
Not all hours are equal: could time be a social determinant of health?

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Abstract Time can be thought of as a resource that people need for good health. Healthy behaviour, accessing health services, working, resting and caring all require time. Like other resources, time is socially shaped, but its relevance to health and health inequality is yet to be established. Drawing from sociology and political economy, we set out the theoretical basis for two measures of time relevant to contemporary, market-based societies. We measure amount of time spent on care and work (paid and unpaid) and the intensity of time, which refers to rushing, effort and speed. Using data from wave 9 (N = 9177) of the Household, Income and Labour Dynamics of Australia Survey we found that time poverty (> 80 h per week on care and work) and often or always rushing are barriers to physical activity and rushing is associated with poorer self-rated and mental health. Exploring their social patterning, we find that time-poor people have higher incomes and more time control. In contrast, rushing is linked to being a woman, lone parenthood, disability, lack of control and work–family conflicts. We supply a methodology to support quantitative investigations of time, and our findings underline time’s dimensionality, social distribution and potential to influence health. A video abstract of this article can be found at: https://www.youtube.com/watch?v=5__HOxglddk&feature=youtu.be

Keywords: gender inequalities, physical activity, mental health, social determinants of health, time poverty, time pressure, work and family

Introduction

The distribution of resources – from the material to the social – is central to an analysis of how societies shape health (Scambler 2012). We propose that time is another resource people require for good health, and addressing its social patterning and health consequences would help achieve public health goals (Strazdins *et al.* 2011). Lack of time is one of the most common reasons people give for not exercising or not eating healthy food, behaviour essential to halting chronic disease burdens (see Banwell *et al.* 2005, Jabs and Devine 2006, Sherwood and Jeffery 2000). Building strong and supportive relationships involves time, as does earning an income and visiting a doctor. Yet, despite its potential relevance to people’s health, time’s

role as a social determinant of health remains largely untheorised and untested: few health policies or interventions address it, and few quantitative studies of health systematically research it.

One obstacle for quantitative research is how to think about (and therefore measure) time. Outside the field of population health there exists a well-developed literature theorising time, its dimensions and its significance to people's experience of agency, power and value. Within population health, what time is and what people mean when they say they lack it is usually taken for granted. In the few quantitative studies to date, time is measured as a count of hours, an amount that people allocate to activities (also referred to as clock time). Constraints on people's time can result from excessive or competing demands (not enough hours, for example, Spinney and Millward 2010) or from priorities and attitudes (when people have enough hours but the problem is how they allocate them, for example, Trost *et al.* 2002). However, when people say that they don't have enough time, they may also be referring to other aspects of time, such as the intensity of their temporal experience, which is connected to an accelerating pace of life, rushing and trying to do more (for example, Southerton 2003, Teuchmann *et al.* 1999). This aspect of people's time, and its potential to affect health, is rarely accorded the same legitimacy as insufficient hours and minutes, yet rushing and time intensification have become a defining characteristic of contemporary market societies, generating a new theory of modernity (Rosa 2013).

Technology and the premium placed on efficiency means that activities and tasks occur – and are expected to occur – faster and with less 'down' time; people rush through tasks or do them simultaneously, striving to keep pace or free up time (Southerton 2003). This occurs both on and off the job and it is especially acute when combining jobs with caregiving (Wacjman 2008). People's reports of time pressure have increased, even though, for many, their employment hours have reduced (Robinson and Godbey 2005). This apparent temporal paradox reflects both the unresolved and competing time demands of care and paid work and the experience of social acceleration (Rosa 2013). It further reflects the need to measure more than one dimension of time: intensified time cannot be revealed by a count of hours.

Whereas qualitative studies are well suited to investigating time as a multidimensional social resource we seek to introduce a dimensional approach to quantitative studies of time and health. A first step is to develop a feasible methodology that enables measures of time to be included in epidemiological and cohort studies. We therefore set out the theoretical basis for considering two dimensions of time, amount and intensity, discuss approaches to measuring them, examine their social patterning, and finally consider their relationships with health. Our aim is to advance research and policy approaches to time as a social determinant of health.

Two dimensions of time

There are established theoretical reasons to consider more than one dimension of time (Adam 1990, Shove *et al.* 2008). In this article we draw on theory from political economy and sociology to identify two dimensions central to contemporary societies. In a market economy employers pay workers for their time, thus defining a fundamental social relationship. In this wage–time exchange, time refers not only to how long people work but how fast: both elements theorised by Marx (*Capital, Vol. 1*, in Tucker 1978). Marx argued that profitability can be increased by holding wages constant and increasing the amount of time people work, or by increasing the intensity of work time (that is, how fast they work and how much they do per unit of time). Amount and intensity are constantly in play in the wage–time exchange and are integral to social stratification. Power relations are partly defined by people's ability to

determine the terms of the (time–wage) exchange, that is, how much money they are paid and how long and fast they work to earn it.

Further, market demands on time are not static: amount and intensity can be traded off. Thus amount of time at work can decline as intensity (and potentially productivity) increases, and this is one argument why work hours dropped from 12 hours per day in 1850 to 8 hours in 1950 (Nyland 1986). This does not necessarily mean, however, that as work hours go down people feel they have more time, because they are now trying to achieve more in each hour and are doing things faster, that is, their time has intensified. Nor can it be assumed that work hours will keep dropping or that intensification will plateau. New work regimes, enabled by technology, are continuously redefining performance, which in turn affects people's time. Outputs achieved are what matters, leading to what are termed boundaryless jobs. These jobs are spatially and temporally flexible, which means work can be done anywhere and at any time, so long as it gets done. On the one hand this helps people organise work around other commitments, on the other it erodes any limits on how long, when and how fast they work (Albertsen *et al.* 2010; Kamp *et al.* 2011).

Marx's analysis of the connection between time, power and the market was incomplete, however, with an omission symptomatic of another fundamental social divide. In families, caregiving and domestic work (largely women's work) is not included in the wage–time exchange, yet both forms of work are time-consuming, measurable and subject to intensification (Brown and Warner-Smith 2005). For example, US households without children are estimated to have a (free) time advantage of nearly 3 hours per day compared to households with one or more children (Kalenkoski *et al.* 2011). Women are more likely than men to rush, and even when they are employed, do more caregiving (Mattingly and Bianchi 2003). As well as a greater time intensity, women may face more time commitments in total, and proportionally more of their time will be unrewarded by income: all could contribute to gender differences in health (Bird and Fremont 1991).

Measuring amount of time Most quantitative studies of time sum the hours and minutes spent in contracted (employment and related travel), committed (caregiving, unpaid or domestic work) and necessary (personal care, sleep and eating) activities (Harvey and Mukhopadhyay 2007). Time poverty is said to occur when there is insufficient free time remaining, which, similar to income poverty, has been calculated based on 50, 60 or 70% of the median of population free time (for example, Kalenkoski *et al.* 2011). Time use diaries are the most accurate way to assess amounts of time, recording what people do over a 24-hour period (usually in 10 or 15 minute intervals), identifying their primary (for example, preparing a meal) and, in some instances, secondary activity (for example, also helping children with homework).

