Supplementary Table 1. PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title (page 1)
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Structured abstract (page 3)
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction (page 4-5)
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Last sentence of introduction (page 5)
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Methods section: Data sources and searches, first sentence (Page 5)
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Methods, Data sources and searches, 2nd paragraph and Eligibility criteria (page 5-6)
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Methods, Data sources and searches, 2nd paragraph (page 5)
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary Table 2
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Methods, Eligibility criteria (page 6-7), Study selection, Figure 1
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Methods, Data extraction (page 7-

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			8)
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Methods, Data extraction and Data synthesis (page 7-11)
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Methods, Quality appraisal and risk of bias analysis (11-12)
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Methods, Data synthesis (page 7-11)
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Methods, Data synthesis (page 7-11)

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Methods, Quality appraisal and risk of bias analysis (11-12)
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Methods, Quality appraisal and risk of bias analysis, last paragraph (11-12)
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Results, Selection of studies (Page 12) and Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Results, Study characteristics (Page 12-13); Table 1; Supplementary Table 5
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Results, Study characteristics (11-

Supplementary Table 1. PRISMA 2009 Checklist

			12) and Supplementary Table 6
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N/A (not a meta-analysis)
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Results, Risk of bias analysis (page 11-12)
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Results, Risk of bias analysis (page 11-12); Supplementary Table 7
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Throughout the Discussion (page 20-29)
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Discussion, Strengths and limitations (page 28)
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Discussion, Conclusions (page 28-29)
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Funding

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Supplementary Table 2. Search strategy used for MEDLINE

#	Search Statement
1	exp Residence Characteristics/
2	residential relocation.mp.
3	((relocat* or mov*) adj3 (residen* or hous* or neighbo?rhood*)).mp.
4	(moving adj2 opportunity).tw.
5	(residen* adj3 mobil*).mp.
6	1 or 2 or 3 or 4 or 5
7	Environment Design/
8	Transportation/
9	(neighbo?hood adj2 (walk* or environmen* or character*)).mp.
10	built environment.mp.
11	neighborhood environment walkability scale.mp.
12	(environmen* adj4 influenc*).mp.
13	7 or 8 or 9 or 10 or 11 or 12
14	6 and 13
15	physical activ*.tw.
16	(pedestrian* or cycling or walk* or activ*).tw.
17	Motor Activity/
18	(level adj3 activ*).tw.
19	(sedent* or commut* or exercis*).tw.
20	15 or 16 or 17 or 18 or 19
21	14 and 20
22	Diet/
23	Food/
24	diet quality.mp.
25	nutrition.mp.
26	diet.tw.
27	Fruit/ or fruit.mp.
28	vegetables.mp. or Vegetables/
29	(fruit and vegetable*).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word,

	protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
30	22 or 23 or 24 or 25 or 26 or 27 or 28 or 29
31	14 and 30
32	Body mass index.mp. or Body Mass Index/
33	BMI.mp.
34	Obesity/ or obes*.mp.
35	weight.mp.
36	weight outcome.mp.
37	overweight.mp. or Overweight/
38	waist circumference.mp. or Waist Circumference/
39	32 or 33 or 35 or 36 or 37 or 38
40	14 and 39
41	Fit.mp.
42	Physical Fitness/ or fitness.mp.
43	urban health.mp. or Urban Health/
44	health impact assessment.mp. or Health Impact Assessment/
45	Health Status/ or Self Report/ or self-rated health.mp.
46	health*.mp.
47	41 or 42 or 43 or 44 or 45 or 46
48	14 and 47
49	cardiovascular disease.mp. or Cardiovascular Diseases/
50	CVD.mp.
51	blood pressure.mp. or Blood Pressure/
52	coronary heart disease.mp.
53	CHD.mp.
54	stroke.mp. or Stroke/
55	Hypertension/
56	ischemic heart disease.mp.
57	ischaemic heart disease.mp.
58	49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57
59	14 and 58

60	Mental health.mp. or Mental Health/
61	depression.mp. or Depression/
62	Stress, Psychological/ or Kessler 10.mp.
63	"Quality of Life"/ or SF-12.mp.
64	60 or 61 or 62 or 63
65	14 and 64
66	physical function.mp. or "Activities of Daily Living"/
67	MOSPF.mp.
68	66 or 67
69	14 and 68
70	type 2 diabetes.mp. or Diabetes Mellitus, Type 2/
71	blood glucose.mp. or Blood Glucose/
72	Hemoglobin A, Glycosylated/ or HbA1c.mp.
73	70 or 71 or 72
74	14 and 73
75	21 or 31 or 40 or 48 or 59 or 65 or 69 or 74
76	limit 75 to (humans and "all adult (19 plus years)")

The search terms and strategies were adapted for other databases

Supplementary Table 3. The expected direction of associations between neighbourhood environment attributes and walking/PA/active travel outcome

	The expected association with	
Neighbourhood environment attributes	**Walking/PA/active travel**	**Driving**
Parks/greenspace/recreation facilities (Access/area/quality)	Positive	Unclear
Residential/population density	Positive	Inverse
Street connectivity	Positive	Inverse
Land-use mix/destinations	Positive association (particularly with transport walking/PA)	Inverse
Walking/cycling facilities (presence/quality)	Positive	Inverse
Public transport (access/services)	Positive (particularly with transport walking/PA)	Inverse
Overall transportation access	Positive (particularly with transport walking/PA)	Inverse
Parking (ease/access)	Inverse (particularly with transport walking/PA)	Positive
Traffic (speed/volume)	Inverse	Unclear
Aesthetics	Positive (particularly for recreational walking/PA)	Unclear
Crime-related safety	Positive	Inverse
Social environment (sociability)	Positive	Unclear
Neighbourhood type (New-Urbanist, traditional)	Positive	Inverse
Walkability/pedestrian index	Positive	Inverse
Sprawl	Inverse	Inverse
Overall accessibility (to destinations and transportation)	Positive	Inverse

PA=physical activity

Supplementary Table 4. Quality appraisal checklist

Criterion	Rating			Appraiser Comments
	Yes (score=1)	No (score=0)	Can't tell (score=0)	
1. Were study samples randomly recruited from the study population with a response rate of at least 60%, or were they shown to be representative of the population?				
2. If the study was prospective longitudinal, was the attrition rate less than 30%, or if results were based on retrospective longitudinal design, was a minimum of at least 100 participants achieved?				
3. Were the environmental exposure measure(s) shown to be valid and reliable in published research/pilot study or recognised as an acceptable measure (e.g. previously used in national physical activity or travel survey)?				
4. Were the outcome measure(s) shown to be valid and reliable in published research/pilot study or recognised as an acceptable measure (e.g. previously used in national physical activity or travel survey)?				
5. Was the analysis adjusted for self-selection into neighbourhoods (e.g. questions about residential preferences)?				
6. Was the analysis adjusted for sociodemographic characteristics (at least age, sex, education)?				
7. What was the study design? Score=1 if prospective longitudinal study; score=0 if retrospective longitudinal study.				

