



Brief Original Report

Longitudinal determinants of walking, moderate, and vigorous physical activity in Australian adults

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ABSTRACT

Objective. To explore longitudinal (demographic, socioeconomic, health and psychological) determinants of walking, moderate and vigorous physical activity.

Methods. The sample included 11,133 adult participants (5913 women; 5220 men) taken from the Household, Income and Labour Dynamics in Australia (HILDA) project. Demographic, socioeconomic, health and psychological data were collected in 2010 and estimates of walking, moderate and vigorous physical activity were collected in 2014.

Results. Participant age, sex, occupational status, working hours, and neighbourhood remoteness were most strongly related to total physical activity. Psychological traits (personality and distress sensitivity) were unrelated to subsequent physical activity, and health-related behaviours (diet variables and smoking frequency) were moderately related. Participant demographics (age and sex) were most important for vigorous intensity physical activity, and socioeconomic factors (e.g., neighbourhood remoteness, total income, occupational status, weekly hours worked) were most important for moderate intensity physical activity.

Conclusions. This investigation shows that demographic, socioeconomic, and health-related variables are important determinants of adult physical activity levels, and that demographic and socioeconomic factors might become more or less important for different intensities of physical activity.

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Introduction

Physical inactivity is an important contributor to the development of non-communicable diseases worldwide (Lee et al., 2012). There is a growing interest in identifying factors that might explain physical activity levels in order to design more targeted interventions that encourage an active lifestyle. Studies have found that a combination of individual (e.g., personality traits), interpersonal (e.g., social support), environmental (e.g., neighbourhood socioeconomic position), national (e.g., transport systems) and global (e.g., economic development) factors relate to adult physical activity levels (Bauman et al., 2012; Rech et al., 2014). Less is known about how such factors might relate to different intensities of physical activity. This is important as different modes of physical activity are associated with different health and behaviour outcomes (Biddle et al., 2015). For example, regular walking is associated with improved survival in cancer survivors, but moderate intensity physical activity is associated with a greater protective effect against colon and breast cancer than low intensity physical activity (Warburton et al., 2006). In this investigation we explore longitudinal determinants (demographic, socioeconomic, health and psychological)

of walking, moderate and vigorous physical activity in a large cohort of Australian adults.

Method

Sample

The Household, Income and Labour Dynamics in Australia (HILDA) project is Australia's first nationally representative household panel survey that targets family, income, and work related processes (see Watson and Wooden, 2012, for details). We use data collected in 2010 (wave 9) – that we refer to as Time 1 – and 2014 (wave 13) – that we refer to as Time 2. At Time 1 13,301 participants (6983 women; 6318 men) were sampled (67.0% original household response rate, with immigrants from non-English speaking countries under-represented) and at Time 2 11,133 of these participants returned (5913 women; 5220 men), representing an attrition rate of 16.3% (see supplementary file for attrition analyses). An important amendment to the 2014 data collection phase was the inclusion of questions targeting different intensities of physical activity.

Measures

Physical activity

At Time 2, the international physical activity questionnaire (IPAQ) – short-form (Craig et al., 2003) was used to assess walking, moderate, and vigorous

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physical activity. Participants were first provided a description of each activity mode (see [Wooden, 2014, for details](#)) and asked to provide the number of days they participated in each form of physical activity during the previous 7 days. Participants also provided the average number of hours and minutes in each activity mode for an average day. In this investigation we explore minutes of participation per week (minutes*days). We also explore a composite physical activity estimate that is the sum of the three physical activity modes. The IPAQ has demonstrated acceptable construct and concurrent validity, and test–retest reliability ([Craig et al., 2003](#)) but somewhat low predictive validity ([Lee et al., 2011](#)) in adult samples.

Socioeconomic factors

At Time 1, participants provided information on their marital status and the number of current resident children. Self-reported education was provided from 1 (masters or doctorate degree) to 9 (year 11 or below). Participants provided their home postcode, total income (in AUD per week), average number of hours worked (per week), and their main occupation. Occupation was coded to the Australian and New Zealand Standard Classification of Occupations ([Australian Bureau of Statistics, 2006](#)) and this was used to determine occupational status (from 0 to 100). Using the participants' postcode, an estimate of neighbourhood socioeconomic position (NSP) and neighbourhood economic resources (NER) was determined according to the Socio-Economic Indexes for Areas ([Australian Bureau of Statistics, 2013a](#)) and neighbourhood remoteness was estimated using the Australian Statistical Geography Standard ([Australian Bureau of Statistics, 2013b](#)).

Health variables

At Time 1, participants completed four items (e.g., “I get sick a little easier than other people”) from the SF-36 health survey ([Ware and Sherbourne, 1992](#)) that assess general health ($\alpha = .79$). Participants also listed their height and weight and these were used to calculate body-mass-index (BMI; kg/m²). Participants listed the number of cigarettes (or other tobacco products) they usually smoke each week and the units of alcohol consumed on average per day. They also provided the number of days in an average week that they eat vegetables (tinned, frozen and fresh) and fruit (tinned, frozen, dried and fresh), and the average number of servings on those days. In this investigation we explore the participants' total fruit and vegetable intake (days*servings).

