View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by University of Queensland eSpace

Long-Term Dynamics in Physical Activity Behavior across the Transition to Parenthood

Introduction

Undertaking regular Moderate to Vigorous Physical Activity (MVPA) has well-established health and wellbeing benefits (Egger et al. 2001; Mummery et al. 2004; Perales et al. 2014a; Perales et al. 2014b), while physical inactivity and sedentarism are amongst the top causes for disease, disability and mortality across the globe (Waxman 2004). Additionally, lack of physical activity has been related to increasing individual- and societal-level healthcare costs (Blair 2009). It is thus highly relevant for academics and policymakers alike to gain a deep understanding of the factors that promote or deter participation in this sort of activity. We know that MVPA not only differs across individuals with different socio-demographic profiles, but also within individuals over the life course (Azevedo et al. 2007; Brown and Roberts 2011; Hansen et al. 2014; Mann et al. 2013; Osler et al. 2001; Parks et al. 2003).

There is increasing recognition that life-course events play a key role in promoting or deterring MVPA, with most of the attention focused on work-related transitions (Barnett et al. 2014; Dai et al. 2014; Engberg et al. 2012), such as the retirement transition (Henkens et al. 2008; Zantinge et al. 2014). There is also some research on other major life events, including relationship transitions (Eng et al. 2005) or the onset of certain health conditions (Oman and King 2000).

We focus on a life-course transition that has so far been relatively neglected: parenthood. The transition to parenthood is a major life-course transition that (i) is experienced sooner or later by a majority of people and (ii) has a transformative effect on people's lives by shifting goals, identity and resources such as time and income. Additionally, sociological research has demonstrated that the transition to parenthood is associated with the onset of gender inequalities in, amongst others, paid and unpaid work, leisure and sleep time, and mental health (Baxter et al. 2008; Budig and England 2001; Craig and Mullan 2013; Kaufman and Uhlenberg 2000; Singley and Hynes 2005; Wheaton 1990).

Few studies have examined the relationships between parenthood and MVPA, with contradictory results. Some report that MVPA decreases before and after the birth of a child (Brown et al. 2009; Pereira et al. 2007) with a slight rebound postpartum (Pereira et al. 2007), whereas others report no difference in MVPA between parents and non-parents and for individuals who move into parenthood (Blum et al. 2004; Treuth et al. 2005). Most of these studies use cross-sectional or short-span longitudinal data, and so fail to examine long-term dynamics in MVPA across the transition to parenthood. Taking a longitudinal approach is important because it can inform more targeted and appropriately timed strategies to prevent losses in MVPA associated with entry into parenthood.

In this paper we examine the frequency of MVPA for men and women in the years leading to and from the transition to parenthood using a large, nationally representative, Australian, panel study. In doing so, we develop a piecewise pre/post fixed-effect modelling strategy that (i) accounts for person-specific unobserved confounders, (ii) provides policy-relevant insights into long-term time dynamics, and (iii) can be extended to the analysis of other life-course transitions.

Methods

To examine the effects on MVPA of the transition to parenthood we exploit the properties of the Household, Income and Labour Dynamics in Australia (HILDA) Survey, a large, nationally representative, panel dataset. For more information about the survey properties, see Watson and Wooden (2012). For 12 consecutive years (2001 to 2012), the HILDA Survey has collected information on the weekly frequency of MVPA undertaken by respondents within a self-completion questionnaire item that reads: "*In general, how often do you participate in moderate or intensive physical activity for at least 30 minutes? Moderate level physical activity will cause a slight increase in breathing and heart rate, such as brisk walking*". Possible responses include: [0] 'Not at all', [1] 'Less than once a week', [2] '1 or 2 times a week', [3] 'Three times a week', [4] 'More than 3 times a week (but not every day)', and [5] 'Everyday'.

Our analytical sample comprises 61,968 yearly observations from 11,267 men and 70,642 yearly observations from 12,284 women who are over 18 years of age. The distribution of the MVPA variable by sex is shown in Figure 1. A majority of respondents cluster in the middle categories, especially "1 or 2 times a week" and "More than 3 times a week (but not every day)", but men are on average more physically active than women in Australia.

Our interest is on changes in the frequency of MVPA across the transition to parenthood. We derive several analytical variables of increasing complexity tapping into different dimensions of this important life-course transition. First, we create a simple 'parenthood' dummy variable that takes the value 1 if individuals have been observed to become parents in any previous wave of the panel, and the value 0 otherwise. Second, for those who are observed to become parents, we construct two continuous measures counting the number of years before the first birth and the number of years after. Third, we develop quadratic and cubic terms of these two variables to capture non-linear trajectories in MVPA before and after the birth of the first child.