8. Did the study assess whether the participants experienced life changing events which may have led them to relocate and did they account for these events?				
9. If the study was prospective longitudinal, did it have more than one year of follow-up?				
Overall article quality score				

Supplementary Table 5. Summary of all included publications (n=23)

First author, publication year, study name	Study design, setting and follow-up	Sample recruitment	Sample characteristics	Outcome measures	Built/social environmental exposure variables	Covariates	Self-selection adjustment	Moderators	Findings relating to residential relocation
Retrospective longitudinal studies									
Aditjandra 2016	Quasi-longitudinal household survey; 10 selected neighbourhoods; North East England, UK; spring 2007. Neighbourhood definition: smallest administration area used in the 2001 British Census data, LSOA	Neighbourhoods were screened and the most representative ones were selected after controlling for income and sustainable mobility (percentage of walking, cycling and public transport use); 716/2157 questionnaires were returned (33% response rate, of which 32% contained valid data for the analysis); respondents had relocated within the last 8 years	n=219 respondents; referred to another study[a] for sample characteristics which are categorised by housing type and neighbourhood: mean age range: 6.5-49.3 years; 35%-58% women	Self-reported public transport use and walking behaviour based on a Likert scale; adapted questionnaire	Self-reported neighbourhood characteristics/ preferences measure using 27 Likert-scale items. Factor analysis performed. *Perceived neighbourhood characteristics:* safety, travel accessibility, residential spaciousness, social factors, shopping/facilities accessibility, outdoor space accessibility, neighbourhood unattractiveness	Age, gender, educational background, economic status, household income, household size, number of children, and changes in household income, household size and number of children	Yes; structural equation modelling that included residential preferences and travel attitudes	Not mentioned	Changes in public transport use are determined by accessibility features of the built environment, socio-demographic and travel attitude characteristics. Changes in walking are determined mostly by built environment characteristics.
Cao 2007	Quasi-longitudinal survey; October-November 2003; four "traditional" and four "suburban" neighbourhoods in Northern California, US; neighbourhood definition: not clearly defined	Neighbourhoods selected to vary systematically on neighbourhood type, metropolitan area size, and region. Random samples of 500 movers and 500 non-movers for each of the eight neighbourhoods were drawn from two commercial databases of	n=547 respondents who moved in the previous year; mean age range: 35.6-49.4 years; 48-74% women	Changes in self-reported travel behaviour	*Objective:* Accessibility measures (number of different types of businesses within specified distances, distance to the nearest establishment of each type, number of establishments of each business	Age, gender, educational background, household income, employment status, household size, number of children in the household, mobility constraints, residential tenure, travel attitudes, preferred neighbourhood characteristics	Yes; structural equation modelling that included residential preferences and attitudes	Not mentioned	Increases in reported walking were positively associated with increases in physical activity options, safety, socialising, and current socialising, number of business types within 400m and current distance to nearest fast food (p<0.05).

		residents. Mail-out, mail-back approach; 1682 responses, 24.9% response rate			types within specified distances) *Perceived*: Changes in accessibility, physical activity options, safety, socialising, attractiveness, outdoor spaciousness				
Cervero 2008	Pre-post survey; October 2006; 20 housing developments in three Shanghai suburban districts, China; neighbourhood definition: within 1,000m radius of residences	Stratified sampling; three suburban districts and 6-7 housing developments selected per district	n=900 households (2,840 residents aged ≥12 years); 75% had lived in their current residence ≤3 years; socio-demographic characteristics not described	Self-reported commute mode change from non-motorised travel to auto and from bus to auto	*Objective*: Road length and street connectivity index; measuring method not described	*Model from non-motorised travel to auto:* Change in job accessibility index, move near rail service, move near metro, road length, street connectivity index, change in household income, automobile ownership, job change, non-choice move *Model from bus to auto:* Age, education level, change in job accessibility index, prior residence, moved near rail service, road length, automobile ownership	Yes; ordinary least square modelling that adjusted for residents who moved by choice and those who were asked to relocate by the government (non-choice movers)	Not mentioned	Change in commute mode from non-motorised travel to auto was associated with road length (p=0.015) but not street connectivity. Change in commute mode from bus to auto was not significantly associated with road length.
Handy 2005	Same as Cao et al., 2007	Same as Cao et al., 2007	n=688 respondents who moved in the previous year; characteristics of movers not mentioned (although characteristics of the overall sample described in Table 1; mean age range: 43.3-54.7 years; 46.9%-58.2% women)	Changes in self-reported travel behaviour	*Objective:* Accessibility measures (number of different types of businesses within specified distances, distance to the nearest establishment of each type, number of establishments of	Age, gender, educational background, household income, employment status, household size, number of children in the household, mobility constraints, residential tenure, travel attitudes, preferred neighbourhood characteristics	Yes; ordinary least square and ordered probit modelling that adjusted for residential preferences and attitudes	Not mentioned	*Cross-sectional analyses:* Built environment variables were no significantly associated with travel behaviour. *Quasi-longitudinal bivariate analyses:* A higher proportion of respondents reported increased walking levels with increases in perceived

