Cohort Profile: HABITAT-a longitudinal multilevel study of physical activity, sedentary behaviour and health and functioning in mid-to-late adulthood

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Title

Cohort Profile: HABITAT – a longitudinal multilevel study of physical activity, sedentary behaviour and health and functioning in mid-to-late adulthood

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Profile in a Nutshell

- The benefits of physical activity in reducing the risk of non-communicable disease and promoting healthy ageing are well documented. Most Australians, however, do not engage in sufficient activity to accrue health benefits, and activity tends to decline with age.
- HABITAT was established to advance our understanding of the patterns and determinants of physical activity (and sedentary behavior) as the bases for informing policy designed to improve population health and supporting healthy ageing.
- HABITAT is a multilevel prospective observational study of change in physical activity and sedentary behaviour and associated health outcomes, and investigates the relative contributions of environmental, social, psychological, and sociodemographic factors, to these changes.
- The HABITAT study is conducted in the Local Government Area of Brisbane, Australia. Baseline data were collected in 2007 from 200 neighbourhoods (n=11,035 participants, 68.4% response rate).
- The baseline sample was aged 40 – 65 years and sociodemographically representative of the Brisbane population within this age-range.
- Since baseline, follow-up has comprised self-completed questionnaires in 2009 (n=7,866, 72.6% response rate), 2011 (n=6,900, 67.6%), 2013 (n=6,520, 67.6%) and 2016 (n=5,187, 58.8%) administered by mail survey to the main cohort, and two home-based clinical assessments of a subsample in 2014 (n=767, 54.6% response rate) and 2016/17 (n=606, 79.0%).
- Main categories of data collected include physical activity and sedentary behaviours; physical health and psychological wellbeing; physical functioning; risk factors; transport behaviour; sociodemographics; psychological (intrapersonal) and social (interpersonal) influences on physical activity; neighbourhood environment (objective and subjective); natural experiments (e.g. residential relocation); census-derived population profiles; measures using accelerometers and geographic positioning systems.
- Researchers interested in collaborating with the HABITAT Chief Investigators and accessing the data should contact the Lead Investigator, Professor Gavin Turrell (gavin.turrell@rmit.edu.au).

Why was the cohort set up?

The benefits of physical activity in reducing the risk of non-communicable diseases are well documented (1, 2). Physical inactivity contributes to 6 to 10% of the burden of coronary heart disease, type 2 diabetes, and breast and colon cancers (1, 3). Physical activity helps reduce waist circumference, blood pressure, and cholesterol (2, 4), and may play a key role in the prevention and management of poor mental health (5). Recent evidence demonstrates that regular physical activity is particularly important for healthy ageing (6-8). Physical activity at older ages reduces the risk of falls, musculoskeletal conditions, disability and functional/cognitive decline, anxiety and depression; and promotes longevity, health-related quality of life, and wellbeing (9). Thus, understanding the patterns, prevalence and determinants of physical activity participation is key to understanding population health and healthy ageing.

Ecological models of health behaviour posit that there are multiple levels of influence on physical activity, including individual (e.g., biological, psychological), social (e.g., social support and norms), organisational (e.g., social institutions), environmental (e.g., neighbourhood walkability, recreational facilities) and policy (e.g., legislation) (10). These models provide a framework for understanding the multiple and interacting determinants of physical activity, which in turn can inform comprehensive interventions that target individuals and the environments in which they live (11-12).

Few studies have been designed to prospectively assess the multilevel determinants of physical activity (i.e., simultaneously examining area-, group- and individual-level effects on physical activity outcomes) (13-15). Those that do rely primarily on secondary (i.e. published) data sources, thus lacking the data to study specific physical activities and the environments and contexts relevant for those activities (16). Further, although other large prospective studies include measures of physical activity, few have investigated the influence of multilevel factors in the context of *change* in people's activity levels over time as they age (17-19).

