Measuring Physical Inactivity: Do Current Measures Provide an Accurate View of “Sedentary” Video Game Time?

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Background. Measures of screen time are often used to assess sedentary behaviour. Participation in activity-based video games (exergames) can contribute to estimates of screen time, as current practices of measuring it do not consider the growing evidence that playing exergames can provide light to moderate levels of physical activity. This study aimed to determine what proportion of time spent playing video games was actually spent playing exergames. Methods. Data were collected via a cross-sectional telephone survey in South Australia. Participants aged 18 years and above (n = 2026) were asked about their video game habits, as well as demographic and socioeconomic factors. In cases where children were in the household, the video game habits of a randomly selected child were also questioned. Results. Overall, 31.3% of adults and 79.9% of children spend at least some time playing video games. Of these, 24.1% of adults and 42.1% of children play exergames, with these types of games accounting for a third of all time that adults spend playing video games and nearly 20% of children’s video game time. Conclusions. A substantial proportion of time that would usually be classified as “sedentary” may actually be spent participating in light to moderate physical activity.

1. Introduction

Obtaining an accurate view of factors that can affect health and wellbeing is of vital importance. In order to implement strategies to improve overall health through better lifestyle choices, it is necessary to first have a clear picture of the types of behaviour that represent a genuine threat to health, while at the same time identifying those in the community who are most likely to develop such types of behaviour. If data gathered on these types of behaviour is not being interpreted correctly, the efficacy of health promotion strategies may be compromised.

Physical inactivity is increasingly being viewed as one of the most serious public health problems in the developed countries today [1]. Not only does it contribute heavily to the development of many other risk factors (e.g., obesity and high blood pressure), but it can itself be attributed to a large proportion of noncommunicable deaths. Long-term physical inactivity contributes significantly to the secondary aging of various metabolic systems and reduces average life expectancy [2]. It is estimated to cause around 21–25% of breast and colon cancer burden, 27% of diabetes, and about 30% of ischaemic heart disease burden [3]. It was found to be responsible for 1 in 10 deaths in the United States [4], and in a recent large study of Australian adults it was consistently associated with all-cause mortality across a number of different demographic and behavioural factors, including physical activity itself [5]. In Australia, about 16,000 people die prematurely every year because they are not active enough. Lives are at risk, and so too is the economy with the cost of physical inactivity in Australia estimated at $14 billion dollars annually [6].

Current recommendations in Australia suggest that adults should participate in at least 30 minutes of moderate to vigorous physical activity each day [7] and that children should participate in at least 60 minutes [8]. However, recent research indicates that, irrespective of meeting physical activity guidelines, those who spend a significant proportion of their day sedentary are still susceptible to a number of adverse health outcomes such as increased waist
circumference, blood pressure and blood glucose, and lipid profiles [9]. It is becoming clearer that not only do we need to encourage people, particularly young people, to get involved in traditional forms of physical activity, but we also need to encourage people to engage in more active forms of entertainment in their leisure time, rather than the more sedentary types of behaviour.

Screen time can account for a large proportion of the time awake spent being physically inactive [10] and includes any activity in which a person is viewing images on a screen, whether it is a television, a computer screen, or a hand-held video game device. However, the differing nature of the various types of screen-based activities may make the dynamics of this relationship ambiguous. There is growing evidence that not all screen-based activities are treated equal in terms of factors like energy expenditure [11–14], and so they should not be treated as such when attempting to determine an accurate picture of levels of physical inactivity in the community.

The emergence and growing popularity of “exergames” (video games in which people are required to be physically active in order to play them) in recent years requires us to be a little more specific when determining levels of sedentary time and physical activity. Many of these games require extended periods of moderate levels of activity, similar to walking in relation to energy expenditure [15–17], and currently this is not taken into consideration when calculating time spent being either sedentary or physically active.

The aim of this study was to determine what proportion of time spent playing video games was actually spent playing exergames. Using this, it would be possible to calculate estimates within other data sources as to the amount of video game time that involves a moderate degree of physical activity. This would allow us to understand the degree to which current estimates of physical activity and sedentary behaviour in the community are not fully representative.