					each business types within specified distances) *Perceived*: Changes in accessibility, physical activity options, safety, socialising, attractiveness, outdoor spaciousness				neighbourhood accessibility, physical activity options, safety, socialising, and attractiveness (p<0.001). *Quasi-longitudinal analyses from ordered probit model:* The number of grocery stores (p=0.048) and pharmacies within 1,600m (p=0.04) were significantly associated with a lower propensity for driving. Increased perceived accessibility and safety were associated with either smaller increases or larger decreases in driving (p<0.001).
Handy 2006	Same as Cao et al., 2007	Same as Cao et al., 2007	n=1,682 (reported n=1672 in text); mean age range: 43.3-54.7 years; 46.9%-58.2% women	Change in self-reported frequency of walking to the store and of strolling around the neighbourhood in the last month; change in self-reported cycling (not confined to the neighbourhood)	*Objective:* Accessibility measures (number of different types of businesses within specified distances, distance to the nearest establishment of each type, number of establishments of each business types within specified distances) *Perceived*: Accessibility, physical activity options, safety,	Age, gender, educational background, household income, employment status, household size, number of children <5 years, children <18 years, number of cars, number of bicycles, driver's licences, driving limitation, walking limitation, biking limitation travel attitudes, preferred neighbourhood characteristics	Yes; negative binomial regression and ordered probit modelling that adjusted for residential preferences and attitudes	Not mentioned	*Cross-sectional analyses:* Objective distance to the nearest grocery store, number of types of businesses within 800m, and perceived safety, attractiveness, and stores within walking distance were associated with higher frequency of walking to the store. Only perceived socialising and attractiveness were significantly associated with higher strolling frequency. *Quasi-longitudinal analyses:* The minimum

					socialising, attractiveness, outdoor spaciousness, stores within walking distance, cul-de-sac; change variables				distance to a bank, number of banks within 800m, number of types of businesses within 1,600m and changes in perceived accessibility, physical activity options, safety, socialising, attractiveness were positively associated with changes in walking. Increases in "alternatives" and "socialising" factors were positively associated with changes in cycling.
Handy 2008	Same as Cao et al., 2007	Same as Cao et al., 2007	n=1,682 stratified by movers (moved within a year) and non-movers; n=1,487 for cross-sectional analysis and n=1,352 for quasi-longitudinal analyses; mean age range: 43.3-54.7 years; 46.9%-58.2% women	Self-reported frequency of moderate-vigorous physical activity in the last week and self-reported change in physical activity within the neighbourhood from prior to moving (movers only) or from one year ago (non-movers); tested for reliability	*Objective:* Accessibility measures (number of different types of businesses within specified distances, distance to the nearest establishment of each type, number of establishments of each business types within specified distances) *Perceived:* Changes in accessibility, physical activity options, safety, socialising, attractiveness, outdoor spaciousness	Age, gender, educational background, household income, employment status, household size, number of children in the household, mobility constraints, residential tenure, travel attitudes, preferred neighbourhood characteristics	Yes; Poisson regression and ordered probit modelling adjusted for residential preferences and attitudes	Not mentioned	*Cross-sectional analyses:* The number of business types within 400m, the distance to the nearest health club and perceived physical activity options, socialising, attractiveness, stores within walking distance were positively associated with exercise frequency. *Quasi-longitudinal analyses:* Perceived neighbourhood safety and changes in physical activity options, socialising, and attractiveness were positively associated with changes in exercise frequency.

Klinger 2015	Quasi-longitudinal retrospective design; survey of people who moved between 2006-2011 between three urban regions; Bremen, Hamburg and the Ruhr area, Germany; neighbourhood definition: not clearly defined	5,185 mailed questionnaires and reminders sent out (with opportunities for entering for a lottery for two shopping vouchers); 1,450 retuned; 28% response rate	49.6% between 30-44 years; 57.8% women	Change in self-reported travel behaviour (frequency of car travel, rail transit and bicycle use)	*Objective:* Change of activity space (spatial orientation was collected for five activities) and of regional accessibility (based on place of residence)	Age, gender, educational level, employment status, change in income, change in number of adults, change in number of children, increase of mode availability, residential choice preferences, change in mobility culture perception, change in city-relation of the move, baseline travel mode use	Yes; ordinary least square regression modelling that adjusted for reasons for residential choice (highway, parking, transit and city centre accessibility)	Not mentioned	Changes in bicycle use were not associated with "urban-form related influences", but were influenced by a "bicycle-oriented cultural setting" and "an orientation towards walking".
McCormack 2017	Quasi-longitudinal study; 2014; Calgary, Alberta, Canada; neighbourhood definition: based on postcodes/neighbourhood names	12 pre-1980 built Calgary neighbourhoods were selected as recruitment sites using stratified random sampling; strata defined by block pattern and socioeconomic status quartiles; a random sample of 10,500 households was mailed a survey package and two reminder postcards; one participant/household aged ≥20 years was recruited; response rate of 10.1%	n=915; 820 non-movers (mean age=54.4 years; 61.3% women) and 95 who relocated in the last 12 months to either a more walkable (n=48; mean age=42.8 years; 72.9% women) or less walkable (n=47; mean age=41.6 years; 74.5% women) neighbourhood	Self-reported transport-related walking, cycling, and overall physical activity since moving (or not moving) in the last 12 months; PAHDQ	*Objective:* Walk Score; tested for validity	Age, gender, ethnicity, educational level, household income, marital status, number of children at home, dog ownership in past 12 months, motor vehicle access, self-reported mental and physical health, presence of an injury in the past 12 months	Yes; propensity score multinomial linear regression modelling that adjusted for residential self-selection based on thirteen reasons for neighbourhood choice	Not mentioned	Compared with non-movers, those who moved to less walkable neighbourhood were more likely to report both an increase (OR [95% CI]=4.37 [1.98, 9.44]) and decrease (OR [95% CI]=3.17 [1.43, 6.81]) in transport-related walking. Compared with non-movers, those who moved to a more walkable neighbourhood were more likely (OR [95% CI]=4.14 [2.0, 8.43]) to report an increase in transport-related walking and cycling (OR [95% CI]= 4.22 [1.65, 9.99]).
Prospective longitudinal studies									