The HABITAT Study commenced in 2007 with a cohort of men and women aged 40 to 65 years (n=11,035) living in 200 neighbourhoods in the Brisbane Local Government Area, Australia. Funded by two nationally competitive project grants, the overarching aim of Phase One of HABITAT was to examine change in physical activity, and investigate the relative contributions of environmental, social, psychological, and sociodemographic factors, to these changes (Figure 1). Additional funding awarded in 2013 allowed an expansion of focus (Phase Two) to include *objective* assessment of physical activity, sedentary behaviour and physical functioning. Sedentary behaviours are defined as any waking activities characterised by an energy expenditure $\leq$ 1.5 METs in a sitting or reclining posture (20). The MET (metabolic equivalent of task) is a measure of energy expenditure whilst engaging in an activity, relative to energy expenditure at rest. Sedentary behaviours have synergistic effects with physical activity, and have been associated with a range of outcomes relevant to healthy ageing (21-25) The primary objectives of Phase Two were to assess the role of physical activity and sedentary behaviours in preventing, delaying, or accelerating declines in physical function as people age; and to examine how associations between physical activity, sedentary behaviour, and trajectories of physical functioning are influenced by environmental, social, psychological, and sociodemographic factors.

[Insert Figure 1]

Who is in the cohort?

Initial sample selection used a two-stage design, whereby study areas were selected first, and individuals chosen subsequently (see Burton et al. (26) for more detail). Study areas were Australian Bureau of Statistics (ABS) Census Collection Districts (CCD), each of which typically contains approximately 200 dwellings in urban areas (27). CCDs were ranked into deciles using the ABS' Index of Relative Socioeconomic Disadvantage (IRSD) (28), with twenty areas per decile randomly selected (*n*=200). A CCD's IRSD score reflects the area's overall level of disadvantage measured based on multiple social and economic components including education,

occupation, income, unemployment, household structure, motor vehicle availability. Using systematic probability sampling without replacement and proportional to the number of households per CCD with at least one person aged 40 to 65 years, an average of 85 households per area were selected, and one person per household was randomly chosen to participate. A structured self-administered questionnaire was developed (available at https://cur.org.au/project/habitat/) and copies were sent to 17,000 potentially eligible participants in May 2007 using a mail survey methodology developed by Dillman (29). Completed questionnaires were returned by 11,035 eligible participants, with 841 refusals and 4,251 non-responders (response=68.4%). Compared with 2006 census data, the socio-demographic characteristics of the HABITAT cohort at baseline were broadly representative of the Brisbane population aged 40 to 65 years (Table 1).

[Insert Table 1]

How often have they been followed up?

Since the baseline data collection in 2007, the cohort (i.e. those who responded in 2007 and who hadn't actively withdrawn) have been approached to complete four follow-up surveys (2009, 2011, 2013 and 2016). Surveys were sent out in winter (May to July) each time to minimise potential seasonal effects on physical activity (30-32). Participants who relocated from their baseline address to elsewhere in Brisbane or Australia ("movers") remained eligible to participate, and as at 2016, 17.4% (n=1,916) of the HABITAT cohort has changed address on at least one occasion.

Multiple strategies were used to optimise cohort maintenance, including: personalised communication; the collection of contact details about a family member or friend who didn't live with the participant in case the participant moved or contact was lost; a study newsletter and Christmas card; the inclusion of a change-of-address card with most correspondence; a study website, email address, and free-call phone number, and; the use of survey front-covers that were

customised for each suburb to orient participants to provide data about their local area rather than Brisbane in general.

At Wave 5 in 2016, 77.8% (n=8,588) of the baseline participants remained in the study, and 22.2% (n=2,447) were classified as 'withdrawn' for a range of reasons: voluntarily withdrew (n=1,474), deceased (n=311), moved overseas (n=75), physical or cognitive incapacity (n=49), language impairment (n=8) and lost to follow-up/uncontactable (n=530). The proportion of participants who did not return a survey after five attempts to contact them via postal letter (classified as 'non-respondents') has risen incrementally across each successive follow-up wave (Table 2). Analysis of study attrition shows that loss to follow-up has been higher for older persons, the least educated, blue collar workers and persons not in the labour force, and members of lower income households.

[Insert Table 2]

As part of Phase Two, a sub-sample was randomly selected and invited to take part in a physical function sub-study in 2014. The sub-study assessments were conducted individually at a time and location negotiated with participants, and typically occurred at their residence. Assessments were conducted from July to February, with participants interviewed at approximately the same time of year at each wave of assessment. From the 1,559 HABITAT respondents invited to participate, 154 were deemed ineligible (*n*=49 no longer living in selected study area; *n*=96 no valid phone number/unable to contact; *n*=3 deceased; *n*=6 unable to stand or walk without assistance/language difficulties) and 767 were assessed in 2014/2015 (response=54.6%). Follow-up assessments were completed in 2016/17 (n=606, response=79.0%). Socio-demographic characteristics of the sub-sample at baseline and first follow-up are in Table 3

[Insert Table 3]

What has been measured?