Psychological variables

At Time 1 participants responded to 28 adjectives that correspond to five personality dimensions: extraversion (e.g., “talkative”; $\alpha = .75$), agreeableness (e.g., “sympathetic”; $\alpha = .78$), conscientiousness (e.g., “efficient”; $\alpha = .79$), neuroticism (e.g., “jealous”; $\alpha = .80$), and openness (e.g., “imaginative”; $\alpha = .75$). Items were taken from an established scale ([Saucier, 1994](#)) and were scored from 1 (*does not describe me at all*) to 7 (*describes me very well*). Participants also completed the K-10 ([Kessler et al., 2002](#)) that includes 10 items of psychological distress sensitivity (e.g., “you feel depressed?”; $\alpha = .92$) scored from 1 (*all of the time*) to 5 (*none of the time*).

Results

Descriptive data are presented in [Table 1](#) and findings from the linear regression models are presented in [Table 2](#). 2014 estimates of walking ($R^2 = .04$), moderate ($R^2 = .06$), and vigorous ($R^2 = .11$) physical activity were related to 2010 demographic, socioeconomic, health, and psychological variables. The standardised regression coefficients ([Table 2](#)) show that demographics, socioeconomic, and health variables were important, but psychological traits (personality and distress sensitivity) were relatively unimportant for all intensities of physical activity. For the combined physical activity index, age ($\beta = -.14$), sex ($\beta = -.14$), occupational status ($\beta = -.14$), working hours ($\beta = .18$) and neighbourhood remoteness ($\beta = .10$) showed the largest standardised regression coefficients. Thus, more active adults tended to be younger, male, reported a lower occupational status, reported working more hours, and lived in more remote areas. Across subcategories, demographics (age and sex) appear more important for vigorous intensity physical activity than for walking or moderate intensity physical activity, and socioeconomic factors appear more important for moderate intensity physical activity than for walking or vigorous intensity physical activity.

Discussion

This investigation explored longitudinal determinants of walking, moderate, and vigorous physical activity in a large cohort of Australian

Table 1
Descriptive statistics (and correlations with physical activity categories) for all measured variables.

	Mean	SD	Skew	Walking	Moderate PA	Vigorous PA	Combined PA
Walking	258.41	329.43	1.83				
Moderate PA	178.61	290.67	2.19	.27***			
Vigorous PA	121.70	230.96	2.82	.21***	.28***		
Combined PA	557.20	603.50	1.75	.75***	.73***	.63***	
Sex	53.1% Women			-.05***	-.13***	-.20***	-.17***
Marital status	49.3% Legally married			.05***	-.01	.09***	.05***
Age	43.87	18.01	.25	-.12***	-.04***	-.20***	-.16***
Education level	6.16	2.67	-.29	.02	.03***	.04***	.04***
Resident children	.72	1.09	1.59	.01	-.00	-.01	-.00
Occupational status	32.84	30.23	.42	.02	-.06***	.03**	-.01
Hours worked	24.05	21.25	.22	.09***	.07***	.14***	.14***
Income	585.53	748.21	2.16	.03**	-.02	.06***	.04***
Neighbourhood socioeconomic position	5.60	2.87	-.05	-.01	-.04***	.01	-.02*
Neighbourhood remoteness	.50	.78	1.52	.05***	.13***	.07***	.11***
Neighbourhood economic resources	5.53	2.82	-.03	-.00	.00	.02	.01
General health	69.92	20.71	-.79	.09***	.07***	.12***	.13***
BMI	26.58	5.44	1.21	-.07***	-.04***	-.08***	-.09***
Smoking frequency	16.17	44.60	3.45	.04***	.07***	.06***	.07***
Alcohol consumption	5.08	2.57	-1.20	-.01	-.00	-.01	-.01
Vegetable intake	16.89	9.31	.58	.04***	.04***	-.01	.04***
Fruit intake	9.85	8.06	1.11	.02*	-.00	.01	.02
Distress sensitivity	15.47	6.08	1.92	-.02*	-.04***	-.02*	-.04***
Extraversion	4.43	1.07	-.10	.03**	-.01	.05***	.03**
Agreeableness	5.35	.92	-.60	-.01	-.03**	-.07***	-.05***
Conscientiousness	5.07	1.02	-.37	-.00	.00	-.02*	-.01
Neuroticism	2.77	1.06	.46	.02	-.01	.04***	.02*
Openness	4.17	1.07	-.10	.02	.02	.03**	.03**

Note: PA = physical activity. BMI = body mass index. Sex was coded as 1 (men) or 2 (women), and marital status was coded as 1 (legally married) and 2 (not legally married). $n = 11,133$. * $p < .05$, ** $p < .01$, *** $p < .001$.

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