Time diaries are, however, relatively expensive and can be burdensome to respondents (Schulz and Grunow 2012). Diary days may not be representative, and comparing time use data longitudinally is problematic. Alternative measures of time use have been developed that may be more suitable for epidemiological designs (Juster *et al.* 2003). One approach involves a survey measure that asks people to estimate the hours per week they typically spend on sets of related activities (for example, housework, shopping and cooking) and uses a short set of items. While survey measures are distorted by recall bias, typically leading to overestimates of unstructured activities such as domestic work and care (Juster *et al.* 2003, Schulz and Grunow 2012), they supply fairly accurate estimates of hours spent in employment and commuting (Sonnenberg *et al.* 2012). They also preserve the rank ordering of time expenditures useful for longitudinal analyses (Juster *et al.* 2003).

Measuring time intensity Measuring the time people spend on activities does not reveal whether they are rushing, nor capture their experience of intensity. There is, however, no gold standard for directly assessing intensity, so most measures assess perceptions (Gunthorpe and Lyons 2004). A key problem with existing measures is that nearly all are confined to the workplace and are applicable only in studies of employed people. There is one index assessing a perceived 'time crunch' in both work and non-work roles, although it contains items about generally feeling worried, trapped or stressed (potentially confounded by mental health) (Zuke-wich 2003). A single item 'how often do you feel rushed and pressed for time?' has, however, been widely used in population surveys in Canada, the UK, Europe, the USA and Australia. Rushing and time pressure is associated with key elements of intensity: multi-tasking, a fast work pace, tight deadlines, frequent use of a cell phone and combining employment with caring (Bittman *et al.* 2009, Bittman and Wajcman 2000, Gunthorpe and Lyons 2004, Mattingly and Bianchi 2003).

Potential time–health relationships Like other socially structured resources, committed time is likely to be relevant to more than one aspect of health, and in more than one way. However, there are large gaps in the literature investigating these relationships and mechanisms; research to date has largely been piecemeal, and no single study considers amount and intensity together. Below, we briefly summarise available research to guide preliminary analyses and theory building.

Firstly, constraints on time may act as a barrier to behaviour that is important for health, especially physical activity and preparing healthy food. As noted earlier, lack of time is why many people say that they do not exercise (Reichert *et al.* 2007, Sherwood and Jeffery 2000, Spinney and Millward 2010). Few studies, however, have examined the influence of intensity on health behaviour. Yet rushing leads to physical and cognitive fatigue, with rest and recovery becoming the imperative, not healthy behaviour (Shah *et al.* 2012, Teuchmann *et al.* 1999).

Lack of time (in terms of hours and minutes) and rushing could also have direct impacts on health. For example, as well as fatigue, rushing and time pressure leads to a negative mood and is likely to affect health via a bio-behavioural stress response (Lundberg 1993, Offer and Schneider 2011, Teuchmann *et al.* 1999). Considering amount of time, the evidence is mixed. Long work hours may increase the risk for coronary heart disease and depression (Virtanen *et al.* 2010, 2011), although a cross-sectional study using diary data found that people with heavy time commitments (work and non-work) report better, not worse, self-rated health (Kal-enkoski *et al.* 2011). The relative share of paid to unpaid committed time may also affect health, with some studies showing that long hours spent in unpaid work are detrimental (Bird and Fremont 1991), others indicating that it is the combination of paid and unpaid time that is most problematic (MacDonald *et al.* 2005). Time intensity does not appear to be linked to coronary heart disease (Strodl *et al.* 2003) or general health complaints (Roelen *et al.* 2008). Some studies have found associations with poorer self-rated health, sleep problems and psychosomatic complaints (Höge 2009, Zuzanek 2004), but the most consistent relationship is with poorer mental health (De Raeve *et al.* 2009, Roxburgh 2004).

All the studies discussed above have assumed that relationships between time and health are one-directional, that is, that time affects health. However, there are other ways in which time and health may be related. Ill health and disability restricts how people spend their time and can be time-consuming. Ill health and disability is especially restrictive to paid work, leading to the convergence of poor health, low income and low time commitments (Podor and Halliday 2012). Here, health is driving people's capabilities to use their time, yet this process is also profoundly social; the extent to which health excludes people from employment stems

from the attributes valued by social institutions, markets and societies (West 1991). Both Marx's and Rosa's analysis suggest that time will play a role here, as people's capacities to be mobile, available, multi-task and work quickly are, from employers' point of view, valuable. Health-related incapacity to 'keep up' and manage temporally demanding jobs may be one reason why disabled or chronically ill people become excluded from the labour market (Pagan-Rodriguez 2013).

Summary and aims Our aim is to connect quantitative approaches to time-health relationships with social theory. Our specific aims are to (i) describe the patterning of time poverty (amount) and rushing (intensity) across key socio-demographic characteristics and (ii) examine the associations between time poverty, rushing, health behaviour and health status (physical activity, self-rated and mental health). We also explore the social patterning of paid relative to unpaid hourly commitments, asking whether the composition of time spent is associated with health status and behaviour.

We expect amount and intensity to vary by gender, employment status, caregiving and the life course, and that our measures of time (amount and intensity) are related but empirically distinguishable. Based on findings to date, it is possible that amount and intensity will show different patterns of associations with health outcomes. For example, the number of committed hours may be more relevant to physical activity, whereas rushing may be more relevant to mental health. However, poor health and disability can also constrain mobility and capacity to work (paid and unpaid). In this instance health drives hours and intensity, not vice versa. We therefore consider time-health relationships in people with and without health-related restrictions.

Method

Data and sample

This study used Wave 9 data (collected in 2009) from the Household, Income and Labour Dynamics of Australia (HILDA) survey (Watson and Wooden 2012). The HILDA survey used an annual household-based panel design, sampling all people in private dwellings (remote and very remote areas were undersampled). Comparisons with census data indicate that the HILDA sample is broadly representative of Australians aged 15 years and older living in private dwellings (Watson and Wooden 2012). Data for this study were collected during an interview and from a mailed self-completion questionnaire (SCQ).

In the first wave of HILDA 11,693 households were enumerated. Interviews were completed with all eligible members of 6872 households and with at least one eligible member in a further 810 households, generating a 66% household and 61% individual response rate. Household response rates for subsequent waves ranged from 87 to 96% (Watson 2012). Attrition was highest among respondents who were young, Indigenous, single, unemployed, low skilled or born in non-English speaking countries. Wave 9 contained data on 6667 households (13,301 individuals).