Self-reported measures (mail survey)

Baseline survey measures were pilot tested and assessed for test-retest reliability (34), and new items used in follow-up surveys are based on validated measures (where possible). In addition to assessing multilevel determinants specific to physical activity, other items included in the survey relate to healthy ageing, socio-economic disadvantage, social determinants of health, life events, psychological wellbeing, transportation, and health (physical and mental).

Given the complexity of physical activity behaviour, several domain-specific measures were incorporated in the survey. Items from the Active Australia survey assess the frequency and total time spent during the previous week (i) walking for recreation, exercise or to get to or from places, (ii) doing vigorous gardening or heavy work around the yard, (iii) doing vigorous physical activity (e.g., jogging) and (iv) other more moderate physical activity (e.g., slow swimming) (35). These items have acceptable levels of reliability and validity and have been recommended for use in population-based monitoring of physical activity in Australia (36, 37). In addition, we measured frequency of participation in each of 15 specific active recreation pursuits (e.g., running, tennis, etc.) which were derived from the Exercise, Recreation and Sport Survey (38), and the total time spent in the previous week walking for transport, cycling for transport, walking for recreation, and cycling for recreation. Sedentary behaviour is assessed as sitting time (hours, minutes) on a usual weekday and weekend day across four domains: whilst travelling, watching television (including gaming), in general leisure, and using a computer at home. This measure has been shown to be more reliable and valid for weekdays than weekends, and more valid for assessment of sitting at work, watching television, and computer use at home, than for other domains (39). In 2013 and 2016 self-reported physical functioning was assessed using the 10 item Physical Functioning Scale (PF-10), a component of the Short Form 36 Health Survey (40). The PF-10 has been extensively

validated (41) and measures a hierarchical range of difficulties, from vigorous activities such as lifting heavy objects to bathing and dressing.

Participants who moved to a different address between data collection waves were sent a survey that contained additional questions to those included in the non-movers survey. The questions asked about the reasons for moving (e.g. to buy a bigger home; commence a new job; relationship breakdown) and the reasons for choosing the new address (e.g. closeness to work, childcare, public transport, plus others). These data were used to measure residential self-selection, which we defined as moving to a neighbourhood that was consistent with ones' preferences, life-stage, circumstances, or socio-demographic charactersitics. Self-selection is a potential confounder of the association between environmental factors and health, and represents one of the biggest threats to claims of causal inference (42), hence measuring self-selection allowed this to be accounted for in analyses.

Objective measures of the environment

At each of the five time-points corresponding to the survey data collections, a suite of objective environmental measures was generated using a Geographic Information System (GIS). The built environment measures (i.e. residential density, street connectivity, land-use mix, street lights, bikeways, and parks) were generated at four scales: (i) 1 km Euclidean (straight-line) buffer around each participant's home; (ii) 1 km road network buffer around each participant's home; (iii) Census Collector District and; (iv) suburb. GIS was also used to create road network distances from the participant's home to the Brisbane Central Business District, the Brisbane River and coast, the closest public transport node (i.e. bus stop, train station, ferry terminal), shop, public open space, and *CityCycle* station (public bicycle-hire scheme). In addition, at each of the four built environment scales, we generated measures of crime, topography, and traffic density, and for CCDs we derived an area-level measure of disadvantage using the ABS' IRSD (28).

Objective measures of individuals

Individual-level data in the main cohort study have been linked to mortality records. As part of the HABITAT sub-study we measured blood pressure and resting heart rate, height, weight, and waist circumference. Physical functioning was measured based on static balance using the Short Physical Performance Battery measure; grip strength; and functional fitness using the Seniors Fitness Test (upper and lower body muscular strength, aerobic endurance, upper and lower body flexibility, agility and dynamic balance) (43-46). All measurements were taken by research assistants trained to follow a standard protocol. Sub-study participants also wore an Actigraph GT3X-BT accelerometer and QStarz BT-Q1000XT Global Positioning Systems (GPS) device during waking hours for seven days.