Beenackers 2012, RESIDE	Longitudinal, natural experiment; 74 new housing developments; Perth, Australia; before (2003-04) and after relocation (2005-06); neighbourhood definition: 1600m network service buffer around residential address	Housing developments selected based on developments planned according to the state government's "Liveable Neighbourhoods Guidelines" (new urbanism); people planning to relocate in the study areas by December 2005 were invited to participate by the state water authority (n=10,193) or study team (n=9148); one person from each household was randomly selected; n=1813 completed pre questionnaires (33.4% response rate)	Participants not cycling for transport at baseline (n=1289); mean 40.7 (SD:11.7) years; 62.2% women Participants not cycling for recreation at baseline (n=1232); mean 40.5 (SD:11.7) years; 62.6% women Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	Self-reported cycling (min/week) for transport and recreation at least once in a usual week; only participants who did not cycle at baseline but who cycled post-relocation were included (uptake of cycling); NPAQ, tested for reliability	*Objective:* Measures for street connectivity, residential density, land-use mix, number of destinations relevant for transport of recreation; GIS *Perceived:* Access to mixed services, neighbourhood aesthetics, traffic hazards, major barriers, local parking, access to park, access to cycling paths, pedestrian crossings, number of transport and recreation destinations; validated NEWS	Neighbourhood clustering, age, gender, educational level, marital status, children <18 years at home, access to a car, baseline neighbourhood measures, baseline intrapersonal and interpersonal factors	Not mentioned	Not mentioned	After relocation, 5% and 7% of non-cyclists took up transport-related and recreational cycling, respectively. Uptake of transport-related cycling was predicted by an increase in objective residential density (OR=1.54, 95% CI: 1.04, 2.26), self-reported increased access to parks (OR=2.60, 95% CI: 1.58, 4.27) and more recreation destinations (OR=1.57, 95% CI=1.12, 2.22). Uptake of recreational cycling was mostly predicted by an increase in objective street connectivity (OR=1.20, 95% CI: 1.06, 1.35).
Braun 2016, CARDIA	Longitudinal study; 4 regions in US (Birmingham, Alabama; Chicago, Illinois; Minneapolis, Minnesota; Oakland, California); neighbourhood definition: 3 km area around each residential location	Participants who relocated between 2000-2006; referred to another study for recruitment details, >95% enrolment rate	n=1079 participants; ages 32-36 years in 2000; 55% women; 49% Caucasian/51% African American Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	Changes in self-reported walking (participation, exercise units)	*Objective:* Composite walkability index based on population density, street connectivity, food and physical activity resources; GIS	Age, gender, race/ethnicity, educational level, income, household size, marital status, employment status, smoking status, health problems interfering with physical activity, reasons for moving to the current neighbourhood	Yes; in fixed effects models, unmeasured confounders, such as residential preferences and attitudes, were treated as time-invariant factors; random effects models included an indicator of self-selected	Not mentioned	In fixed-effects models, a 1 SD increase in walkability was associated with a 0.81 mmHg decrease in systolic blood pressure (95% CIL -1.55, -0.07) and a 7.36% increase in C-reactive protein (95% CI: 0.60, 14.57). There was no significant association between change in walkability and change in self-reported walking.[d]

							reasons for moving to current neighborhood		
Christian 2013, RESIDE	Longitudinal, natural experiment; 73 new housing developments; Perth, Australia; before relocation (between 2003-December 2005) and one and three years after relocation; neighbourhood definition: ≤15 min walk from home or 1600m network service buffer around residential address	18 livable (complying with most of the state government's "Liveable Neighbourhoods Guidelines" [new urbanism]), 11 hybrid (some compliance), 44 conventional (no compliance) housing developments; people planning to relocate in the study areas by December 2005 were invited to participate by the state water authority and the study team; one person from each household was randomly selected; n=1813 completed pre questionnaires (33.4% response rate)	n=1,047 participants who completed surveys at all three time points; mean baseline age=41.7 (SD:11.8) years; 61.2% women Any comparison between participants who completed all three surveys and those without follow-up data was not mentioned	Self-reported walking (min/week) in a usual week within and outside the neighbourhood; transport, recreational and total walking; NPAQ, tested for reliability	*Objective:* Measures for street connectivity, residential density, land-use mix and access to types of destinations (services, convenience goods, public open space) and public transportation; GIS *Perceived:* Access to mixed use services, street connectivity, cul-de-sacs present, traffic safety, traffic-slowing devices present, crime safety, footpaths, on most streets, neighbourhood aesthetics, access to transportation, retail, recreation and total destinations; validated NEWS	Neighbourhood clustering, baseline age, gender, educational level, marital status, children at home, baseline minutes of recreational, transportation or total walking, self-selection factors	Yes; general linear modelling that adjusted for self-selection factors based on five main reasons for choosing to move to a new neighbourhood	Not mentioned	Participants relocating to liveable vs. conventional developments had greater street connectivity, residential density, land use mix, access to destinations and more positive perceptions of their neighbourhood (all $p<0.05$). There were no significant differences in walking over time by development type.
Clark 2016, UKHLS	Longitudinal; panel survey (2009-2010 and 2010-2011); England, United Kingdom; neighbourhood definition: LSOA/MSOA	Recruitment details and response rates not provided nor reference provided; UKHLS sample (40,000 households) is representative of the 2009 UK	n=15,200 residents of England and employed at both waves; aged ≥16 years; socio-demographic characteristics not further described and no reference is	Changes in self-reported commuting from non-car to car and from non-active to active travel (walking and cycling).	*Objective*: Changes in MSOA population density, number of employment centres with at least 100 jobs accessible by	Age, gender, education, employment type, household size, structure and income, driver license, number of household cars, environmental attitude.	Yes; logistic regression modelling included one attitudinal factor	Not mentioned	Changes in land use characteristics and public transport availability were not significantly associated with changes from non-car to car commuting mode.