Measures

Amount of time Respondents estimated in hours or minutes how much time they 'would spend on each of the following activities in a typical week' and given a list of activities with examples. These covered paid work and commuting, domestic work, volunteering and caregiving, using similar activity groups to those in time use diaries (see Table A1, appended). Respon-

dents were asked to total and check their estimates, with the explanation that they could not exceed 168 and typically should not exceed 120 hours.

We considered amount of time in three different ways. Firstly, we top-coded estimates at two standard deviations above the mean, summing them to yield a total committed time score; a continuous measure with high scores representing less free (leisure) time. For the analyses, scores were categorised into six 20-hour brackets (0–19 to 100+). Secondly, a dichotomous measure of time poverty was constructed based on a cut-point of 150% of the median total committed time, analogous to 50% of the median free time (Kalenkoski *et al.* 2011). In our sample, this was equivalent to 81 hours per week. Finally, we calculated the proportion of committed time spent in paid work. Scores were dichotomised into < 50% or \geq 50% of committed time in paid work.

Time intensity Rushing was measured by one item asking ‘how often do you feel rushed or pressed for time?’ using a five-point response scale where 1 = never to 5 = almost always. This measure is ordinal and can be dichotomised to classify people who are rushed, that is, often and almost always rushed or pressed for time (Australian Bureau of Statistics [ABS] 2013a). We used both ordinal and dichotomous approaches in the analysis.

Validation To assess the validity of the measures we compared (i) survey estimates with nationally representative time diary estimates published by the ABS (2008) and (ii) associations with related constructs in subsamples of employed respondents: work time autonomy (three items, employed $n = 5437$, for example, ‘I have freedom to decide when I work’); work time intensity (three items, employed $n = 5437$, ‘I have to work fast’) and work–family conflict (three items, employed parents $n = 2419$, for example, ‘because of my family the time I spend at work is less enjoyable and more pressured’). Items were summed and dichotomised to classify respondents in the top 20% (high) versus bottom 80% of scores.

Socio-demographic characteristics and confounders We used the following categorical variables:

- gender (male, female)
- age (15–24, 25–34, 35–44, 45–54, 55–64 and 65 years or older)
- disability (currently receiving disability support pension)
- education (high school qualification or less, tertiary qualification, postgraduate qualification)
- household annual disposable (after tax) income in quartiles (mean AUD poorest: \$24251.86, second: \$57121.29, third: \$88202.32, richest: \$150456.10)
- caring responsibilities co-resident or living elsewhere (yes, no)
- household (one person, couple without children, couple with resident children, lone parent with resident children, other) number of resident children under 15 years (0, 1, 2 or more)
- work status (not in the labour force, retired, unemployed, employed).

Health behaviour and status Physical inactivity was measured with one item asking respondents how often they exercised moderately or intensely for at least 30 minutes (with moderate defined as a slight elevation in heart rate, such as brisk walking). Response categories were dichotomised into physical inactivity (‘not at all,’ ‘less than once a week,’ or ‘one to two times a week’) and physical activity (‘three times a week,’ ‘more than three times a week but not every day’ and ‘every day’).

We measured poor self-rated health using a single question (‘In general would you say your health is excellent, very good, good, fair or poor?’) shown to be predictive of later morbidity

and mortality (Idler and Benyamini 1997). Responses were categorised into poor (poor or fair) versus good health (good, very good or excellent).

Poor mental health was assessed using the Kessler 10 scale (K10) (Furukawa *et al.* 2003). The K10 is a screening tool for measuring psychological distress and risk of mental health problems. The 10 items asked how often over the previous 4 weeks respondents felt, for example, 'Tired out for no good reason,' 'So nervous that nothing could calm them down,' 'Depressed'. Response categories ranged from 1 = none of the time, through to 5 = all of the time. Items were summed and dichotomised to classify people at no or low risk for mental health problems (score 0–19) and those at medium or high risk (score 20–50) (Andrews and Slade 2001).

We also computed a health restriction variable, which classified people whose health restricted their time use ($n = 1942$) or did not ($n = 7235$). The former included 1809 respondents who had reported at least one long-term health condition that restricted time use or the type or amount of work they could do and a further 133 who reported that their health permanently excluded them from the workforce.

Statistical approach

All analyses used sample weights to adjust for survey and wave non-response bias (Watson 2012). The two-stage complex sampling frame (census districts, households, stratification by major metropolitan centre versus other) were taken into account with first-order Taylor linearisation that calculates robust standard errors to adjust for lack of independence. Sensitivity tests showed that further adjustment for households marginally changed standard errors and we proceeded without further adjustment. Missing data were imputed using a fully conditional chained specification Markov Chain Monte Carlo algorithm to predict missing scores on the time measures (ranging from 4.6% for employment to 12.9% for time caring for others' children) and on health outcomes (ranging from < 1% for physical activity to 2.2% for self-rated health). Ten datasets were imputed to derive parameter estimates.

To examine the social patterning of time, we estimated the mean time spent in paid work, caregiving and other unpaid work and the proportions of people classified as time poor and rushed, by socio-demographic characteristics and health restriction. We used logistic regression to quantify the strength of association between the dichotomous time measures – poverty and rushing – and (i) related constructs (work time autonomy, work time intensity and work–family conflict); and (ii) socio-demographic variables with and without mutual adjustment for the other variables. To examine relationships between time and health, we used a logistic regression to separately model the associations between each dichotomous health outcome (physical inactivity, poor mental health and poor self-rated health) and categories of time commitments in hours (reference group: 20–39 h), rushing (reference group: rarely) and proportion of committed time in paid work (<50 or ≥ 50%). These associations were estimated without and with adjustment for age, gender and income. We also tested for linear trends where appropriate (excluding the lowest time categories '0–19 hours and 'never' because of possible reverse-causality among people with chronic illness). We further stratified the unadjusted analyses by health restriction, and for the adjusted analyses excluded people who reported health restriction. Similarly we tested for interaction effects in a series of adjusted analyses excluding people who reported health restriction. All analyses were performed using Stata 12.

Results

Exclusion criteria and sample characteristics Individuals were excluded if they (i) failed to return their SCQ ($n = 1738$, 13.1%), (ii) reported being a student at any part of the previous year ($n = 2,343$, 17.6%), because estimates of study time were not collected, or (iii) gave implausible time estimates ($+ 2$ SD on two or more activities, or daily time commitments of > 20 h; $n = 43$, 0.3%), achieving a final sample of 9177 respondents.

We compared the characteristics of those retained with those who were excluded (Supporting Tables S1 and S2), finding that the excluded students were more likely to be young, never married and nonparents. The few people who were excluded because of implausible time estimates were more likely to be women; aged 24–64; parents and not in the labour force. Table 1 describes the final sample in relation to socio-demographic, time and health characteristics, separately by gender and in total.