To model the relationships between MVPA and the transition to parenthood in a multivariate setting we use fixed-effect models for panel data. These have the advantage over traditional cross-sectional designs that they account by design for any unobserved time-constant person-specific factors that might confound the associations of interest. This is accomplished by estimating how deviations from individuals' usual behaviour relate to deviations from their usual outcomes - see Allison (2009) and Wooldridge (2010) for further methodological detail, and Perales (2014a; 2014b) for applications in the context of MVPA. Formally, the models take the form:

$$MVPA_{po} - \overline{MVPA}_P = a + \left(X_{po} - \bar{X}_p\right)b + (Z_P - \bar{Z}_P)c + (e_{po} - e_p) + (u_p - \bar{u}_p) \quad (1)$$

…where subscripts p and o refer to the person and observation period respectively, the horizontal bar $(\bar{.})$ refers to the mean value, $MVPA$ is a measure of the weekly frequency of MVPA, X represents time-changing explanatory variables (including variables on parenthood), Z represents time-constant explanatory variables, b and c are coefficient vectors, e is the usual stochastic error term in regression, and u refers to person-specific idiosyncratic unobserved factors affecting MVPA.

Application of the within person transformation by subtracting person means from person-year observations, as done above, averages out the Z and u terms from equation (1), which simplifies to:

$$MVPA_{po} - \overline{MVPA}_P = a + \left(X_{po} - \bar{X}_P\right)b + (e_{po} - e_p) \quad (2)$$

This enables estimation of the effects of the X variables on $MVPA$ while controlling for u, which minimizes potential omitted variable bias.

This model requires repeated observations from the same individuals for at least two time periods, and explanatory variables that change over time. This is because the predicted impacts are estimated using only information from individuals who experience change in their circumstances over the life of the panel. For example, only individuals who become parents for the first time over the observation window (n=1,767) contribute to the estimation of the predicted impacts on the explanatory variables capturing aspects of the transition to parenthood.

Note also that despite MVPA being an ordered variable and fixed-effect models for ordered responses being possible (see e.g. our previous work, BLINDED REFERENCE), in this paper we will treat MVPA as a continuous variable ranging from 0 to 5. This is because doing so substantially simplifies estimation, interpretation and graphical representation of the results. This course of action is validated by the fact that (i) the variable is roughly normally distributed, (ii) the errors in the regression are also normally distributed, (iii) not a single one of the 132,610 predicted values falls outside the admissible 0 to 5 range, and (iv) sensitivity checks using more complex ordered fixed-effect models give very similar results.

Variables known to influence MVPA are used as control variables in our models. They include age, age square (to capture non-linear age trends in physical activity over the life course); marital status (married or *de facto*, single, divorced, separated or widowed); highest educational qualification (low or no education, school year 12, professional certificate, University degree); employment status (employed in white collar occupation, employed in blue collar occupation, unemployed, inactive); living alone; total weekly work hours (the sum of domestic and paid work hours); annual household income; self-assessed health (on a scale of 1 to 5); having a long term health condition, disability or impairment; and being a smoker. Means and standard deviations for these variables are shown in Table 1.

Results

We first examine raw means of MVPA across the transition to parenthood for those men and women who are observed to have children over the life of the HILDA Survey panel. The results are presented in the top left-hand side of Figure 2. Men undertake more frequent MVPA than women. Both men and women decrease the frequency of MVPA in the years immediately preceding and following the birth of the first child, with a slight recovery becoming apparent from 3 years after the parenthood event onward. Thus, in the raw data, parenthood brings about a reduction in the frequency of MVPA for men and women from even before the birth of the child, with evidence of non-linear associations.

We will now estimate the trend while controlling for observable and unobservable confounding factors using panel fixed-effect regression models. The predicted impacts are presented in Table 2. A first, simple way to accomplish this is to use a dichotomous 'parenthood' indicator (Model 1). There is a statistically significant decrease in MVPA with parenthood amongst men (b=—0.282, p<0.001) and an even more pronounced fall amongst women (b=—0.440, p<0.001) when the first child is born. The predicted effect is shown in the top right-hand side of Figure 2. This approach is nevertheless restrictive and ignores the time dimensions of the relationship discussed before.

A better approach is to include continuous variables capturing the years before and after the transition to parenthood as additional regressors (Model 2). Doing so reveals that not only is there a downward discontinuity in MVPA amongst men (b=—0.193, p<0.001) and women (b=—0250, p<0.001) when they become parents, but also a previous and a posterior downward trend. These can be inferred from the negative and statistically significant coefficients on the variables capturing years before the first birth (b=—0.029, p<0.01 for men; b=—0.057, p<0.001 for women) and – for women only – years after the first birth (b=—0.031, p<0.001). This time trend can be better inferred by inspection of the bottom left-hand side of Figure 2.