2. Materials and Methods

2.1. Sample. In order to assess the proportion of video game time spent playing exergames, questions were developed and contributed to the May/June 2010 South Australian Health Monitor survey, conducted by Population Research and Outcome Studies (PROS) within the Discipline of Medicine, the University of Adelaide. Health Monitor is a user-pays telephone survey system that conducts large representative surveys of 2000 South Australian households two to three times a year.

Telephone numbers were selected randomly from the electronic white pages (EWP). A letter was sent to each selected household introducing the survey. Only one interview was conducted per household. Where more than one person aged 18 or over resided in the household, the respondent was the person who was last to have their birthday. This was a nonreplacement sample, and up to 10 callbacks were made, if needed, to households to interview the selected person. Respondents were informed that participation in the survey was voluntary, that they could choose to not answer any questions they did not want to, and that they were free to end the interview at any time. Informed consent was obtained from the participant before any survey questions were asked. The May/June 2010 Health Monitor received ethics approval from the Human Research Ethics Committee, SA Health (HREC Protocol number 356/03/2013).

The survey was administered using a CATI (computer-aided telephone interviewing) system whereby respondents’ answers were entered directly into the computer by the interviewer. From the 4900 households selected, 2026 interviews were conducted with a participation rate of 64.6% and a response rate of 59.2%. All interviews were conducted by professional health interviewers from 3/5/2010 to 10/6/2010. Telephone calls were made between 10:00 a.m. and 8:30 p.m., seven days a week.

2.2. Video Game and Exergame Time. Respondents were first asked how much time they spent playing video games in general. They were then provided with a definition of the term “exergames” (“exergames is the term used to describe video games that incorporate physical activity as part of their gameplay”) and were then asked how much time they spent playing those types of games. The data pertaining to children presented below were collected through the adult respondent. Respondents that indicated that there was a child between 5 and 17 years in the household were asked about the age, sex, and video game/exergame habits of the last child to have a birthday in that age range.

2.3. Sociodemographic Items. Demographic questions included in the survey were on age, sex, area of residence, dwelling status, country of birth, education level, marital status, gross annual household income, work status, and number of people in the household.

2.4. Statistical Analyses. Univariable analyses were performed on the data gathered using SPSS Version 18.0. Data are weighted by area (metropolitan/country), age, gender, and probability of selection in the household to the most recent South Australian population data so that the results are representative of the South Australian population.

3. Results and Discussion

Overall, 2026 adult respondents were asked about their gaming habits (specifically, how many hours per day or per week they spent playing them), and of these 537 gave additional information regarding the gaming habits of a child in the household aged between 5 and 17 years. The demographic characteristics of the respondents are presented in Table 1, while the age and sex distribution of the children for whom data regarding video game habits was collected is displayed in Table 2. The mean age of the adult respondents was 47.6 (SD 18.5), while the mean age of the children was 11.0 (SD 3.8).

Table 3 presents the proportion of adults and children that spend any time playing video games and the average amount of time spent playing them. Table 4 highlights the
Table 1: Demographic characteristics of respondents.

