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Associations of physical activity and screen-time on health related quality of life in adults

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ABSTRACT

Background: Associations between the combined effect of physical activity and screen based activities on health related quality of life remain largely undetermined.

Methods: During 2008–2010, cross-sectional data for self-reported health related quality of life, physical activity, and screen-time were collected for 3796 Australian adults. Logistic regression was conducted to examine associations for six combinations of physical activity (none, insufficient, and sufficient), and screen-time (low and high) on health related quality of life.

Results: In comparison to the reference category (sufficient physical activity and low screen-time) men and women who reported no physical activity and either high (OR = 4.52, 95% CI 2.82–7.25) or low (OR = 2.29, 95% CI 1.37–3.80) screen-time, were significantly more likely to report over 14 unhealthy days. Men reporting either; no physical activity and high (OR = 3.15, 95% CI 1.92–5.15), or low (OR = 2.17, 95% CI 1.30–3.63) screen-time; insufficient physical activity and high (OR = 1.68, 95% CI 1.08–2.60), or low (OR = 1.79, 95% CI 1.14–2.82) screen-time were more likely to rate their health as poor or fair. In women this was significant for those who reported no physical activity and high screen-time (OR = 1.98, 95% CI, 1.19–3.31).

Conclusions: Results suggest that the combination of no physical activity and high screen-time demonstrated the greatest negative impact on health related quality of life.

Introduction

There is increasing evidence that physical activity (PA) and screen-time, a marker of sedentary time, are independently associated with a range of physical health outcomes, such as obesity and Type 2 Diabetes (Hu et al., 2003). The effects on psychological health are less clear. This presents cause to investigate the combined effect of these behaviours on psychological health; specifically, how high levels of screen-time might influence mental health in the presence or absence of PA. The purpose of the current study is to investigate associations between different combinations of PA and screen-time with health related quality of life (HRQOL) in a sample of Australian adults, and examine if these associations differ between men and women.

Methods

Sample and design

Cross-sectional data were collected from a random sample of adults from Queensland, Australia, as part of the annual Queensland Social Survey, from 2008 to 2010. Participants (aged 18 and over) were contacted by land-line telephone and interviewed using Computer-Assisted-Telephone-Interviewing by CQUniversity's Population Research Laboratory as per protocols described elsewhere (Badland and Duncan, 2009). Survey response rates were 37.1%, 41.5% and 35.2% in 2008, 2009 and 2010 respectively. Data were collected for 3796 people over the three-year period. After excluding 352 participants with missing data, the sample size for this analysis was 3444. All surveys received ethical approval from the Human Ethics Research Committee at CQUniversity, Australia.

Measures

HRQOL was measured using the HRQOL-4, a valid and reliable measure of HRQOL (Centres for Disease Control and Prevention, November, 2000). The HRQOL-4 measure consists of four questions used to report three measures of HRQOL during the past 30 days; self-rated health, unhealthy days and activity limitation days. Self-rated health was dichotomized into poor or fair health compared to good, very good or excellent health (Ford et al., 2001). The number of days on which physical and mental health was not good were summed and dichotomised into <14 or ≥14 unhealthy days (Moriarty et al., 2003). Similarly, activity limitation days were dichotomised into <14 or ≥14 days (Ford et al., 2001).

Self-reported PA was assessed using the valid and reliable Active Australia Survey (Australian Institute of Health and Welfare, 2003; Brown et al., 2004). Total minutes and sessions of moderate to vigorous intensity PA over the previous week were classified as: 1) sufficient PA (SPA), meeting Australian National PA Guidelines for Adults of at least 150 min of moderate

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intensity PA/week, through the accumulation of 30 min or more on at least five days/week (Department of Health and Aging, 1999); 2) insufficient PA (IPA, doing some PA, but not meeting the guidelines); or 3) no PA (NPA, zero minutes of PA).

Screen-time was assessed by two questions assessing the total estimated time spent in the previous week, 1) watching TV; and 2) using a computer during leisure time and/or at work. Total time was summed together and dichotomised as either high (HST, ≥21 h/week) or low screen-time (LST, <21 h/week). This threshold approximates the sample median and a level of screen based activity that is associated with increased risk of ill health (Hu et al., 2001). The socio-demographic and health variables assessed are listed in Table 1.

Table 1
Socio-demographic, health and behavioural characteristics of participants[a].