An even more encompassing approach to model these relationships is that undertaken in Model 3, where a quadratic term for the variable 'years before first birth' and quadratic and cubic terms for the variable 'years after first birth' are added. We also tried a cubic term for the variable 'years before the first birth' but the associated coefficient was statistically insignificant for both men and women. For men, the model reveals an abrupt fall in MVPA after the birth of the first child (b=—0.116, p<0.1), and a linear downward trend thereafter (b=—0.078, p<0.05). For women, however, there are no abrupt changes (b=0.025, p>0.1) but rather steeper, smooth and non-linear prior (b=—0.170, p<0.001; b^2=—0.012, p<0.001) and posterior trajectories (b=—0.185 p<0.001; b^2=0.033 p<0.001; b^3=—0.002, p<0.01). These time dynamics can be more clearly visualized in the bottom right-hand side of Figure 2.

Though not the focus of this research, our models also provide insights into the role of other factors in promoting or deterring the frequency of MVPA (Table 1). *Ceteris paribus*, ill health, the presence of a long term health condition, and being partnered, a smoker, or employed in a white collar (rather than blue collar) occupation are all negatively and statistically significantly related to men's and women's frequency of MVPA. For both sexes, there is also a concave relationship between age and MVPA, with turning points at 46 and 47 years of age respectively. Living alone, working more hours and being unemployed (rather than employed in white collar work) are positive and significantly associated to women's (but not men's) MVPA, whereas education and income have no independent effects on neither men nor women.

Discussion

In this paper we have used 12 years of nationally representative panel data from the HILDA Survey and a novel piecewise pre/post fixed-effect modelling strategy to examine the influence of the transition to parenthood on men's and women's frequency of MVPA. Our approach has the advantages of being able to (i) control for time-constant unobserved confounders, (ii) unveil long-term dynamic temporal dimensions, (iii) separate effects before, during and after the parenthood transition, and (iv) allow for non-linear associations. By using this modelling technique, we offer a unique and more nuanced picture of the relationships between parenthood and MVPA. The model we fit is nevertheless data demanding and requires a panel dataset that, as the HILDA Survey: (i) stretches over a long period of time, (ii) collects data reasonably frequently, and (iii) contains observations from a sufficiently large number of people before and after they experience the life-course transition of interest.

A number of interesting findings emerge from our empirical analyses. First, we show that there is a decline in MVPA for men and a most noticeably one for women after they experience the birth of their first child. This is consistent with sociological evidence that women do the lion share of young infants' care, which reduces the time that they can devote to leisure – including activities that feature MVPA (Craig 2007). Other potential reasons include a higher post-partum prevalence of overweight, tiredness and mobility restrictions amongst women (Evenson et al. 2009). Second, the pattern of change in the frequency of MVPA differs by sex across the transition to parenthood: women experience a smooth declining trend before and after the birth of the first child, whereas men experience an abrupt fall in the year immediately after. This may reflect that birth takes a toll on women's fitness levels during pregnancy, and men only experience major constraints to their MVPA when the child has arrived. It is also plausible that couples decide to transit to parenthood after they have adopted a more sedentary lifestyle for exogenous reasons. Third, neither men nor women seem to ever return to prior MVPA frequency levels after the birth of the first child, despite a timid recovery between 4 and 8 years after. This suggests that the presence of young children is an important factor deterring MVPA. Overall, we find persistent gender differences - whereby men do more MVPA than women - amongst individuals who become parents, and these exacerbate over time. For example, the predicted difference in mean MVPA between men and women 3 years before the birth of the first child is 0.1 units (on a 0-5 scale), but this grows to 0.5 units by 4 years after the birth of the first child.

Our findings can be used to inform evidence-based policies that capitalize on the unique temporal dimensions that we unveil. First and foremost, policymakers interested in promoting MVPA should turn their attention to parenthood as a critical deterring factor, as becoming a parent can trigger long term trends of low MVPA. Our findings suggest that particular measures should be taken to encourage MVPA amongst fertile-age women, as they not only tend to undertake less frequent MVPA than men, but also experience more marked reductions due to parenthood. Effective policy measures for both men and women should also target prospective parents, as the fall in MVPA begins prior to the birth of the first child. Finally, policy planners should be wary of basing their decisions on findings from over-simplistic analyses, as these can give an incomplete or even distorted picture of the true relationships.