|                          | n   | %     | (95% CI)          |
|--------------------------|-----|-------|-------------------|
| Sex                      |     |       |                   |
| Male                     | 990 | 48.9  | (46.7–51.0)       |
| Female                   | 1036| 51.1  | (49.0–53.3)       |
| Age of respondent        |     |       |                   |
| 18 to 24                 | 250 | 12.3  | (11.0–13.8)       |
| 25 to 34                 | 329 | 16.2  | (14.7–17.9)       |
| 35 to 44                 | 366 | 18.1  | (16.5–19.8)       |
| 45 to 54                 | 369 | 18.2  | (16.6–19.9)       |
| 55 to 64                 | 314 | 15.5  | (14.0–17.1)       |
| 65 to 74                 | 200 | 9.9   | (8.6–11.2)        |
| 75 and over              | 199 | 9.8   | (8.6–11.2)        |
| Area                     |     |       |                   |
| Metropolitan             | 1446| 71.4  | (69.4–73.3)       |
| Country                  | 580 | 28.6  | (26.7–30.6)       |
| Income                   |     |       |                   |
| Up to $20,000            | 258 | 12.8  | (11.4–14.3)       |
| $20,001–$40,000          | 310 | 15.3  | (13.8–16.9)       |
| $40,001–$60,000          | 291 | 14.4  | (12.9–16.0)       |
| $60,001–$80,000          | 243 | 12.0  | (10.7–13.5)       |
| $80,001–$100,000         | 221 | 10.9  | (9.6–12.3)        |
| More than $100,000       | 425 | 21.0  | (19.3–22.8)       |
| Not stated/refused/do not know | 277 | 13.7  | (12.3–15.2)       |
| Marital status           |     |       |                   |
| Married/living with a partner | 1376| 67.9  | (65.8–69.9)       |
| Separated/divorced       | 144 | 7.1   | (6.3–8.3)         |
| Widowed                  | 120 | 5.9   | (5.0–7.1)         |
| Never married            | 382 | 18.8  | (17.2–20.6)       |
| Education                |     |       |                   |
| No schooling to secondary| 932 | 46.1  | (43.9–48.2)       |
| Trade/certificate/diploma| 630 | 31.1  | (29.1–33.1)       |
| Degree or higher         | 460 | 22.8  | (21.0–24.6)       |
| Country of birth         |     |       |                   |
| Australia                | 1573| 77.6  | (75.8–79.4)       |
| UK/Ireland               | 199 | 9.8   | (8.6–11.2)        |
| Other                    | 251 | 12.4  | (11.0–13.9)       |
| Household status         |     |       |                   |
| Owned or being purchased by the occupants | 1678 | 83.2  | (81.1–84.4)       |
| Renting                  | 290 | 14.4  | (12.8–15.9)       |
| Retirement village       | 22  | 1.1   | (0.7–1.7)         |
| Other                    | 28  | 1.4   | (1.0–2.0)         |
| Socioeconomic Indexes For Areas (SEIFA) 2006 |     |       |                   |
| The lowest quintile      | 362 | 18.0  | (16.4–19.7)       |
| Low quintile             | 427 | 21.2  | (19.5–23.0)       |
| Middle quintile          | 367 | 18.2  | (16.6–20.0)       |
| High quintile            | 390 | 19.4  | (17.7–21.2)       |
| The highest quintile     | 468 | 23.2  | (21.4–25.1)       |
| Overall                  | 2026| 100.0 |                   |

The weighting of data can result in rounding discrepancies or totals not adding.

4. Conclusions

This study highlights that a substantial proportion of video game time is spent playing games that require a light to moderate amount of physical activity. It could be argued that the standard practice of asking people how much time they spend engaged in any kind of screen activity should be amended to include clarification of what proportion of that time is spent playing exergames.

There is a growing body of the literature to support the position that exergames can have a positive effect on the health and wellbeing of children and adolescents that play them. It has been observed to increase heart rate [18, 19], caloric expenditure [20–22], and weight loss, particularly in the overweight and obese youth [23, 24]. There has also been evidence to suggest that participation in exergames can increase the amount of other types of physical activity that children undertake, while decreasing the total amount of time spent playing video games overall [25].
Table 3: Time spent playing video games, for adults and children.

|                        | Adults |                  |                  | Children |                  |                  |
|------------------------|--------|------------------|------------------|----------|------------------|------------------|
|                        | 𝑛      | %                | (95% CI)         | 𝑛        | %                | (95% CI)         |
| **Spent any time playing video games** |        |                  |                  |          |                  |                  |
| Yes                    | 633    | 31.3             | (29.3–33.3)      | 429      | 79.9             | (76.3–83.1)      |
| No                     | 1383   | 68.3             | (66.2–70.2)      | 103      | 19.2             | (16.1–22.8)      |
| Do not know/refused    | 10     | 0.5              | (0.3–0.9)        | 5        | 0.8              | (0.3–2.0)        |
| **Hours per day playing video games** |        |                  |                  |          |                  |                  |
| None                   | 1383   | 68.3             | (66.2–70.2)      | 103      | 19.2             | (16.1–22.8)      |
| Up to half an hour     | 358    | 17.7             | (16.1–19.4)      | 229      | 42.7             | (38.6–46.9)      |
| More than half an hour to an hour | 145 | 7.2              | (6.1–8.4)        | 102      | 19.1             | (16.0–22.6)      |
| More than 1 to 2 hours | 80     | 3.9              | (3.2–4.9)        | 59       | 11.0             | (8.7–14.0)       |
| More than 2 hours      | 50     | 2.5              | (1.9–3.2)        | 38       | 7.1              | (5.2–9.6)        |
| Do not know/refused    | 10     | 0.5              | (0.3–0.9)        | 5        | 0.5              | (0.3–2.0)        |
| Overall                | 2026   | 100.0            |                  | 537      | 100.0            |                  |