What has been found to date? Key findings

A list of publications arising from the HABITAT study to date is available online (https://cur.org.au/project/habitat/).

Physical activity: Baseline evidence shows that residents of socioeconomically disadvantaged neighbourhoods report lower levels of total physical activity, general walking, and moderate and vigorous activity; however, they are more likely to walk for transport (47). Propensity to walk for transport declines with age; however, the declines are more precipitous for older persons, members of lower income households, and residents of disadvantaged neighbourhoods (48). Higher levels of walking for transport in disadvantaged neighbourhoods are associated with living in a built environment more conducive to walking (i.e. greater street connectivity, more diverse land use mix) (49). In the mid-to-older-age population, walking for transport at levels consistent with physical activity recommendations is more likely in neighbourhoods characterised by greater residential density, access to bikeways, proximity to public transport and shops, and living in a well-lit area (50). Moreover, compared with traditional suburban developments, transport walking

(and other active modes such as cycling and public transport use) are more likely in 'Transit Oriented Developments', which are urban forms that integrate mixed land use, a relatively dense built environment, well connected street networks, and pedestrian-friendly infrastructure around a transport node (e.g. train station, bus transit centre) (51). Recent longitudinal findings show that investments in changing the built environment to be more walkable are associated with increased walking for transport (52). At the individual-level, our work shows that social and group contexts influence propensity to engage in recreational physical activity (53-55); for example, older people prefer activities with others of a similar age, but are less likely than their younger counterparts to express a preference for fixed-time and structured activity sessions; and persons from low income households are more likely to express a preference for low-cost and team-based activities (56). Among the mid-to-older age population in Brisbane in 2007, approximately 20% cycled for recreation and 4% for transport (57). A diverse range of environmental (built and social) and individual-level factors (e.g. socio-demographics, perceptions) are associated with cycling, and the determinants of recreational and transport cycling are often different (58).

Sedentary behaviour: Cross-sectional evidence shows that sedentary leisure is largely independent of physical activity level and does not preclude meeting physical activity recommendations (59). Those who report longer sitting times (especially watching TV) are likely to be male, single and living alone, experience health problems, be less educated, not in paid employment, and be overweight (60). Longitudinal findings show that despite overall total sitting-time remaining stable between 2007 and 2013, significant increases were observed in some domains (e.g. home computer use, TV viewing) and in some sub-groups (e.g. women and the unemployed). These increases were countered by declines in work-related sitting due to retirement (61).

Greenspace: Evidence linking urban greenspace and mental health and wellbeing is growing and gaining recognition in planning policies and mental health services (62). Using a causal-inference

longitudinal design we contributed to this evidence by showing that within-person perceptions of increases in neighbourhood greenspace were associated with improvements in mental health over three years; conversely, persons who perceived a decline in surrounding greenspace reported a decrease in wellbeing (63).

Parks and public open space: Among mid-to-older aged Brisbane residents, park use is higher among dog walkers, couples with children, and residents of more socioeconomically advantaged areas (64). Park users are more likely to meet physical activity guidelines than non-users, and users of larger-sized neighbourhood and district-catchment parks spend more time doing vigorous activity and engage in more activity sessions than non-users. People who use parks or beaches for physical activity, and those who live within close walking distance to a river or the coast, are more likely to express support for nature conservation as measured by willingness to sacrifice for the environment (e.g. accept reductions in standard of living, salary, and higher taxes and prices to fund environmental initiatives) (65).

Body Mass Index: Prospective assessments of BMI show that consistent use of active travel (i.e. walking and cycling) is associated with lower BMI (66), and that changes in transport mode from passive to active (e.g. motor vehicle use to walking) are associated with reductions in BMI (67). However, to date, we have found no compelling evidence that moving to a new neighbourhood is associated with within-person change in BMI (68) or that weight changes are associated with area-level characteristics (69).

Health inequalities: Cross-sectional multilevel analyses show that residents of socioeconomically disadvantaged neighbourhoods are more likely to report: poorer self-rated health (70); chronic arthritis (71); tobacco consumption (72); being diagnosed with type 2 diabetes, heart disease, and comorbidity (73), and; lower levels of physical function (74). Neighbourhood disadvantage was associated with these outcomes after adjustment for within-neighbourhood variation in individual-

level SEP (i.e. education, occupation, household income) suggesting that features of the neighbourhood environment are associated with these inequalities.