Despite the powerful features of the panel dataset used, an important limitation of our study is the nature of the information on MVPA available in the HILDA Survey. As previously noted - see Brown and Roberts (2011); Perales et al. (2014a; 2014b), the construct is self-reported and prone to measurement error; does not discriminate moderate from vigorous physical activity; and captures overall MVPA but lacks insights into the duration and domain of the activities undertaken. Of these, it is particularly unfortunate that unlike some recent and influential studies - see Barnett et al. (2014) - we cannot disentangle the dynamic effects of parenthood on different domains of MVPA, including recreational, household, transport and work-related MVPA, or sedentary behaviour. Additionally, with these data it cannot be tested whether parenthood promotes lighter forms of physical activity.

Nevertheless, our findings and methodological innovation pave the way for emerging research avenues. New research could further our substantive findings by examining factors producing heterogeneity in MVPA outcomes after the parenthood transition. In this paper, we report the overall trend, but it is likely that some new parents see their MVPA levels decline more than others, for instance those who did little MVPA prior to the birth, the lowly educated and those with poor physical or mental health. Models featuring statistical interactions and/or random coefficients could be deployed to accomplish this. Our analytical approach is suitable to be applied to the analysis of the frequency of MVPA across other important life-course transitions that have not yet been examined or only explored using rudimentary techniques, such as retirement or relationship dissolution. The model can also be expanded to explore the influence on MVPA of higher order births through the use of multilevel multi-process models (Haynes 2010).

We conclude by stressing that the transition to parenthood is an important factor influencing MVPA, and has more marked effects on women than men. This is important, as decreasing rates of physical activity across the transition to parenthood not only pose health risks to parents, but can be transmitted to their offspring (Dollman 2010). Modelling strategies that do not allow for longitudinal and non-linear effects provide an incomplete and even distorted picture of the nature of the associations. Understanding MVPA and its gendered dimensions requires turning our attention to the role of long-term life-course trajectories.

Acknowledgements

We are thankful for useful comments and suggestions by two anonymous referees. This paper uses unit record data from the HILDA Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either DSS or the Melbourne Institute.

References

Allison P (2009) Fixed Effects Regression Models. Sage, London

Azevedo MR, Araujo CL, Reichert FF, Siqueira FV, da Silva MC, Hallal PC (2007) Gender differences in leisure-time physical activity Int J Public Health 52:8-15

Barnett I, van Sluijs E, Ogilvie D, Wareham NJ (2014) Changes in household, transport and recreational physical activity and television viewing time across the transition to retirement: longitudinal evidence from the EPIC-Norfolk cohort Journal of epidemiology and community health 68:747-753 doi:10.1136/jech-2013-203225

Baxter J, Hewitt B, Haynes M (2008) Life course transitions and housework: Marriage, parenthood, and time on housework J Marriage Fam 70:259-272 doi:DOI 10.1111/j.1741-3737.2008.00479.x

Blair SN (2009) Physical inactivity: the biggest public health problem of the 21st century British journal of sports medicine 43:1-2

Blum JW, Beaudoin CM, Caton-Lemos L (2004) Physical activity patterns and maternal well-being in postpartum women Matern Child Healt J 8:163-169 doi:Doi 10.1023/B:Maci.0000037649.24025.2c

Brown H, Roberts J (2011) Exercising choice: the economic determinants of physical activity behaviour of an employed population Social science & medicine 73:383-390 doi:10.1016/j.socscimed.2011.06.001

Brown WJ, Heesch KC, Miller YD (2009) Life Events and Changing Physical Activity Patterns in Women at Different Life Stages Ann Behav Med 37:294-305 doi:DOI 10.1007/s12160-009-9099-2

Budig MJ, England P (2001) The wage penalty for motherhood Am Sociol Rev 66:204-225 doi:Doi 10.2307/2657415

Craig L (2007) Contemporary Motherhood: The Impact of Children on Adult Time. Aldershot, Ashgate

Craig L, Mullan K (2013) Parental Leisure Time: A Gender Comparison in Five Countries Soc Polit 20:329-357 doi:Doi 10.1093/Sp/Jxt002

Dai S, Wang F, Morrison H (2014) Predictors of decreased physical activity level over time among adults: a longitudinal study American journal of preventive medicine 47:123-130 doi:10.1016/j.amepre.2014.04.003

Dollman J (2010) Changing associations of Australian parents' physical activity with their children's sport participation: 1985 to 2004 Australian and New Zealand journal of public health 34:578-582 doi:DOI 10.1111/j.1753-6405.2010.00617.x

Egger G, Donovan RJ, Giles-Corti B, Bull F, Swinburn B (2001) Developing national physical activity guidelines for Australians Australian and New Zealand journal of public health 25:561-563

Eng PM, Kawachi I, Fitzmaurice G, Rimm EB (2005) Effects of marital transitions on changes in dietary and other health behaviours in US male health professionals Journal of epidemiology and community health 59:56-62 doi:10.1136/jech.2004.020073