**Mean minutes per day playing video games**: 15.10 (SD: 38.866, Range: 0–420) 8.1 (SD: 14.692, Range: 0–120)

The weighting of data can result in rounding discrepancies or totals not adding. * Including those that did not play video games at all.

Table 4: Time spent playing exergames, for adults and children who reported playing video games.

|                        | Adults |                  |                  | Children |                  |                  |
|------------------------|--------|------------------|------------------|----------|------------------|------------------|
|                        | 𝑛      | %                | (95% CI)         | 𝑛        | %                | (95% CI)         |
| **Spent any time playing exergames** |        |                  |                  |          |                  |                  |
| Yes                    | 149    | 24.1             | (20.9–27.7)      | 181      | 42.1             | (37.5–46.8)      |
| No                     | 467    | 75.8             | (72.3–79.0)      | 247      | 57.6             | (52.8–62.1)      |
| Do not know/refused    | 17     | 2.7              | (1.7–4.2)        | 1        | 0.3              |                  |
| **Hours per day playing exergames** |        |                  |                  |          |                  |                  |
| None                   | 467    | 75.8             | (72.3–79.0)      | 247      | 57.6             | (52.8–62.1)      |
| Up to half an hour     | 123    | 19.9             | (16.9–23.2)      | 154      | 36.0             | (31.6–40.6)      |
| More than half an hour to an hour | 25 | 4.1              | (2.8–6.0)        | 23       | 5.4              | (3.6–8.0)        |
| More than 1 to 2 hours | 1      | 0.1              | (0.0–0.9)        | 3        | 0.7              | (0.3–2.1)        |
| Do not know/refused    | 17     | 2.7              | (1.7–4.2)        | 1        | 0.3              |                  |
| Overall                | 617    | 100.0            |                  | 429      | 100.0            |                  |

**Mean minutes per day playing exergames**: 5.07 (SD: 13.130, Range: 0–120) 8.1 (SD: 14.692, Range: 0–120)

The weighting of data can result in rounding discrepancies or totals not adding. * Insufficient cell sizes for statistical tests.

The strengths of this study include a sound methodology that enables confidence in the data gathered as being representative of the South Australian community. However, it is acknowledged that the method of using proxy respondents to gather data on children’s gaming habits is less than ideal. Directly surveying the children themselves or better yet monitoring their gaming habits for a period of time would yield more representative data and increase confidence in the relative exergame time proportions.

To the best of our knowledge, no other population-based research has been undertaken to determine what proportion of screen-based time is spent playing exergames. It remains to be seen if the association between screen time and undesirable health outcomes would hold constant if the distinction between exergames and other screen-based activities was factored into calculations. Further research is needed in order to assess whether those who spend their leisure time playing exergames display improved health outcomes compared to those who engage in other, more sedentary, screen-based activities. This can only be achieved if the accuracy in which we measure sedentary behaviour is improved [26].

Historically, campaigns to promote physical activity and also the processes that measure their success have focused almost exclusively on encouraging people to participate in the more traditional types of activities (e.g., group sports, walking, etc.). While these interventions are, and will continue to be, very important with regard to improving health outcomes for people, current research suggests the necessity to widen the focus of such campaigns and processes to include people’s leisure time activities. As previously stated, it is becoming clear that the time people spend engaged in sedentary behaviour is a major contributor to poor health.
outcomes, regardless of their level of activity at other times. Encouraging them to choose more active types of behaviour in their leisure time could be an important step towards dealing with the problem of physical inactivity.

Ethical Approval

Ethical approval for the project was obtained from SA Health (HREC Protocol no. 356/03/2013). All participants gave informed consent to be interviewed.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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