What are the study's main strengths and weaknesses?

The main strengths of HABITAT include its longitudinal multi-level study design and focus on physical activity, a key health-related behaviour relevant to many physical and psychological health outcomes. Unique internationally, HABITAT includes a wide-range of self-report and objectively assessed determinants of physical activity, many measured at multiple scales, and most measured at five time-points between 2007 and 2016. All of HABITAT's GIS data have been captured at each of the survey time-points, thus permitting us to examine how changing environments influence change in behaviour and health. The study's large, population-based sample and relatively high retention rate has produced findings that are representative and generalizable to the Brisbane population of 'baby boomers'.

HABITAT is an observational cohort study based primarily on self-report data and hence subject to all the biases and limitations inherent in this design. As is the case with most cohort studies, response rates have decreased over time. Differential attrition has led to an over-representation of higher socioeconomic groups. Although designed as a longitudinal multilevel study of physical activity, some determinants – especially within the psychological and social domains – focus on recreational activity and may not pertain to other activity domains (e.g. active transport). Further, despite measuring sedentary behaviour as an outcome, HABITAT was not purpose-designed to examine the multilevel determinants of this behaviour.

Can I get hold of the data? Where can I find out more?

For researchers interested in collaborating on data analyses with the Chief Investigators, enquiries can be submitted to the Lead Investigator, Professor Gavin Turrell (gavin.turrell@rmit.edu.au).

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Figure 1: HABITAT Study conceptual framework

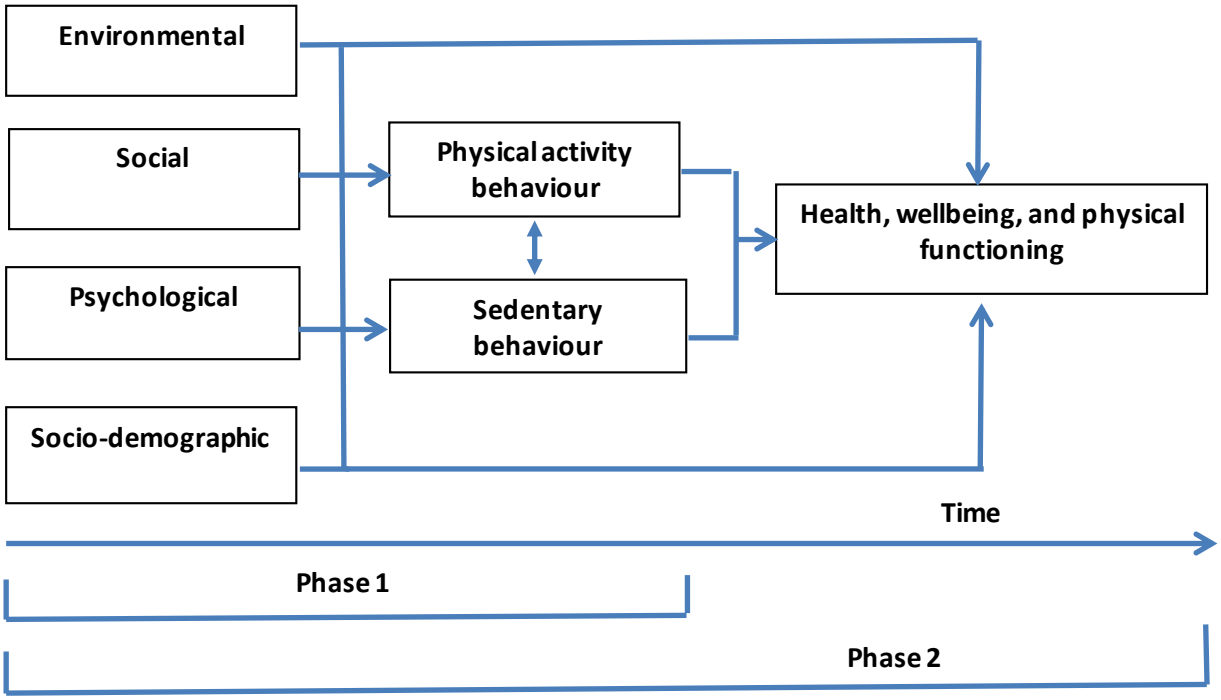

Table 1: Socio-demographic profile of the HABITAT Study cohort at baseline (2007) compared with the Brisbane population aged 40-65 years (2006); and the socio-demographic profile of the HABITAT Study cohort in 2016 (sample participants aged 49-74 years)