Engberg E, Alen M, Kukkonen-Harjula K, Peltonen JE, Tikkanen HO, Pekkarinen H (2012) Life events and change in leisure time physical activity: a systematic review Sports medicine 42:433-447 doi:10.2165/11597610-000000000-00000

Evenson KR, Aytur SA, Borodulin K (2009) Physical Activity Beliefs, Barriers, and Enablers among Postpartum Women J Womens Health 18:1925-1934 doi:DOI 10.1089/jwh.2008.1309

Hansen BH, Ommundsen Y, Holme I, Kolle E, Anderssen SA (2014) Correlates of objectively measured physical activity in adults and older people: a cross-sectional study of population-based sample of adults and older people living in Norway Int J Public Health 59:221-230 doi:10.1007/s00038-013-0472-3

Haynes M, Baxter, J. , Hewitt, B. , Western, M. (2010) Marital Status Transitions and Domestic Labour: A Multiprocess, Multilevel Approach. Paper presented at the Annual meeting of the American Sociological Association, Atlanta, USA, Henkens K, van Solinge H, Gallo WT (2008) Effects of retirement voluntariness on changes in smoking, drinking and physical activity among Dutch older workers European journal of public health 18:644-649 doi:10.1093/eurpub/ckn095

Kaufman G, Uhlenberg P (2000) The influence of parenthood on the work effort of married men and women Soc Forces 78:931-947 doi:Doi 10.2307/3005936

Mann KD, Hayes L, Basterfield L, Parker L, Pearce MS (2013) Differing lifecourse associations with sport-, occupational- and household-based physical activity at age 49-51 years: the Newcastle Thousand Families Study Int J Public Health 58:79-88 doi:10.1007/s00038-012-0392-7

Mummery K, Schofield G, Caperchione C (2004) Physical activity dose-response effects on mental health status in older adults Australian and New Zealand journal of public health 28:188-192

Oman RF, King AC (2000) The effect of life events and exercise program format on the adoption and maintenance of exercise behavior Health psychology : official journal of the Division of Health Psychology, American Psychological Association 19:605-612

Osler M, Clausen JO, Ibsen KK, Jensen GB (2001) Social influences and low leisure-time physical activity in young Danish adults European journal of public health 11:130-134

Parks SE, Housemann RA, Brownson RC (2003) Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States Journal of epidemiology and community health 57:29-35

Perales F, del Pozo-Cruz J, del Pozo-Cruz J, del Pozo-Cruz B (2014a) On the associations between physical activity and quality of life: findings from an Australian nationally representative panel survey Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation 23:1921-1933 doi:10.1007/s11136-014-0645-4

Perales F, Pozo-Cruz JD, Pozo-Cruz BD (2014b) Impact of Physical Activity on Psychological Distress: A Prospective Analysis of an Australian National Sample American journal of public health:e1-e7 doi:10.2105/AJPH.2014.302169

Pereira MA, Rifas-Shiman SL, Kleinman KP, Rich-Edwards JW, Peterson KE, Gillman MW (2007) Predictors of change in physical activity during and after pregnancy - Project viva American journal of preventive medicine 32:312-319 doi:DOI 10.1016/j.amepre.2006.12.017

Singley SG, Hynes K (2005) Transitions to parenthood - Work-family policies, gender, and the couple context Gender Soc 19:376-397 doi:Doi 10.1177/0891243204271515

Treuth MS, Butte NF, Puyau M (2005) Pregnancy-related changes in physical activity, fitness, and strength Med Sci Sport Exer 37:832-837 doi:Doi 10.1249/01.Mss.0000161749.38453.02

Watson N, Wooden M (2012) The HILDA Survey: A case study in the design and development of a successful household panel study. Longitudinal and life course studies 3:369-38

Waxman A (2004) World Health Organization global strategy on diet, physical activity and health Food and nutrition bulletin 25:292-302

Wheaton B (1990) Life Transitions, Role Histories, and Mental-Health Am Sociol Rev 55:209-223 doi:Doi 10.2307/2095627

Wooldridge J (2010) Econometric Analysis of Cross Section and Panel Data (2nd edition) MIT Press, London

Zantinge EM, van den Berg M, Smit HA, Picavet HS (2014) Retirement and a healthy lifestyle: opportunity or pitfall? A narrative review of the literature European journal of public health 24:433-439 doi:10.1093/eurpub/ckt157

Tables and figures

Table 1 Sample descriptive statistics, Australia (HILDA Survey 2001-2012)