	Overall ($n=3444$) n (%)	Men ($n=1774$) n (%)	Women ($n=1670$) n (%)	p[b]
Year completed				
2008	1120 (33)	579 (33)	541 (32)	
2009	1185 (34)	606 (34)	579 (35)	
2010	1139 (33)	589 (33)	550 (33)	0.95
Age group (y)				
18–34	475 (14)	252 (14)	233 (14)	0.01
35–44	667 (19)	309 (17)	358 (21)	
45–54	751 (22)	380 (21)	371 (22)	
≥55	1511 (45)	833 (47)	718 (43)	
Education				
High school or less	1558 (45)	734 (41)	824 (49)	<0.01
More than high school	1886 (55)	1040 (59)	846 (51)	
Household income				
Nil–$26,000	516 (15)	240 (14)	276 (17)	<0.01
$26,001–$52,000	444 (13)	230 (13)	214 (13)	
$52,001–$100,000	721 (21)	384 (22)	337 (20)	
More than $100,000	765 (22)	452 (25)	313 (19)	
No response	998 (29)	468 (26)	530 (32)	
Body mass index category (kg/m^2)				
<25	1352 (39)	541 (31)	811 (49)	<0.01
25–29.9	1298 (38)	806 (45)	492 (29)	
Above or equal to 30	794 (23)	427 (24)	367 (22)	
Smoking status				
Non-smoker	2943 (85)	1491 (84)	1452 (87)	0.02
Current smoker	501 (15)	283 (16)	218 (13)	
Chronic condition				
Yes	1432 (42)	746 (42)	686 (41)	0.56
No	2012 (58)	1028 (58)	984 (59)	
Physical activity				
SPA	1723 (50)	916 (52)	807 (48)	
IPA	1172 (34)	560 (32)	613 (37)	
NPA	548 (16)	298 (17)	250 (15)	<0.01
Screen-time				
LST	1723 (50)	851 (48)	872 (52)	
HST	1721 (50)	923 (52)	798 (48)	<0.05
Combined PA/screen-time				
SPA/LST	894 (26)	448 (25)	446 (27)	<0.01
SPA/HST	829 (24)	468 (26)	361 (22)	
IPA/LST	563 (16)	256 (14)	307 (18)	
IPA/HST	610 (18)	304 (17)	306 (18)	
NPA/LST	266 (8)	147 (8)	119 (7)	
NPA/HST	282 (8)	151 (9)	131 (8)	
Unhealthy days				
<14 days	2776 (81)	1470 (83)	1306 (78)	<0.01
≥14 days	668 (19)	304 (17)	364 (22)	
Self-rated health				
Poor or fair	562 (16)	310 (17)	252 (15)	0.06
Good, very good or excellent	2882 (84)	1464 (83)	1418 (85)	
Activity limitation days				
<14 days	3200 (93)	1649 (93)	1551 (93)	0.93
≥14 days	244 (7)	125 (7)	119 (7)	

Note: Due to rounding some column percentages may not add up to 100%.
HST, high screen-time; IPA, insufficient PA; kg/m^2, kilogram per meter squared; LST, low screen-time; NPA, no PA; SPA, sufficient PA; y, year.
[a] Participants are from Queensland, Australia (2008–2010).
[b] p value for difference between men and women (X^2 test).

Statistical analysis

Based on the classifications for PA and screen-time, participants were classified into 1) SPA/LST (the reference category); 2) SPA/HST; 3) IPA/LST; 4) IPA/HST; 5) NPA/LST; or 6) NPA/HST. This classification system was modified from a previously developed classification system (Sugiyama et al., 2008).

HRQOL, screen-time, PA and covariates were described for the total group and for men and women separately, using Pearson chi-square analysis to examine gender differences. Associations between the combinations of PA and screen-time, and HRQOL were examined using logistic regression (odds ratio; OR), adjusted for socio-demographic and health covariates (age, education, income, body mass index, smoking, chronic condition and survey year; Fig. 1). At this stage the 'Activity Limitation Days' measure was removed as one of the HRQOL measures due to insufficient sample size across categories, resulting in separate models being run for the two remaining measures of HRQOL. Unhealthy days and self-rated health remained as the two dependent measures representing HRQOL. All analyses were stratified for gender, as previous research investigating the combined effect of PA and screen-time in relation to overweight/obesity has suggested gender differences in patterns of PA and screen-time (Sugiyama et al., 2008). Although the primary aim was to examine associations between combinations of PA and screen-time with HRQOL, additional models including both PA (SPA, IPA and NPA) and screen-time (high and low) were run for each HRQOL outcome stratified by gender. Furthermore, an interaction term (PA*Screen-time) was added to these models. There were no statistically significant interaction effects. All analyses were undertaken using SPSS V18.0, with statistical significance set at $p<0.05$.