	HABITAT cohort at baseline (2007)		Brisbane population aged 40-65 years (2006)[1]		HABITAT cohort at Wave 5 (2016)	
Sex	**n**	**%**	**n**	**%**	**n**	**%**
Male	4,848	43.9	146,067	49.1	2,198	42.4
Female	6,187	56.1	151,213	50.9	2,989	57.6
Age (years)						
40 - 44	2,530	22.9	69,758	23.5	--	--
45 - 49	2,382	21.6	65,704	22.1	139	2.7
50 - 54	2,312	21.0	59,796	20.1	1,094	21.1
55 - 59	2,080	18.8	55,013	18.5	1,078	20.8
60 - 64	1,731	15.7	40,348	13.6	1,098	21.2
65 - 69			6,658	2.2	1,016	19.6
70 - 74	-	-	-	-	761	14.7
Highest education level attained[2]						
Bachelor's degree or higher	3,457	31.3	75,414	25.4	1,882	37.0
Diploma/Associate diploma	1,268	11.5	28,526	9.6	618	12.2
Certificate (trade/business)	1,952	17.7	45,962	15.5	869	17.1
Secondary school or less	4,311	39.1	126,777	42.6	1,699	33.4
Missing	47	0.4	20,588	6.9	13	0.3
Occupation						
Managers and professionals	3,688	33.4	90,597	30.5	1,563	30.1
White collar	2,433	22.0	67,314	22.6	808	15.6
Blue collar	1,580	14.3	50,000	16.8	439	8.5
Occupation unknown	832	7.5	--	--	174	3.4
Not in the labour force[3]	2,004	18.2	85,987	28.9	2,106	40.6
Missing	498	4.5	3,385	1.1	97	1.9
Gross household income per annum (AUD)						
$130,000 or more	1,889	17.1	27,854	18.0	1,060	20.4
$72,800 - $129,999	2,845	25.8	38,370	24.8	1,226	23.6
$52,000 - $72,799	1,625	14.7	24,140	15.6	650	12.5
$41,600 - $51,999	813	7.4	10,354	6.7	377	7.3
$26,000 - $41,599	1,188	10.8	19,846	12.8	574	11.1
$0 - $25,999	1,044	9.5	16,148	10.4	562	10.8
Don't know	270	2.4	--	--	125	2.4
Don't want to answer this	1,147	10.4	--	--	470	9.1
Missing	214	1.9	17,923	11.6	143	2.8
Neighbourhood disadvantage[4]						
Quintile 1 (least disadvantaged)	2,613	23.7	67,016	23.5	1,317	28.4
Q2	2,671	24.2	59,121	20.8	1,054	22.7
Q3	2,303	20.9	56,461	19.8	885	19.1
Q4	1,813	16.4	52,777	18.5	741	16.0
Quintile 5 (most disadvantaged)	1,635	14.8	49,360	17.3	637	13.8

1. Based on Australian Bureau of Statistics 2006 Census data (i.e. closest Census to baseline data collection)
2. The survey question pertaining to education was only asked at baseline (2007). Number of participants with valid education data in 2016 was 5,081: those who returned a completed survey in 2016 and who were not the sampled participant in 2007 (n=106) were excluded from the percentage calculation as their education level was unknown
3. Category includes the retired, home duties, unemployed, and permanently unable to work
4. Quintile 1 contains the 20% least disadvantaged neighbourhoods (Census Collector Districts) and quintile 5 contains the 20% most disadvantaged neighbourhoods

Table 2: HABITAT Study participant attrition: 2007 to 2016

Wave	Respondent		Non-respondent		Withdrawn		Deceased		Unable to contact	
	n	%	n	%	n	%	n	%	n	%
Baseline (2007)	11,035									
1st follow-up (2009)	7,866	71.3	2,634	23.9	377	3.4	46	0.4	112	1.0
2nd follow-up (2011)	6,900	62.5	2,843	25.8	923	8.4	124	1.1	245	2.2
3rd follow-up (2013)	6,520	59.1	3,011	27.3	1,089	9.9	170	1.5	245	2.2
4th follow-up (2016)	5,187	47.0	3,401	30.8	1,606	14.6	311	2.8	530	4.8