	Men		Women	
	Mean/%	SD	Mean/%	SD
Moderate to Vigorous Physical Activity	2.72	1.56	2.43	1.52
Parenthood	70%		65%	
Age	45.64	17.07	45.73	17.36
Marital status				
Married or *de facto*	70%		65%	
Single	21%		17%	
Divorced, separated or widowed	9%		18%	
Lives alone	15%		16%	
Highest educational qualification				
Low or no education	26%		36%	
Year 12	15%		17%	
Professional certificate	38%		23%	
University degree	22%		24%	
Employment status				
Employed in white collar occupation	38%		46%	
Employed in blue collar occupation	35%		14%	
Unemployed	3%		3%	
Inactive	24%		38%	
Total weekly work hours (in 10s)	3.74	2.23	3.53	1.99
Annual household income (in 10,000s)	8.37	6.37	7.86	6.23
Self-assessed health (1-5)	3.39	0.97	3.37	0.96
Long-term health condition	27%		27%	
Smoker	24%		19%	
n (observations)	61,968		70,642	
n (individuals)	11,267		12,284	

Table 2 Predictions from linear fixed-effect models of the weekly frequency of Moderate to Vigorous Physical Activity (MVPA), Australia (HILDA Survey 2001-2012)

	Model 1		Model 2		Model 3		
	Men	Women	Men	Women	Men	Women	p (Wald)
Parenthood	-0.282***	-0.440***	-0.193***	-0.250***	-0.116(*)	0.025	ϑ
	(0.033)	*(0.032)*	*(0.044)*	*(0.041)*	*(0.064)*	*(0.058)*	
Years before first birth			-0.029**	-0.057***	-0.049(*)	-0.170***	ϑ
			(0.010)	*(0.009)*	*(0.030)*	*(0.027)*	
Years before first birth^2					-0.002	-0.012***	ϑ
					(0.003)	*(0.003)*	
Years after first birth			-0.010	-0.031***	-0.078*	-0.185***	ϑ
			(0.007)	*(0.007)*	*(0.038)*	*(0.035)*	
Years after first birth^2					0.015	0.033***	ϑ
					(0.010)	*(0.009)*	
Years after first birth^3					-0.001	-0.002**	
					(0.001)	*(0.001)*	
Age	0.027***	0.068***	0.032***	0.080***	0.032***	0.080***	ϑ
	(0.006)	*(0.005)*	*(0.006)*	*(0.005)*	*(0.006)*	*(0.005)*	
Age^2	-0.000***	-0.001***	-0.000***	-0.001***	-0.000***	-0.001***	
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	
Married or *de facto (ref.)*							
Single	0.185***	0.162***	0.170***	0.137***	0.172***	0.143***	
	(0.033)	*(0.030)*	*(0.034)*	*(0.030)*	*(0.034)*	*(0.030)*	
Divorced, separated or widowed	0.098*	0.080**	0.098*	0.085**	0.098*	0.085**	
	(0.038)	*(0.029)*	*(0.038)*	*(0.029)*	*(0.038)*	*(0.029)*	
Lives alone	-0.021	0.065*	-0.021	0.060*	-0.022	0.057*	ϑ
	(0.029)	*(0.026)*	*(0.029)*	*(0.026)*	*(0.029)*	*(0.026)*	
Low or no education *(ref.)*							
Year 12	-0.002	-0.062	-0.006	-0.072	-0.006	-0.068	
	(0.067)	*(0.055)*	*(0.067)*	*(0.055)*	*(0.067)*	*(0.055)*	
Professional certificate	-0.045	-0.031	-0.050	-0.045	-0.049	-0.045	

	(0.059)	*(0.043)*	*(0.059)*	*(0.043)*	*(0.059)*	*(0.043)*	
University degree	0.023	-0.041	0.018	-0.059	0.017	-0.064	
	(0.078)	*(0.062)*	*(0.078)*	*(0.063)*	*(0.078)*	*(0.063)*	
Employed in white collar occupation *(ref.)*							
Employed in blue collar occupation	0.107***	0.090***	0.107***	0.089***	0.107***	0.091***	
	(0.019)	*(0.020)*	*(0.019)*	*(0.020)*	*(0.019)*	*(0.020)*	
Unemployed	0.020	0.164***	0.020	0.169***	0.020	0.168***	ϑ
	(0.040)	*(0.033)*	*(0.040)*	*(0.033)*	*(0.040)*	*(0.033)*	
Inactive	0.056(*)	0.123***	0.056(*)	0.123***	0.056(*)	0.122***	ϑ
	(0.031)	*(0.019)*	*(0.031)*	*(0.019)*	*(0.031)*	*(0.019)*	
Total weekly work hours (in 10s)	0.001	0.012**	0.001	0.012**	0.001	0.012**	ϑ
	(0.005)	*(0.004)*	*(0.005)*	*(0.004)*	*(0.005)*	*(0.004)*	
Annual household income (in 10,000s)	-0.001	0.000	-0.001	0.000	-0.001	0.000	
	(0.001)	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	
Self-assessed health (1-5)	0.291***	0.249***	0.291***	0.249***	0.291***	0.249***	ϑ
	(0.009)	*(0.008)*	*(0.009)*	*(0.008)*	*(0.009)*	*(0.008)*	
Long-term health condition	-0.086***	-0.091***	-0.086***	-0.091***	-0.085***	-0.092***	
	(0.017)	*(0.015)*	*(0.017)*	*(0.015)*	*(0.017)*	*(0.015)*	
Smoker	-0.064**	-0.085***	-0.064**	-0.087***	-0.065**	-0.089***	
	(0.024)	*(0.023)*	*(0.024)*	*(0.023)*	*(0.024)*	*(0.023)*	
n (observations)	61,968	70,642	61,968	70,642	61,968	70,642	
n (individuals)	11,267	12,284	11,267	12,284	11,267	12,284	
Within group R^2	0.028	0.029	0.028	0.030	0.028	0.031	