Results

Table 1 provides an overview of the sample by socio-demographic, health and behavioural variables. The associations between patterns of PA and screen-time on unhealthy days and self-rated health are reported in Fig. 1.

Compared to participants doing SPA/LST (referent category), men and women who reported NPA in combination with both high and low screen-time were more likely to have lower HRQOL. Men were more likely to report ≥14 unhealthy days and to rate their health as poor/fair, and the association was stronger in those doing NPA/HST than in those doing NPA/LST (≥14 unhealthy days: OR = 4.52, 95% CI 2.82–7.25 for NPA/HST versus OR = 2.29, 95% CI 1.37–3.80 for NPA/LST; poor/fair health: OR = 3.15, 95% CI 1.92–5.15 for NPA/HST versus OR = 2.17, 95% CI 1.30–3.63 for NST/LST). Although women doing NPA were more likely to report ≥14 unhealthy days, the associations were less pronounced than in men and similar for high or low screen-time (≥14 unhealthy days: OR = 1.84, 95% CI 1.16–2.92 for NPA/HST versus OR = 1.87, 95% CI 1.15–3. for NPA/LST). Only women doing NPA/HST were significantly more likely to report their health as poor/fair (OR = 1.98 95% CI, 1.19–3.31).

The additional models, including PA and screen-time as separate variables, showed that compared to participants doing SPA, men and women doing NPA were more likely to report ≥14 unhealthy days (men: OR = 2.60, 95% CI 1.86–3.63; women: OR = 1.87, 95% CI 1.33–2.63) and to rate their health as fair/poor (men: OR = 2.39, 95% CI 1.68–3.39; women: OR = 1.91, 95% CI 1.30–2.82). Additionally men reporting HST were more likely to report ≥14 unhealthy days (OR = 1.48, 95% CI 1.12–1.92). Detailed results of these multivariable models are presented in Appendix A.

Discussion

This is the first study to examine the influence of screen-time on HRQOL for different levels of PA in an Australian adult population. The results demonstrate that the combination of high screen-time and no PA was consistently associated with lower HRQOL, especially in men.

Previous research has demonstrated that individuals can meet the recommended level of PA and still compromise their metabolic health when they sit for extended periods (Owen et al., 2010). As the current evidence predominantly applies to metabolic health, the authors