	level	population	provided Any comparison between participants who completed both surveys and those without follow-up data was not mentioned		public transport/walk, number of food stores accessible by public transport/walk, travel time to the nearest employment centre with at least 100 jobs by public transport/walk, travel time to nearest town centre by public transport/walk, rail station proximity, number of bus stops, commute distance; measures from other data sets				The likelihood of switching to active travel increased with a decrease in commute distance and increase in mixed land use areas.
Coogan 2009, Black Women's Health Study	Prospective cohort study; three metropolitan regions in US (New York, New York; Chicago, Illinois; Los Angeles, California); biennial follow-up (1995-2001); neighbourhood definition: 0.5 mile network buffer around participants' addresses	Referred to two other studies[b,c] for recruitment details; questionnaires mailed to subscribers to Essence magazine, members of selected Black professional organisations, friends and relatives of respondents[c]; 83% response rate for 1997 questionnaire[c]	n=18,525; mean age=39.2 years; 63%, 16%, and 21% contributed 6, 4, and 2 years of follow-up Compared with respondents and non-respondents, participants lost to follow-up were more likely younger, separated/widowed/ divorced, to have more children, to be a current smoker.	Self-reported vigorous exercise, walking for exercise (hours/week) and utilitarian (e.g. church, store, school, work) walking (hours/week)	*Objective:* Housing density, land use, street connectivity, traffic, availability of public transportation, presence of sidewalks, distance to parks; GIS	Age, educational level, marital status, parity, smoking history, alcohol consumption, estimated energy intake, presence of chronic disease, prior cancer, caregiver responsibilities; neighbourhood socio-economic status, crime level, physical disorder (based on % of vacant homes)	Not mentioned	Not mentioned	Compared to women who moved to neighbourhoods of similar density, women who moved to less dense neighbourhoods were 36% more likely to report decreased levels of utilitarian walking. Women who moved to more dense neighbourhoods were more likely to report increased or decreased levels of exercise walking.

Foster 2016, RESIDE	Longitudinal, natural experiment; 73 new housing developments; Perth, Australia; before relocation (between 2003-December 2005) and one, three and seven years after relocation; neighbourhood definition: same as Christian et al., 2013	People planning to relocate in the study areas by December 2005 were invited to participate by the state water authority; n=1813 completed pre questionnaires (response rate 33.4%)	n=1813 (baseline), 1467 (1 year), 1230 (year 3), 531 (year 7); mean baseline age=40 (11.9) years; 59.5% women Any comparison between participants who completed all three surveys and those without follow-up data was not mentioned	Self-reported walking (min/week) in a usual week within and outside the neighbourhood; total, recreational and transport walking; NPAQ, tested for reliability	*Objective:* Objective crime at the suburb-level (committed against a person in a public space) supplied by the Western Australia Police *Perceived:* Safety from crime; composite score (based on five items) rated on a 5-point Likert scale; modified NEWS; tested for reliability	Age, gender, marital status, education, household income, importance of safety from crime to neighbourhood selection at baseline; built environment factors (residential density, street connectivity), local destinations); social environmental factors (perceived social cohesion); neighbourhood perceptions (esthetics, traffic, street lighting))	Yes; marginal repeated measure modelling included the importance of safety from crime to neighbourhood selection at baseline	Age, gender, marital status, education	For every one level increase on a 5-point Likert Scale in perceived safety from crime: total walking increased by 18 min/week (p<0.001), or 10.5 min/week after accounting for other built and social environment factors (p=0.008); a 7 min/week increase in recreational walking (p=0.009) but findings for transport walking were not significant. The association between crime reported to police and walking was not significant. No evidence for effect modification.

Giles-Corti 2013, RESIDE	Longitudinal, natural experiment; 73 new housing developments; Perth, Australia; before relocation (between 2003-December 2005) and one year after relocation; neighbourhood definition: not clearly defined	Housing developments selected based on developments planned according to the state government's "Liveable Neighbourhoods Guidelines" (new urbanism); people planning to relocate in the study areas by December 2005 were invited to participate by the state water authority (n=10,193) or study team (n=9148); one person from each household was randomly selected; n=5238 were eligible for inclusion; n=1813 completed pre questionnaires (34.6% response rate), n=1437 (83.3% of those still eligible) also completed post questionnaires, and n=1420 provided current address data	Participants who completed pre questionnaires only (n=388); mean age=37.2 (SD:11.8) years; 53.5% women Participants who completed both pre and post questionnaires (n=1420); mean age=40.7 (SD:11.8) years; 61.4% women Compared with participants who were lost to follow-up, participants who completed both questionnaires were more likely to be female, older, married/have a partner, to have children at home and less likely to work; the average times spent in transport-related and recreational walking were similar.	Self-reported walking (min/week) for transport and recreation in a usual week within the neighbourhood; NPAQ, tested for reliability	*Objective:* Seven transport-related destinations and three recreation-related destinations; GIS *Perceived:* Access to mixed use and services, not many cul-de-sacs, footpaths on most streets, neighbourhood aesthetics, shorter intersection distances, many alternative routes, slower traffic speeds, traffic slowing devices, accessibility of local parks/reserves, traffic safety, crime safety, infrastructure and safety for walking, local footpaths, hilly streets, major barriers; validated NEWS *Social environmental:* Social support for walking; dog ownership	*All models:* Neighbourhood clustering, baseline age, gender, educational level, marital status, children <18 years at home, baseline total minutes of recreational or transport-related walking; *transport-related walking models:* change in work status, number of hours worked weekly, time to travel to work; *recreational walking models:* change in education level; changes in objective environmental characteristics, changes in neighbourhood environment perceptions, interpersonal variables, intrapersonal variables, self-selection scales	Yes; general linear mixed modelling included self-selection factors based on multiple reasons for choosing to move to a new neighbourhood	Perceived neighbourhood attractiveness	After relocation, overall transport-related walking decreased by 8.5min/week while recreational walking increased by 15.5 min/week (both $p<0.001$); access to transport and recreational destinations changed in similar directions. For participants with increased access to destinations, transport-related walking increased by 5.8 min/week ($p=0.045$) and recreational walking by 17.6 min/week ($p=0.07$) for each type of transport-related/recreational destination that increased. Self-selection was not related with changes in walking. The association between the built environment and recreational walking was partially mediated by changes in perceived neighbourhood attractiveness.
Hirsch 2014, MESA	Longitudinal; 6 US study sites: Baltimore (Maryland), Chicago (Illinois), Forsyth County (North Carolina), Los Angeles (California), New York (New York), St Paul	Participants recruited between 2000-2002 from 6 study sites; referred to another study for recruitment details; response rates not mentioned	n=701 participants who relocated between waves 3 and 5; at wave 3, mean 61.8 (SD: 9.3) years; 52.4% women; ethnically diverse Any comparison between participants who completed both	Walking for transport and leisure; interviewer-administered questionnaire adapted from the Cross-Cultural Activity Participation Study; tested for	*Objective:* Street Smart Walk Score; tested for validity	*All models:* Age, race/ethnicity, educational level, income, employment status, self-reported marital status, health, arthritis, cancer diagnosis/hospitalisation, season from interviewer administered	Not mentioned	Not mentioned	Moving to an area with 10 point higher Walk Score was associated with a 16.04 (95% CI: 5.13, 29.96) min/week increase in walking for transport (AOR=1.11; 95% CI: 1.02, 1.21) and a 0.06 (95% CI: -0.12, -0.01)