Scores for total committed hours ranged from 0 to 148.5 h per week, with a weighted mean of 52 h, 26 min. Just under half (48.9%) spent more than half their committed time in paid work. Although men and women had similar hourly commitments in total, the extent to which their hours were paid or unpaid was different: men spent a mean of around 32 h on paid work out of 53 h of total committed time, women around 20 out of a total 51 h. The extent to which hours were paid relative to unpaid also varied by age, life course, disability and socio-economic status (see Supporting Table S3). In all, 13% of respondents were classified as time poor (that is, $> 150\%$ of the median total), with over 35.5% reporting feeling almost always or often rushed or pressed for time. People who were classified as rushed (often or always, 35.3%) spent nearly 64 hours each week on committed activities (based on amount estimates), compared with 46 hours for those who never, rarely or sometimes rushed. Of those people classified as time poor, 23% report often or almost always rushing and 60% of people who often or always rush are also time poor.

Validation Comparison between HILDA estimates and ABS (2008) time diary estimates shows that where activities were similar, as were the survey and time diary estimates (Supporting Table S4), with three minor exceptions. Compared to the diary estimates, in the HILDA survey women's paid work hours were higher, volunteering estimates were slightly lower, and time spent caring for children higher (if childcare was the primary activity) although lower than combined primary and secondary (if childcare occurred with another activity).

Examining the associations between the time measures and related constructs, we found that, compared with time poverty, rushing was strongly associated with work time intensity (odds ratio [OR] rushed 4.25, 95% CI 3.65 – 5.06; OR time poor 1.77, 95% CI 1.47 – 2.14) and high work–family conflict (OR rushed 3.52, 95% CI 2.62 – 4.73; OR time poor 1.50, 95% CI 1.17 – 1.92). Rushing was also associated with less control over work schedules and start and stop times (OR rushed 0.82, 95% CI 0.69 – 0.97), while time poverty was associated with more control (OR 1.31, 95% CI 1.08 – 1.59). As expected, amount and intensity were moderately associated (OR 3.23, 95% CI 2.74–3.81).

Social patterning of time poverty Table 2 presents the socio-demographic characteristics of people classified as time poor, along with unadjusted and adjusted OR. In terms of prevalence, those most likely to be time poor were aged 35–44 years (27%), in the highest income quartile (21%), employed (20%) and in households with children, with the prevalence of time poverty particularly high where there were resident children under 15 years of age ($\geq 32\%$). Men were slightly more likely to be time poor than women (15 and 12%, respectively). Education level, being a carer and having a health restriction were not associated with time poverty in the

Table 1 *Sample characteristics, time and health (weighted percentages)*

	Men (n = 4342) ^a	Women (n = 4835) ^a	Total (n = 9177) ^a
Socio-demographic characteristics			
Age (years)			
15–24	8.3	7.7	8.0
25–34	14.7	15.2	15.0
35–44	19.4	18.2	18.8
45–54	20.8	20.9	20.8
55–64	17.4	16.7	17.1
65 or older	19.3	21.4	20.4
Education			
High school or less	47.0	47.5	47.3
Tertiary	44.0	43.2	43.6
Postgraduate	8.9	9.3	9.1
Income (quartiles)			
1 (poorest)	21.8	27.9	25.0
2	25.3	24.7	25.0
3	26.2	23.9	25.0
4 (richest)	26.7	23.5	25.0
Work status			
Not in the labour force	4.8	13.8	9.5
Unemployed	2.9	2.0	2.4
Retired	21.3	27.1	24.4
Employed	71.1	57.1	63.7
Household			
One person	16.1	17.8	17.0
Couple without children	34.1	31.4	32.7
Couple parent	32.6	29.7	31.1
Lone parent	1.9	6.2	4.2
Other	15.4	14.8	15.1
Presence of children < 15 years			
0	74.8	71.7	73.2
1	10.9	12.0	11.5
2 or more	14.3	16.3	15.4
Caring responsibilities			
No	94.3	91.5	92.8
Yes	5.7	8.5	7.2
Time			
Committed hours (expressed as hours and minutes per week)			
Paid work	32:18	19:48	25:54
Caregiving	4:12	7:00	5:42
Unpaid work (not care)	16:30	24:24	20:24
Total	52:54	51:12	52:00
> 50% time commitments paid	63.1	36.2	48.9
Committed hours			
0–19	14.7	12.5	13.6
20–39	15.4	19.0	17.2
40–59	26.4	31.0	28.7
60–79	28.2	25.3	26.7

Table 1 (continued)

	Men (<i>n</i> = 4342) ^a	Women (<i>n</i> = 4835) ^a	Total (<i>n</i> = 9177) ^a
80–99	12.6	9.7	11.1
100+	2.7	2.6	2.7
Time poor (80 h per week)	15.1	12.1	13.5
Rushing			
Never	3.8	2.8	3.3
Rarely	24.6	19.3	21.9
Sometimes	41.5	38.9	40.2
Often	24.1	29.0	26.6
Almost always	6.0	10.0	8.0
Rushed (often, always)	31.5	39.1	35.5
Health			
Health restriction ^b			
No	80.4	77.4	78.8
Yes	19.6	22.6	21.1
Physical inactivity			
Inactive	53.7	45.9	49.6
Active	46.3	54.1	51.4
Self-rated health			
Poor (poor to fair)	17.5	17.3	17.4
Good (good to excellent)	82.5	82.7	82.6
Poor mental health			
Medium to high risk	16.6	20.2	18.4
Lo risk	83.4	79.8	81.6

^a Unweighted sample NS. ^b Health condition that restricts time use or paid work, including exclusion from workforce

unadjusted analyses. After mutually adjusting for all variables, being employed and having resident children remained strongly associated with time poverty, with a ninefold increase in the odds for employed people compared to those not in the labour force, and a sixfold and eightfold increase, respectively, with having 1 and 2 or more resident children, compared with no children. Having elder or disabled care responsibilities was also associated with ORs of 2.5 for time poverty. The associations with income and age attenuated after adjustment, and the odds for men became nonsignificant.

Social patterning of rushing Unadjusted analyses (Table 2) reveal that those most likely to feel rushed and pressed for time were aged 35–44 years (50%), in the highest income quartile (50%), employed (44%) and in households with children \geq 50%, a similar pattern to that for time poverty. However, unlike time poverty, women were more likely to rush than men (39 vs 32%) and carers more likely to rush than non-carers (43 vs 35%). After mutually adjusting for all variables, employment and the presence of children showed strong associations with rushing (as they did for time poverty) and markers of economic advantage (income) were unrelated, while markers of social disadvantage (lone parenthood) and gender (women) were associated with elevated odds for rushing. Further, those reporting health-related restrictions were also more likely to feel rushed.