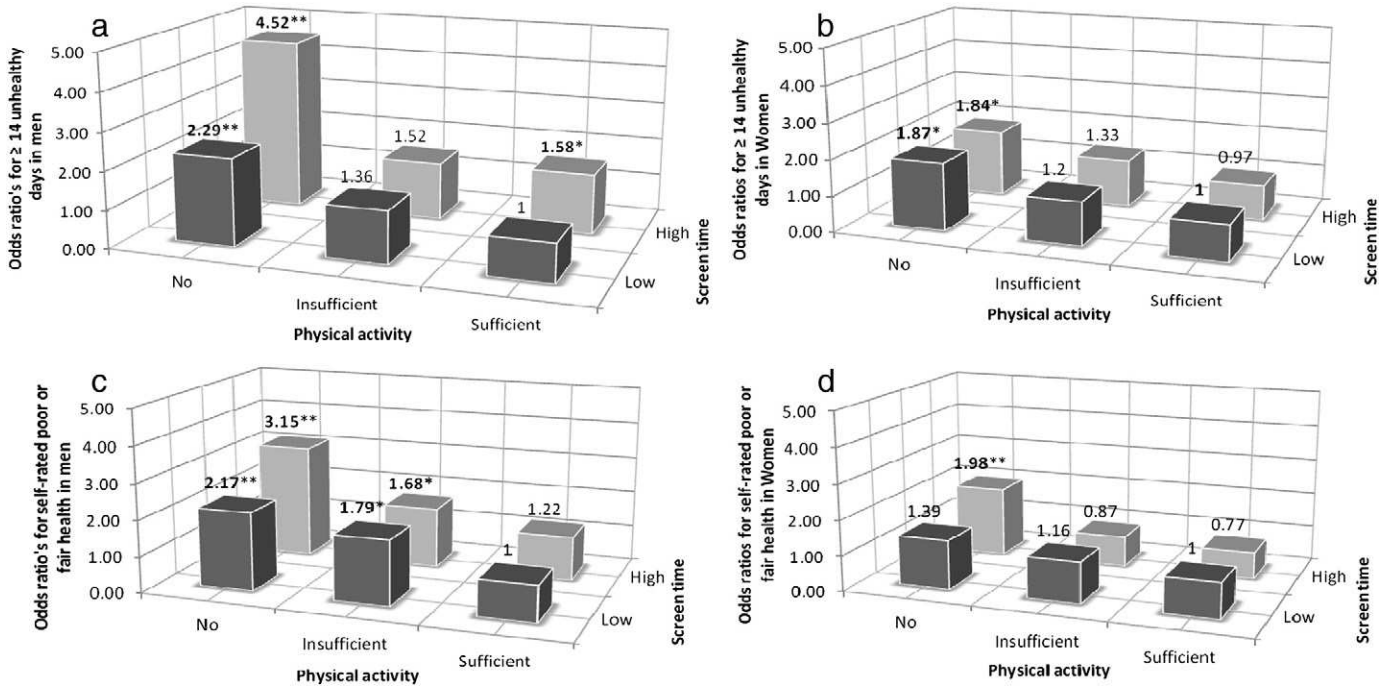

Fig. 1. Adjusted odds ratio for HRQOL measures (Panel a. Men[a] reporting above or equal to 14 Unhealthy days; Panel b. Women[a] reporting above or equal to 14 Unhealthy days; Panel c. Men[a] who reported poor or fair health; and Panel d. Women[a] who reported poor or fair health) according to combined categories of physical activity (no, insufficient and sufficient physical activity) and screen-time (Low or High). Models used in logistic regression analysis are adjusted for age, education, income, body mass index, smoking, chronic condition and survey year. The reference category represents sufficient physical activity and low screen-time, for which the odds ratio is 1. The significance level next to the odds ratio's values on top of the bars is in relation to the reference category: $^{**}p<0.01$; $^{*}p<0.05$. [a]Participants are from Queensland, Australia (2008–2010).

were interested to see if the basic premise of the statement held true when investigating the associations between patterns of PA and screen-time on HRQOL. The findings of this study demonstrate some support for this statement, more so in men than in women, but they provide the greatest support for the detrimental association between no PA and HRQOL, regardless of high or low screen-time. However, the presence of high levels of screen-time exacerbated this relationship. For example, men who were recording SPA were more likely to report ≥14 unhealthy days if they were also reporting high levels of screen-time. Several mechanisms may explain these patterns. Sufficient PA is associated with reduced risk of chronic disease and depression, both of which are subsequently associated with better HRQOL. This could potentially provide a pathway for positive effects of sufficient PA on HRQOL. Additionally, less time spent in screen based activities, independent from PA levels, is associated with a reduced risk of metabolic syndrome, Type 2 Diabetes and cardiovascular disease and mortality (Owen et al., 2010). The positive effects on physical and mental health from both high PA and low screen-time might then have a synergistic effect on HRQOL beyond that which may be achieved by either behaviour separately. Future research may also examine the effect of screen-time in finer categories than used in the current analysis to clarify the role that screen-time has in influencing health. Such analysis was not possible in the current study due to the distribution of behaviours.

Although the combination of NPA/HST was consistently associated with lower HRQOL in both genders, the effect of screen-time on HRQOL was minimal in women compared to men. Gender differences have also been observed in previous studies examining joint associations of PA and screen-time and the risk of overweight or obesity (Sugiyama et al., 2008), and metabolic health risk (Healy et al., 2008). The difference in these studies and our findings is that whilst the aforementioned studies found stronger associations for women, our findings indicate the opposite. Differences between study outcomes may be related to methodological issues including differences associated with assessing physical health compared to psychological health outcomes or differences in the representativeness of the assessed screen based activities between genders.

Strengths and limitations

A significant strength of the study was the large sample size used in the analysis. The cross-sectional design was a limitation, as it does not allow for examination of causal relationships. Additionally wide confidence intervals were observed for some behavioural categories in the logistic regression analysis and as such the outcomes should be interpreted with caution. A further limitation is the use of self-report measures.

Conclusion

The current study demonstrates that although PA was a more important factor relative to screen-time in determining HRQOL, the combined effect of no PA and high screen-time consistently had the greatest negative impact on HRQOL across the two measures for both genders. Men seem more susceptible to the detrimental effects of high screen-time on HRQOL, regardless of PA level. These results suggest that both increasing PA and reducing screen-time may be useful strategies to improve HRQOL, particularly for men, although the cross-sectional nature of the data should be considered. Further research including longitudinal research is needed to replicate the outcomes of the current study.

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.ypmed.2012.05.003.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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