	(Minnesota); mean 6.3 (SD: 0.4) years between waves 3 (2004-2005) and 5 (2010-2012) of follow up; neighbourhood definition: not reported		pre and post-relocation surveys and those without follow-up data was not mentioned	reliability and validity		questionnaire; *BMI models:* Changes in walking for transport and recreation			kg/m² BMI reduction. Change in walkability was not associated with change in recreational walking.
Knuiman 2014, RESIDE	Longitudinal, natural experiment; 73 new housing developments; Perth, Australia; before relocation and one, three and seven years after relocation (2003-2012); neighbourhood definition: ≤15 min walk from home	People planning to relocate in the study areas by December 2005 were invited to participate by the state water authority; n=1813 completed pre questionnaires (response rate 33.4%)	n=1813 (baseline), 1467 (1 year), 1230 (year 3), 531 (year 7); mean baseline age=39.9 (11.8) years; 59.8% women Participant drop-out was associated with age, sex and having children at home but not to prior values of walking.	Self-reported walking (min/week) for transport in a usual week within the neighbourhood; NPAQ, tested for reliability	*Objective:* Measures for street connectivity, residential density, land-use mix and access to types of destinations (services, convenience goods, public open space) and public transportation within 1,600m; GIS and commercial electronic database of services and stores *Perceived:* Access to types of destinations (services, convenience goods, public open space) and public transportation; validated NEWS	Baseline age, gender, educational level, marital status, occupational level, working hours/week, household income, number of adults in the household, children at home, access to a motor vehicle	Yes; based on comparison of effect estimates from subject-level mixed and conditional logistic models	Not mentioned	Connectivity, land-use mix, access to public transportation and variety in types of local destinations were positively related to transport walking
Krizek 2003	Longitudinal travel panel survey; 4 counties; Central Puget Sound region, US; annual survey	Combination of random digit dialling and recruitment of transit riders by recontacting respondents to	n=430 households who relocated between waves (out of 6144 households); household/household member characteristics not	Self-reported travel behaviour between two consecutive years using a 2-day trip diary (purpose, mode, duration,	*Objective:* Neighbourhood accessibility (density, land use mix, street patterns)	Household income, number of vehicles, number of adults, number of children, number of employees; change in household commute distance;	No	Not mentioned	Households that relocate and change their neighbourhood accessibility, change their travel behaviour.

	(1989-1998); geographical unit of analysis: the study region was divided into 150m grid cells (slightly larger than an average city block)	previous travel surveys and handing out letters requesting volunteers on randomly chosen bus routes; response rates not mentioned	mentioned Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	distance) for all household members ≥15 years of age; travel behaviour outcomes: vehicle miles travelled, person miles travelled, number of tours and number of trips/tour summed over 2 days and averaged over persons in each household		changes in life cycle, regional accessibility, work accessibility; baseline travel behaviour variables			Increases in neighbourhood accessibility reduced vehicles miles travelled, personal miles travelled, and number of trips/tour but increased average number of tours.
Lee 2009, Harvard Alumni Health Study	US; 1988 (cross-sectional), 1993 (cross-sectional) and 1988-1993 (longitudinal); neighbourhood definition: county level	Male undergraduates at Harvard University (1916-1950)	1993 cross-sectional sample: n=4,997 men, mean age=70 years; 1988 cross-sectional sample: n=4,918 men; 1988-1993 longitudinal sample: n=3,448; Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	Self-reported physical activity (frequency and duration; mean energy expenditure and distance walked were derived); acceptable reliability and validity	*Objective:* Sprawl index at the county-level; high sprawl (index <100), medium sprawl (index=100-124), low sprawl (index ≥125)	Age, smoking, baseline values	Not mentioned	Not mentioned	There was a cross-sectional association between less urban sprawl and more walking (low vs. high sprawl (reference) OR [95% CI]=1.38 [1.09, 1.76] in 1993 and OR [95% CI]=1.53[1.19, 1.96] in 1988) for meeting physical activity recommendations by walking. In longitudinal analyses, men moving from more to less sprawling counties did not increase their walking.
Scheiner 2013a	Longitudinal household survey; 1994-2008; Germany; neighbourhood definition: not clearly defined	Household members aged ≥10 years; recruitment details and response rates not provided nor reference provided	n=6,932, for 4,304 of whom two observations of change were available; 11,236 weeks of report with complete information; socio-	Changes in self-reported travel mode specific trip rates (mean trip frequencies/day over one week of report) from one	*Perceived:* Walking distance from public transport stop, public transport connection, parking situation,	Cohort, year of survey, gender, household, family biography; social status, employment and educational biography; access to	Not mentioned	Not mentioned	An increase in walking distance from the public transport stop results in a decrease in walking (p<0.001).

			demographic characteristics not mentioned nor reference provided Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	year to the next: car as a driver, public transport, bicycle and walking	change in urbanity, change in public transport quality	place of work or education and associated changes; license holding and car availability and associated changes; spatial context at residence, relocation; baseline value of mode use			A decrease in walking distance from the public transport to work results in an increase in public transport use (p=0.02). A worse public transport connection was associated with decreases in walking (p=0.01) and cycling (p=0.03). A better parking situation was associated with more driving (p=0.04), and less public transport (p<0.001) and walking (p=0.03). A worse parking situation was associated with less driving (p=0.01). An increase in urbanity was associated with increased walking (p<0.001).
Scheiner 2013b	Retrospective, cross-sectional design; 2003; 7 study areas in Cologne, Germany; neighbourhood definition: based on study areas	Survey undertaken within the framework of the project StadtLeben; 27% response rate	n=791 respondents who reported moving at least once since 1989 (within 14 years prior to the survey); mean age=48 years; 52.4% women Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	Self-reported changes since the last residential move in the frequency of use of four transport modes (car, public transport, bicycle and walking)	*Perceived:* Change in the quality of shopping facilities and services; change in level of satisfaction with public transport	Exact covariates not clearly stated	No	Not mentioned	Suburbanisation is significantly associated with increases in car use, and decreases in public transport use, bicycle use and walking. Relocations to the city are associated with changes in decreases in car use, and increases in public transport use, bicycle use, and walking.