Unadjusted time-health relationships People with and without health-related restrictions showed very different associations between the amount and intensity of time and health status

Table 2 Percentage of respondents who are time poor and who are often and almost always rushed in relation to their socio-demographic characteristics, and associated odds ratios (OR) (n = 9177)

	Time poor			Rushing		
	%	OR (95% CI)		%	OR (95% CI)	
		Unadjusted	Adjusted ^a		Unadjusted	Adjusted ^a
Gender						
Men	15.08	1	1	31.46	1	1
Women	12.05	0.76 (0.66–0.88)	0.88 (0.74–1.04)	39.06	1.48 (1.33–1.64)	1.63 (1.45–1.83)
Age (in years)						
15–24	4.91	0.21 (0.12–0.35)	0.44 (0.25–0.75)	31.30	0.54 (0.42–0.69)	0.67 (0.51–0.89)
25–34	17.61	1	1	47.21	1	1
35–44	27.59	1.74 (1.39–2.17)	1.16 (0.92–1.46)	49.70	1.17 (0.97–1.42)	0.96 (0.79–1.17)
45–54	18.66	1.03 (0.81–1.30)	1.23 (0.95–1.58)	44.08	0.90 (0.76–1.07)	0.85 (0.71–1.03)
55–64	6.87	0.36 (0.26–0.50)	1.12 (0.79–1.57)	27.90	0.54 (0.44–0.66)	0.73 (0.59–0.91)
65 and older	10.10	0.06 (0.03–0.11)	1.14 (0.54–2.38)	12.86	0.20 (0.16–0.24)	0.44 (0.32–0.60)
Education						
High school	13.16	1	1	34.79	1	1
Tertiary	13.57	0.85 (0.66–1.11)	0.85 (0.63–1.14)	36.35	1.03 (0.84–1.25)	1.01 (0.82–1.26)
Postgraduate	14.77	0.82 (0.63–1.08)	0.80 (0.59–1.07)	34.74	1.02 (0.85–1.23)	1.00 (0.82–1.22)
Income quartiles						
1 (poorest)	3.24	1	1	22.13	1	1
2	12.40	3.88 (2.75–5.45)	1.37 (0.94–2.00)	33.21	1.61 (1.35–1.91)	0.94 (0.77–1.15)
3	17.69	5.83 (4.21–8.09)	1.26 (0.84–1.88)	40.57	2.10 (1.77–2.48)	0.95 (0.76–1.20)
4 (richest)	20.58	6.52 (4.66–9.13)	1.66 (1.09–2.52)	45.96	2.52 (2.13–2.98)	1.22 (0.97–1.53)
Work status						
Not in the labour force	4.45	1	1	35.51	1	1
Unemployed	1.93	0.41 (0.13–1.25)	0.67 (0.21–2.20)	23.32	0.53 (0.34–0.85)	0.87 (0.54–1.42)
Retired	0.02	0.07 (0.03–0.21)	0.25 (0.09–0.76)	13.89	0.34 (0.26–0.44)	0.72 (0.53–0.97)
Employed	20.34	6.35 (4.30–9.37)	9.37 (6.26–14.03)	44.18	1.45 (1.17–1.80)	1.60 (1.26–2.04)

Table 2 (continued)

	Time poor			Rushing		
	%	OR (95% CI)		%	OR (95% CI)	
		Unadjusted	Adjusted ^a		Unadjusted	Adjusted ^a
Household						
Lone person	6.02	1	1	23.88	1	1
Couples	5.04	0.74 (0.54–1.01)	0.63 (0.44–0.91)	27.09	1.10 (0.92–1.31)	1.06 (0.87–1.30)
Couple parent	28.80	6.02 (4.67–7.77)	0.66 (0.42–1.05)	49.81	2.89 (2.44–3.42)	1.19 (0.90–1.56)
Lone parent	18.61	3.20 (2.16–4.76)	0.62 (0.37–1.02)	52.83	3.64 (2.67–4.95)	1.72 (1.17–2.54)
Other	7.21	1.18 (0.81–1.72)	0.74 (0.47–1.14)	32.34	1.33 (1.09–1.64)	0.96 (0.75–1.23)
Presence of children						
0	5.91	1	1	28.92	1	1
1	32.13	7.84 (6.29–9.79)	6.38 (4.35–9.37)	50.17	2.55 (2.16–3.01)	1.56 (1.23–1.97)
2+	35.66	9.24 (7.58–11.25)	8.36 (5.61–12.47)	55.67	2.99 (2.55–3.52)	1.87 (1.47–2.39)
Carer						
No	13.19	1	1	34.90	1	1
Yes	17.30	1.26 (0.95–1.66)	2.54 (1.79–3.61)	42.80	1.64 (1.31–2.06)	2.14 (1.62–2.81)
Health restriction						
No	15.63	1	1	36.75	1	1
Yes	5.48	0.31 (0.24–0.41)	0.86 (0.63–1.20)	30.68	0.79 (0.69–0.90)	1.60 (1.36–1.89)

Note: Significant findings bolded $P < 0.05$. Time poverty = 50% of median, rushing = often or always. For total sample proportions see Table 1. ^aMutually adjusted for variables in the table.

(stratified results appended, Table A2). Among people with health-related restrictions, low time commitments (0–19 h) and never rushing were associated with elevated odds for physical inactivity, poorer self-rated health and mental health problems. Increased time commitments were associated with better health (all measures), while rushing was associated with poorer mental health but was unrelated to physical activity or self-rated health. Adjusting for gender, age and income did not substantially change these associations.

Among those without health-related restrictions, higher time commitments were associated with elevated odds of physical inactivity but were unrelated to self-rated or mental health. Often or always rushing was associated with elevated odds for physical inactivity and for poorer self-rated and mental health. These distinctive time–health patterns by strata were consistent with a reverse causal relationship for people with restricting health conditions (that is, poor health leading to lower time commitments and less rushing). We therefore focused all adjusted analyses on people who did not report health-related restrictions on their time (whose health status is described in Table A3, appended).

Adjusted time–health relationships Figures 1 to 3 show the adjusted odds ratios from logistic regression models for physical inactivity, poor self-reported health and poor mental health. All models were adjusted for gender, age and income.

For physical activity, excluding the lowest time categories (0–19 h and never), the odds of physical inactivity increased as committed time and frequency of rushing increased (linear trends both $P < 0.001$). Compared with commitments of 20–39 h a week, odds for inactivity were 1.32 (95% CI 1.07 – 1.60) for 60–79 h, 1.39 (95% CI 1.09 – 1.76) for 80–99 and more than 100 h were 1.55 (95% CI 1.09 – 2.19). Compared to rarely rushing, the OR for often rushing was 1.44 (95% CI 1.21 – 1.70) for physical inactivity, and for always rushing the OR was 1.48 (95% CI 1.18 – 1.87).