Table 3: Socio-demographic characteristics of the HABITAT clinical sub-study participants: 2014 (baseline) and predictors of loss to follow-up between 2014 and 2016

	Baseline sample, 2014 (n=767)	Follow-up sample, 2016 (n=606)	Loss to follow-up in 2016 (n=161)[1]			
			Model 1[2]		Model 2[3]	
	%	%	OR	95% CrI	OR	95% CrI
Sex						
Female	59.8	60.2	1.00			
Male	40.2	39.8	1.07	0.65, 1.34	1.03	0.65, 1.45
Age (years)						
45 - 49	14.2	14.4	1.00		1.00	
50 - 54	21.4	21.3	1.08	0.59, 1.96	1.13	0.60, 2.14
55 - 59	20.9	20.3	1.20	0.66, 2.19	1.14	0.61, 2.14
60 - 64	20.2	20.3	1.04	0.57, 1.92	0.94	0.48, 1.81
65 - 69	18.9	19.3	0.95	0.51, 1.80	0.77	0.38, 1.56
70 - 74	4.4	4.5	0.99	0.35, 2.55	0.85	0.28, 2.44
Highest education level attained						
Bachelor's degrees or higher	42.0	44.2	1.00		1.00	
Diploma/ Associate diploma	11.6	10.7	1.86	1.05, 3.24	1.65	0.90, 2.99
Certificate (trade/ business)	16.6	17.2	1.08	0.62, 1.86	0.84	0.45, 1.52
Secondary school or less	29.6	27.9	1.73	1.13, 2.67	1.35	0.82, 2.25
Missing	0.3	0.0	--	--	--	--
Occupation						
Managers and professionals	37.4	38.8	1.00		1.00	
White collar	20.1	19.8	1.28	0.76, 2.11	0.95	0.54, 1.69
Blue collar	9.3	8.3	1.92	1.02, 3.52	1.47	0.72, 2.97
Occupation unknown	2.5	2.2	1.14	0.68, 1.90	0.88	0.50, 1.55
Not in the labour force	28.3	28.9	2.05	0.68, 5.93	1.31	0.39, 4.06
Missing	2.5	2.2	2.09	0.69, 5.95	1.76	0.55, 5.20
Gross Household income per annum (AUD)						
$130,000 or more	23.2	25.1	1.00		1.00	
$72,800 - $129,999	27.0	27.1	1.67	0.96, 2.93	1.53	0.86, 2.70
$52,000 - $72,799	12.1	11.6	2.27	1.16, 4.41	1.92	0.95, 3.88
$41,600 - $51,999	7.8	7.9	1.78	0.79, 3.93	1.41	0.58, 3.33
$26,000 - $41,599	10.3	9.4	3.02	1.47, 6.10	2.51	1.15, 5.52
$0 - $25,999	11.1	10.9	2.25	1.07, 4.68	1.85	0.83, 4.12
Don't know	1.4	1.3	2.42	0.49, 10.10	1.96	0.37, 8.86
Don't want to answer this	5.6	5.5	2.13	0.87, 4.95	1.88	0.72, 4.76
Missing	1.4	1.3	2.29	0.45, 9.48	2.20	0.43, 9.07
Neighbourhood disadvantage						
Quintile 1 (Least disadvantaged)	29.7	31.2	1.00		1.00	
Q2	13.4	13.5	1.23	0.64, 2.30	1.15	0.58, 2.19
Q3	21.9	21.0	1.60	0.94, 2.72	1.46	0.84, 2.54
Q4	18.5	19.0	1.17	0.66, 2.07	0.99	0.54, 1.80
Quintile 5 (Most disadvantaged)	16.4	15.4	1.79	1.03, 3.14	1.32	0.72, 2.41

1. Modelled using multilevel logistic regression, with model parameters (expressed as odds ratios and 95% credible intervals) estimated by Markov chain Monte Carlo simulation using MLwiN software (33)
2. Age and sex adjustment only
3. Simultaneous adjustment for all sociodemographic characteristics
4. Quintile 1 contains the 20% least disadvantaged neighbourhoods (Census Collector Districts) and quintile 5 contains the 20% most disadvantaged neighbourhoods