Wasfi 2016, NPHS	Longitudinal; ten provinces, Canada; bi-annual survey (1994-2006); neighbourhood definition: based on post codes	Statistics Canada bi-annual survey conducted on household residents in 10 Canadian provinces; recruitment details and response rates not provided nor reference provided; study sample restricted to adults aged 18-55 years living in urban areas	n=2,976 (52% women); mean age (SD)= 38 (9) years; 1,313 respondents who moved once during the survey follow-up period (52% women) and 1,663 non-movers (48% women) There were no significant differences in the health status or level of utilitarian walking between participant lost to follow-up and those who remained in the study	Self-reported utilitarian walking (none; low, <1 hour/week; moderate, 1-5 hours/week; high, ≥6 hours/week)	*Objective:* Walk Score; tested for validity; low (0-39), low-medium (40-55), medium-high (56-69), high (70-100) walkability; proportion of cumulative exposure time (time spent in each neighbourhood Walk Score quartile)	Age, gender, educational level, leisure time physical activity, perceived health status	Not mentioned	Not mentioned	A one unit increase in the probability of spending more time in the highest vs. lowest Walk Score quartile neighbourhoods increased the probability of moderate (4% [95% CI: 2.9-5.1]) and high (7% [95% CI: 5.8-9.7%]) utilitarian walking. Moving from low to high walkable neighbourhoods increased the odds of moderate and high utilitarian walking by 59% (95% CI: 3%-140%) compared to moving to a neighbourhood with a similar walkability level.
Wells 2008	Quasi-experimental longitudinal study; in partnership with a housing program, women moved to either 1) a new urbanist community or 2) a conventional suburban neighbourhood; Southeastern US; 2003-2006; neighbourhood definition: based on network buffer zone	Four towns selected in Georgia, Alabama, and Florida as new neighbourhoods were being constructed there by a self-help housing organisation; the organisation provided names of women they had partnered with; 69% response rate of post-move only participants; 64% pre-move response rate with 74%	Post-move cross-sectional sample: n=70 women, mean age=37.6 years; longitudinal sample: n=32, mean age=38 years; low-income, primarily African-American Any comparison between participants who completed both pre and post-relocation surveys and those without follow-up data was not mentioned	*Objective:* Walking (steps/week); pedometer	*Objective:* Type of neighbourhood (suburban vs new urbanist); density, land-use mix, street-network pattern connectivity; GIS	Age, race/ethnicity, marital status, household size, body mass index, pre-move walking	Yes; through quasi-random assignment to neighbourhood type	Not mentioned	Levels of walking were not significantly different between types of neighbourhood. Women who moved to places with fewer cul-de-sacs (street pattern) walked more. Increases in land-use mix were associated with less walking.

within one-quarter mile of participants' residences	follow-up for longitudinal sample

Abbreviations: BMI=body mass index; CARDIA=Coronary Artery Risk Development in Young Adults study; CCHS=Canadian Community Health Surveys; CI=confidence interval, GIS=Geographic Information System; km=kilometres; m=metres; HDL=high-density lipoprotein; IPAQ=International Physical Activity Questionnaire; LDL=low-density lipoprotein; LSOA=Lower Layer Super Output Area level; MESA=Multi-Ethnic Study of Atherosclerosis; min=minutes; MrOS=Osteoporotic Fractures in Men Study; MSOA=Medium Layer Super Output Area level; NEWS=Neighborhood Environment Walkability Scale; NPAQ=Neighbourhood Physical Activity Questionnaire; NPHS=National Population Health Survey; OR=odds ratio; PAHDQ=Physical Activity Health and Demographic Questionnaire; RESIDE=RESIDential Environment Project; SD=standard deviation; UK=United Kingdom; US=United States; UKHLS=United Kingdom Household Longitudinal Study

[a] Aditjandra PT, Cao XJ, Mulley C. Understanding neighborhood design impact on travel behavior: An application of structural equations model to a British metropolitan data. *Transportation Research Part A* 2012;46:22-32.

[b] Rosenberg L, Adams-Campbell L, Palmer JR. The Black Women's Health Study: a follow-up study for causes and preventions of illness. *Journal of the American Medical Women's Association* 1995;50(2):56-8.

[c] Russell C, Palmer JR, Adams-Campbell A, Rosenberg L. Follow-up of a large cohort of black women. *American Journal of Epidemiology* 2001;154(9):845-53.

[d] Findings from fixed-effects models are reported here. Authors compared fixed-effects to random-effects models, with the latter producing biased estimates.

Supplementary Table 6. Quality appraisal of included studies

First author year	Criterion #1	Criterion #2	Criterion #3	Criterion #4	Criterion #5	Criterion #6	Criterion #7	Criterion #8	Criterion #9	Overall quality score (maximum 9)
Aditjandra 2016	0	N/A	0	0	1	1	0	1	N/A	3
Beenackers 2012	0	1	1[a]	1	0	1	1	0	0	5
Braun 2016	0	1	0	0	1	1	1	1	1	6
Cao 2007	0	N/A	0[b]	0	1	1	0	1	N/A	3
Cervero 2008	0	N/A	0	0	0	1	0	0	N/A	1
Christian 2013	0	0	1[a]	1	1	1	1	0	1	6
Clark 2016	1	0	0	0	0	1	1	1	0	4
Coogan 2009	1	0	1	0	0	1	1	0	1	5
Foster 2016	0	0	1[a]	1	1	1	1	0	1	6
Giles-Corti 2013	0	1	1[a]	1	1	1	1	0	1	7
Handy 2005	0	N/A	0[b]	0	1	1	0	1	N/A	3
Handy 2006	0	N/A	0[b]	0	1	1	0	1	N/A	3
Handy 2008	0	N/A	0[b]	0	1	1	0	0	N/A	2
Hirsch 2014	1	1	1	1	0	1	1	0	1	7
Klinger 2015	0	N/A	0	0	1	1	0	1	N/A	3
Knuiman 2014	0	0	1[a]	1	1	1	1	0	1	6
Krizek 2003	0	0	1	0	0	0	1	0	0	2
Lee 2009	0	0	1	1	0	1	1	0	1	5
McCormack 2017	0	N/A	1	0	1	1	0	0	N/A	3
Scheiner 2013a	0	0	0	0	0	1	1	1	0	3
Scheiner 2013b	0	N/A	1	0	0	1	1	1	N/A	4
Wasfi 2016	0	0	1	0	0	1	1	0	1	4

First author year	Criterion #1	Criterion #2	Criterion #3	Criterion #4	Criterion #5	Criterion #6	Criterion #7	Criterion #8	Criterion #9	Overall quality score (maximum 9)
Wells 2008	1	1	1	1	1	1	1	0	0	7

[a] Environmental perceptions were measured with the Neighbourhood Physical Activity Questionnaire which has been tested for reliability, but not validity; objective measures were based on ARC GIS.