Self-rated health (Figure 2) had no relationship with amount of committed time. There was, however, a trend of increasing odds for poor self-rated health the more people rushed (trend $P < 0.001$). Compared to rarely rushing, the ORs for often and always rushing were 1.83 (95% CI 1.26 – 2.64) and 3.15 (95% CI 2.00 – 4.94) for poorer self-rated health.

Similarly, for mental health problems (Figure 3), there was no relationship with committed time, whereas the odds increased as rushing increased (trend $P < 0.001$). Compared to rarely rushing, people who often and always rushed showed ORs of 3.18 (95% CI 2.29 – 4.42) and 5.11 (95% CI 3.45 – 7.58) for poorer mental health, the OR for sometimes rushing was 1.62 (95% CI 1.16 – 2.27).

Relationships between proportion of committed time spent in paid work and health After adjusting for age, gender and household income and total time commitments spending more hours on paid relative to unpaid commitments was associated with elevated ORs for physical inactivity (OR 1.28, 95% CI 1.10–1.48), but unrelated to self-rated or mental health.

Do time–health relationships vary by gender? Gender interactions with amount of time, rushing and proportion of committed time spent in unpaid work were introduced into the respective adjusted models. We observed no significant gender differences in associations between amount of time and health outcomes except for rushing. We found a stronger association between rushing and poor self-rated health among men (gender by rushing OR = 0.78, 95% CI 0.61–0.99).

Additional interaction analyses We found no significant interaction effects for time poverty and rushing. However, there was evidence of a rushing–income interaction for physical inac-

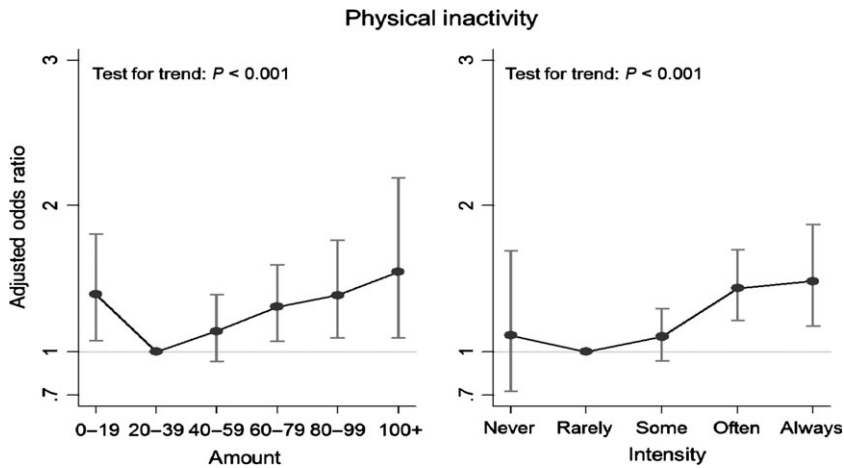


Figure 1 Adjusted odds ratios for physical inactivity by hours per week (amount) and rushing (intensity). Models adjusted for income, age and gender. Reference group is 20–39 hours per week (amount) and rarely (intensity). Analyses exclude people with health-related restrictions ($n = 7235$). Different scales are used for different outcomes.

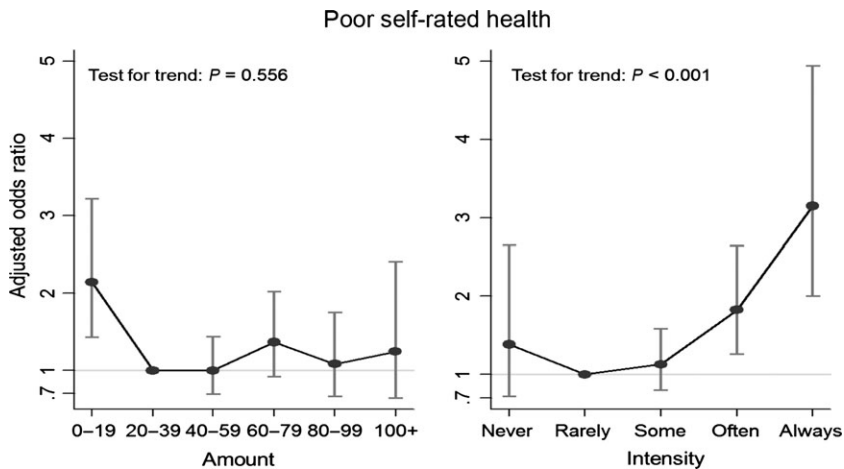


Figure 2 Adjusted odds ratios for poor self-rated health by hours per week (amount) and rushing (intensity). Models adjusted for income, age and gender. Reference group is 20–39 hours per week (amount) and rarely (intensity). Analyses exclude people with health-related restrictions ($n = 7235$). Different scales are used for different outcomes.

tivity, with rushing showed stronger associations with physical inactivity in the high-income group ($P < 0.05$). Restricting the sample to respondents in the labour force ($n = 5845$), we further tested if the associations between time poverty, rushing and health varied by (i) relationship to the labour market (self-employed versus employees) and (ii) work time autonomy and job control. These additional analyses were adjusted for age, gender and household income. We did not find interaction health effects between self-employment and amount of time, although self-employment appears to strengthen the relationship between rushing and physical activity. People who were self-employed and reported almost always rushing had adjusted odds for physical inactivity of 2.37 (95% CI 1.06–5.31). Control over work time and work

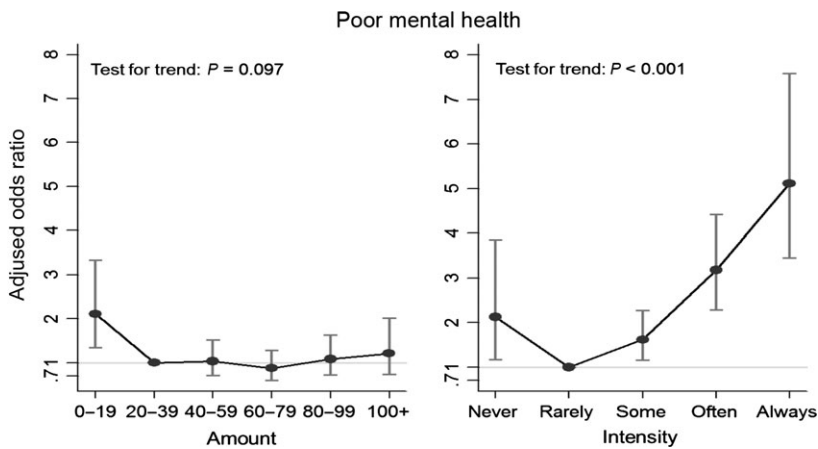


Figure 3 Adjusted odds ratios for poor mental health by hours per week (amount) and rushing (intensity). Models adjusted for income, age and gender. Reference group is 20–39 hours per week (amount) and rarely (intensity). Analyses exclude people with health-related restrictions ($n = 7235$). Different scales are used for different outcomes.

tasks were both associated with lowered odds for poor self-rated or mental health but did not interact with amount or intensity.