Notes: Standard errors in parentheses. Significance levels on model coefficients: (*) $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. ϑ = The p-value of a Wald test comparing the Model 3 coefficients for men and women is smaller than 0.05.

Figures

Fig 1 Frequency of Moderate to Vigorous Physical Activity (MVPA) by gender, Australia (HILDA Survey 2001-2012)

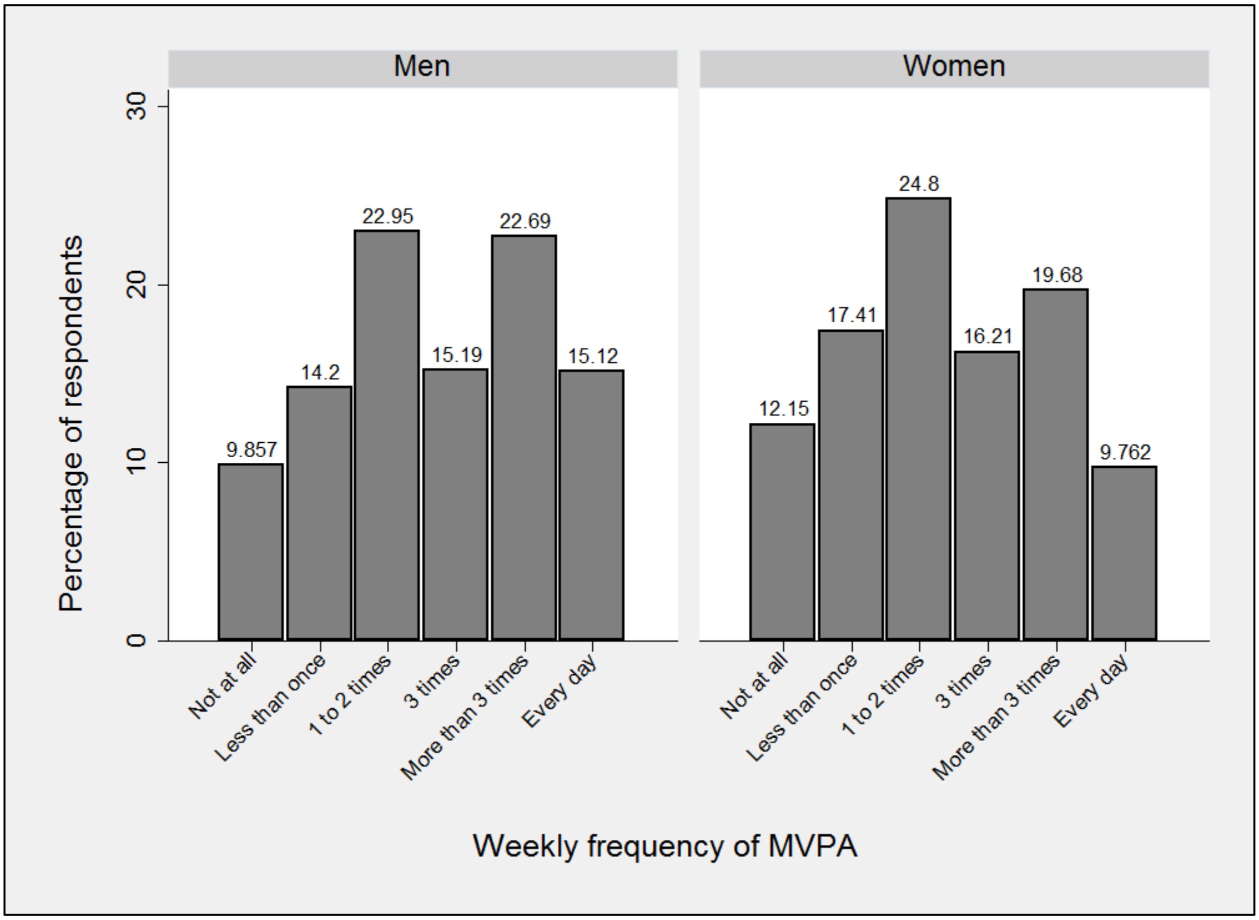
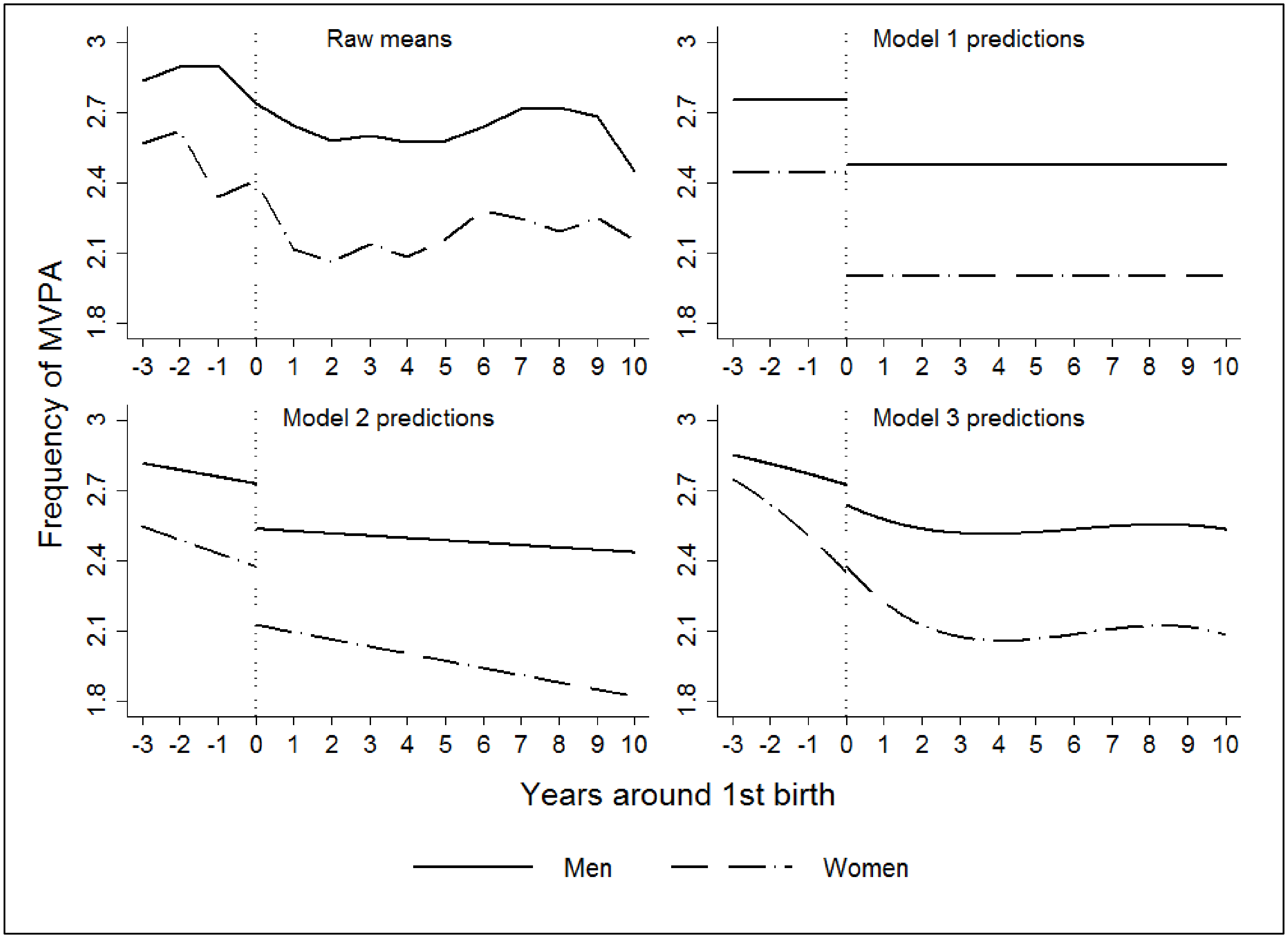


Fig 2 Frequency of Moderate to Vigorous Physical Activity (MVPA) across the transition to parenthood, Australia (HILDA Survey 2001-2012)



Notes: Predictions based on model results in Table 2 for a representative individual who is married, is employed in a white-collar occupation, is 30 years old, works 40 hours per week, has a University degree, has an annual income of $80,000, does not live alone, does not have a long-term health condition, does not smoke, and reports a general health score of 3.4.