CIR.0000000000000440>.