Sensitivity analyses To test the robustness of our findings with respect to missing data, we ran adjusted logistic models using the raw (unimputed) data, finding similar associations to those using imputed data. Further, because poor mental health may lead to reporting bias, we re-ran adjusted logistic models excluding people with scores indicating poor mental health in the year prior to the survey ($n = 1231$). This exclusion did not substantively alter findings (analyses available on request).

Discussion

In just a few generations the speed of communication, travel, consumption and production has increased by an order of magnitude (Rosa 2013). On more intimate scale, rising labour force participation has shifted women's time to market work without a corresponding reduction in caregiving, creating time-related social divisions that intersect with gender and the life course. Sociologists have characterised modernity as the epoch of acceleration, which refers to new experiences of time redefining the social order, while political economists view the wage–time exchange as fundamental to power relations. Seeking to connect this theorising with social determinants of health research, we present two brief measures of the amount and intensity of time that could feasibly be used in survey-based cohort or panel studies. We find that they are empirically distinctive and valid; they have different social patterning and are both associated with health.

Quantitative research on time and health (and health behaviour) has been limited. However, our findings accord well with what has been published so far. Spinney and Millward's time diary study (2010) found that long hours spent in care, travel or work (time poverty) were associated with less exercise. We find a similar linkage between our survey measure of time poverty and physical inactivity. However, we also reveal that another dimension of time –

rushing – could be equally important. Nearly a third of our sample reported that they often or always felt rushed and of those who rush, 60% are also time poor. Rushing is linked to efforts to save time and be on time. Not only is it widespread and associated with lower physical activity but frequent rushing is associated with poorer self-rated and mental health.

The study also sheds light on what has been so far conflicting evidence on time poverty (amount of time) and health. On the one hand, longitudinal research of employed people points to the erosion of mental and cardiovascular health from long work hours (Virtanen *et al.* 2010, 2011). On the other, time diary analyses of the general population indicate that long hours spent on work and care are associated with better self-rated health. In line with the ‘healthy worker effect’ we find that illness and health problems restrict people’s time use (Pagán 2013). Healthy people are able to do more; a relationship that will be masked in studies using employed samples but that is apparent in the general population. Thus, the associations between time and health are complex, embedding probably reverse and reciprocal relationships that will need strong theory and robust methodology; there appear to be temporal dimensions to health selection.

In our cross-sectional study, selecting a relatively healthy group of adults, we did not find that long hours spent on work and care were associated with better or worse self-rated or mental health. However, we did find elevated odds for physical inactivity linked to time poverty. In terms of poor health, the persistence of time poverty may therefore be the key, requiring health impacts to be studied over the longer term, a possibility that the survey measure we present can be used to test.

We further find that time poverty and rushing are socially patterned and could therefore be another source of health inequalities. As in previous research (Chatzitheochari and Arber 2012, Offer and Schneider 2011) we find that people with heavy work and care loads are more likely to be time poor and rush. Women, lone parents and people with health-related restrictions and disability are especially likely to rush, and rushing is also associated with less time autonomy and greater work–family conflict. These linkages between intensity, autonomy, care and social position may reflect the temporal characteristics of marginalisation and devaluation (Scambler 2012), whereby doing more and doing things faster is an attempt to keep up, especially in competitive labour markets that favour those whose time is unencumbered. Rushing may be compounded by the inability to negotiate extra demands on time imposed by caregiving or by disability, especially when combined with employment (see Pagán’s 2012 research on disability and time pressure).

Time should be integral to the analysis of gender disparities in health, just as it has been to gender inequality (ABS 2013a, Mattingly and Bianchi 2003, Sayer 2005). Our results show that time–health relationships are relevant to both men and women, in different ways, and for different dimensions. With one exception, we did not find that associations with health varied for women compared with men; rather, the linkages flow through a gendered patterning of rushing and payment for time. Women are more likely to rush, and rushing shows detrimental associations with all three health outcomes, creating a gendered vulnerability that is temporal, not biological (Roxburgh 2004). However, we found stronger odds for poorer self-rated health among the 6% of men who say they are always rushed. While we cannot explain why this is the case in this study, this group of men were much more likely to be combining work with care roles.

Limitations There are several important caveats to the results. Firstly, the study design is cross-sectional, which limits our capacity to infer causal directions and address endogeneity. Secondly, time is a complex and multifaceted concept, which is part of its conceptual power. We have selected two dimensions – amount and intensity – given their theoretical centrality, but there are other dimensions relevant to health, including time autonomy, synchrony and sequencing, which

qualitative research has been exploring (Adam 1990, Shove *et al.* 2008). We therefore acknowledge and situate this study's theorising and findings as provisional and incomplete.

Although the single-item measure of intensity (widely used in social science research) showed good construct validity, a multi-item measure would improve its robustness of measurement. Our study was conducted on an Australian sample aged 15 years and older, and we further restricted our sample by excluding students, probably underestimating both time poverty and rushing, especially among younger people. Six per cent of all Australians aged 15–64 are studying, with many combining study with employment or family care (ABS 2013b).

Contribution Our article furthers theoretical formulations of how societies shape health. We have put forward the case that time is a health resource that is connected to, but distinct from other resources routinely considered to be markers of social status and privilege. Although everyone has 24 h each day, how many hours people commit to the market, to care, to rest, to leisure and therefore to health, along with how fast they do things, is neither fixed nor a given, as witnessed by the diversity of work time regimes over history and in populations. Indeed, the metrification of time into hours and minutes is itself a social device (Thompson 1967). Time is valuable and it can be traded for income, it is a finite resource, yet it is also renewable daily; characteristics that distinguish time from other social resources. Drawing on Rosa's and Marx's theory (among others) we argue that time is, however, integral to the social order and it is multidimensional. If class and power relations are enacted via the flows of assets and resources, be they material, biological, psychological, social, cultural or spatial (Scambler, 2007), the contribution of our article is to add temporal assets and resources to this analysis.

Our second contribution is methodological. Valid measures are needed if time is to be mainstreamed into quantitative health research and for public health interventions to be evaluated. We review social science approaches to measuring time, and present measures that are feasible, brief and suitable for quantitative data analysis, while encouraging a dimensional approach. They can be used for modelling across committed hours spent, decomposing into types and composition of hourly commitments or dichotomising to identify time poverty and frequent rushing. Importantly these measures are amenable to longitudinal research, which will be critical to understanding causal relationships and therefore advancing the field.

Our third contribution is empirical. We report suggestive evidence that time could be a determinant of physical activity and mental and self-rated health. We further show that time, like other social resources, has multiple and reciprocal health relationships. Our analyses indicate that linear approaches may misrepresent and underestimate the time–health connections, and that health exclusion processes, social selection and endogeneity need to be considered.

Conclusion

Work hours have generally decreased, technologies have sped things up, so why do people say they lack time? Social science theory offers some insight, proposing that increasing affluence, speed and productivity has come at a time cost that includes, but is not confined to, hours and minutes. Such pressures on people's time are unlikely to abate. As nations urbanise and cities expand, travel and commuting adds further temporal demands to each day. Deregulated, flexible labour markets are creating boundaryless jobs, loosening the limits on how long, when and how fast people work. Pushes to increase productivity and speed up production and service delivery are accompanied by a further intensification of time, while the relative devaluing of care means that when combined with employment, care dilemmas and (gendered) discrimination in the labour market are generated. Public health campaigns exhort people to be

more active, with 30 minutes of exercise each day becoming the new prescription, indeed many public health policies and interventions have a time dimension. These are some of the temporal dimensions to how societies could shape health, and by drawing on social science theory, we offer a framework to further investigate them. Should time be considered a social determinant of health? This is a question we hope our article raises.

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Table S1. Socio-demographic characteristics by reasons for exclusion (percentages)

Table S2: Socio-demographic characteristics of those included and excluded from the study (percentages)

Table S3. Proportions (%) of respondents spending $\geq 50\%$ of their total committed time in paid work

Table S4. Comparison of ABS diary and HILDA survey estimates of men’s and women’s time

Appendix

Table A1 *Survey items assessing committed time in the HILDA Survey*

<i>Domain</i>	<i>Items</i>
Paid work	Paid work Travelling to and from a place of paid employment
Unpaid work	Household errands, such as shopping, banking, paying bills and keeping financial records (but not including driving children to school and to other activities) ^a Housework such as preparing meals, washing dishes, cleaning house, washing clothes, ironing and sewing ^b Outdoor tasks including home maintenance (repairs, improvements, painting etc.) care maintenance or repairs and gardening ^c Volunteer or charity work (for example, canteen work at the local school, unpaid work for a community club or organisation)
Caring	Playing with your children, helping with personal care, teaching, coaching or actively supervising them, or getting them to childcare, school or other activities ^d Looking after other people's children (aged under 12 years) on a regular unpaid basis ^d Caring for a disabled spouse or disabled adult relative, or caring for elderly parents or parents-in-law

Activity definitions varied slightly between ABS time use diary and HILDA survey within the time domains. ABS activity categories for the following were: ^a Household errands: household management and purchasing good and services.

^b Housework: food and drink preparation, laundry and clothes care, other housework; ^c Outdoor tasks: grounds and animal care and home maintenance; ^d Childcare: physical and emotional care of children, teaching, reprimanding, playing with and talking to, minding children and visiting childcare establishments or schools.

Table A2 *Unadjusted odds ratios for physical inactivity, poor self-rated and poor mental health in relation to amount of committed time (h) and intensity (frequency of rushing), stratified by health-related restriction on time (restriction reported $n = 1942$; not reported $n = 7235$).*

<i>Amount OR (95% CI)</i>			<i>Intensity OR (95% CI)</i>		
<i>Health restricted</i>	<i>Not health restricted</i>		<i>Health restricted</i>	<i>Not health restricted</i>	
<i>Hours of committed activity</i>			<i>Frequency of rushing</i>		
Physical inactivity					
0–19	1.45 (1.04–2.01)	1.30 (1.00–1.70)	Never	2.79 (1.42–5.48)	1.10 (0.72–1.67)
20–39	1	1	Rarely	1	1
40–59	0.75 (0.52–1.06)	1.13 (0.93–1.37)	Some	1.25 (0.92–1.69)	1.12 (0.96–1.31)
60–79	0.62 (0.41–0.95)	1.25 (1.03–1.52)	Often	1.04 (0.76–1.40)	1.48 (1.26–1.74)
80–99	0.58 (0.32–1.05)	1.31 (1.04–1.65)	Always	1.08 (0.69–1.71)	1.58 (1.27–1.98)
100+	1.00 (0.17–6.01)	1.50 (1.07–2.11)			

Table A2 (continued)

	<i>Amount OR (95% CI)</i>			<i>Intensity OR (95% CI)</i>	
	<i>Health restricted</i>	<i>Not health restricted</i>		<i>Health restricted</i>	<i>Not health restricted</i>
<i>Hours of committed activity</i>			<i>Frequency of rushing</i>		
Poor self-rated health					
0–19	1.55 (1.13–2.13)	1.34 (1.04–1.73)	Never	2.20 (1.17–4.15)	0.81 (0.53–1.21)
20–39	1	1	Rarely	1	1
40–59	0.79 (0.57–1.09)	0.72 (0.60–0.87)	Some	1.07 (0.81–4.41)	1.04 (0.87–1.24)
60–79	0.57 (0.37–0.87)	0.68 (0.57–0.82)	Often	1.30 (0.93–1.80)	1.11 (0.92–1.33)
80–99	0.38 (0.21–0.68)	0.82 (0.65–1.02)	Always	1.24 (0.75–2.03)	1.61 (1.27–2.03)
100+	0.08 (0.02–0.41)	0.61 (0.45–0.85)			
Poor mental health					
0–19	1.46 (1.05–2.03)	2.02 (1.30–3.13)	Never	2.07 (1.09–3.90)	2.19 (1.21–3.96)
20–39	1	1	Rarely	1	1
40–59	1.07 (0.74–1.55)	1.30 (0.90–1.90)	Some	1.52 (1.11–2.08)	1.76 (1.26–2.45)
60–79	1.16 (0.72–1.86)	1.08 (0.74–1.60)	Often	4.15 (2.89–5.95)	3.47 (2.51–4.79)
80–99	1.03 (0.58–1.80)	1.32 (0.88–1.98)	Always	8.15 (5.03–13.22)	5.80 (3.96–8.50)
100+	0.25 (0.06–1.07)	1.60 (0.97–2.62)			

Physical inactivity (less than three times a week), poor self-rated health (fair or poor), poor mental health (medium to high risk of problems). Reference groups for time variables: 20–39 h per week (amount) and rarely rushed (intensity).

Table A3 *Health status by time poverty and rushing for people without a health-related restriction (weighted percentages), n = 7235*

<i>Health status</i>	<i>Time poverty (%)</i>	<i>Rushing (%)</i>
Physical activity		
Inactive	16.4	40.7
Active	14.9	33.0
Self-rated health		
Poor (poor to fair)	12.8	43.9
Good (good to excellent)	15.9	36.2
Poor mental health		
Medium to high risk	16.4	56.5
Low risk	15.5	33.6

Note: Time poverty equivalent to 80 h per week or more spent on committed activities. Rushing (often and almost always rushed or pressed for time).