[b] This study was mainly based on measures of environmental perceptions that have not been validated in combination with objective ARC GIS measures of accessibility.

Supplementary Table 7. Results from risk of bias analysis: Consistency scores for all studies, studies with a higher quality score, studies adjusted for self-selection, and findings involving objectively measured neighbourhood environmental attributes, stratified by study design

	Retrospective longitudinal studies				**Prospective longitudinal studies**			
	All studies	Studies with a quality score≥5[a]	Studies adjusted for self-selection	Findings involving objective environmental measures	All studies	Studies with a quality score≥5	Studies adjusted for self-selection	Findings involving objective environmental measures
Neighbourhood environmental attributes	Unweighted +%[b] Weighted +%[b]				Unweighted +%[b] Weighted +%[b]			
Parks/greenspace/recreation facilities	1/1 (100%) 1/1 (100%)	---	1/1 (100%) 1/1 (100%)	---	2/5 (40%) 0.5/2 (25%)	2/5 (40%) 0.5/2 (25%)	0/1 (0%) 0/1 (0%)	0/1 (0%) 0/1 (0%)
Residential/population density	---	---	---	---	2/8 (25%) 1.5/6 (25%)	2/6 (33%) 1.5/4 (38%)	0/2 (0%) 0/2 (0%)	2/7 (29%) 1.5/6.5 (23%)
Street connectivity	---	---	---	---	3/8 (38%) 1.7/3 (57%)	3/8 (38%) 1.7/3 (57%)	2/3 (67%) 1.5/2 (75%)	3/4 (75%) 1.7/1.9 (89%)
Land-use mix/destinations	1/3 (33%) 1/3 (33%)	---	1/3 (33%) 1/3 (33%)	1/3 (33%) 1/3 (33%)	11/26 (42%) 5/14 (36%)	6/11 (55%) 2/5 (40%)	5/6 (83%) 1/2 (50%)	7/16 (44%) 2.6/7.3 (36%)
Overall transportation access	7/10 (70%) 5/7 (71%)	---	7/8 (88%) 5/6 (83%)	0/2 (0%) 0/1 (0%)	---	---	---	---
Walking/cycling facilities	---	---	---	---	1/3 (33%) 1/3 (33%)	1/3 (33%) 1/3 (33%)	---	---
Public transport access and services	---	---	---	---	6/22 (27%) 3/9 (33%)	4/4 (100%) 1/1 (100%)	4/4 (100%) 1/1 (100%)	6/8 (75%) 0.5/2.5 (20%)
Parking	---	---	---	---	2/5 (40%) 2/5 (40%)	0/1 (0%) 0/1 (0%)	---	---
Traffic	---	---	---	---	0/1 (0%) 0/1 (0%)	0/1 (0%) 0/1 (0%)	---	---
Aesthetics	4/5 (80%) 3/4 (75%)	---	4/5 (80%) 3/4 (75%)	---	0/2 (0%) 0/1 (0%)	0/2 (0%) 0/1 (0%)	---	---
Crime-related safety	6/6 (100%) 4/4 (100%)	---	6/6 (100%) 4/4 (100%)	---	3/7 (43%) 1.5/4 (38%)	3/7 (43%) 1.5/4 (38%)	3/6 (50%) 1.5/3 (50%)	0/3 (0%) 0/3 (0%)
Social environment	4/7 (57%) 2/4 (50%)	---	4/7 (57%) 2/4 (50%)	---	---	---	---	---
Walkability/pedestrian friendliness	---	---	---	---	4/5 (80%)	2/3 (67%)	2/3 (67%)	2/3 (67%)

					3/4 (75%)	2/3 (67%)	2/3 (67%)	1/2 (50%)
Neighbourhood type (New-Urbanist, traditional)	---	---	---	---	0/3 (0%) 0/3 (0%)	0/3 (0%) 0/3 (0%)	0/3 (0%) 0/3 (0%)	---
Sprawl	0/3 (0%) 0/3 (0%)	---	0/3 (0%) 0/3 (0%)	0/3 (0%) 0/3 (0%)	0/2 (0%) 0/2 (0%)	0/2 (0%) 0/2 (0%)	---	0/2 (0%) 0/2 (0%)
Overall accessibility (to destinations and transportation)	4/7 (57%) 3/6 (50%)		4/7 (57%) 3/6 (50%)	---	---	---	---	---
Outcomes								
Walking	18/19 (95%) 10/11 (91%)	---	18/19 (95%) 10/11 (91%)	1/1 (100%) 1/1 (100%)	22/42 (52%) 10.7/26 (41%)	18/33 (55%) 9/19 (47%)	16/28 (57%) 7/16 (44%)	10/22 (45%) 4.7/15 (31%)
Physical activity	3/5 (60%) 3/5 (60%)	---	3/5 (60%) 3/5 (60%)	0/1 (0%) 0/1 (0%)	1/7 (14%) 0.3/4 (8%)	0/1 (0%) 0/1 (0%)	---	1/7 (14%) 0.3/4 (8%)
Cycling	2/4 (50%) 2/4 (50%)	---	2/4 (50%) 2/4 (50%)	0/2 (0%) 0/2 (0%)	5/28 (18%) 1.5/12 (12%)	5/22 (23%) 1.5/8 (19%)	---	2/5 (40%) 0.7/2.67 (23%)
Public transport	2/3 (67%) 2/3 (67%)	---	2/3 (67%) 2/3 (67%)	0/1 (0%) 0/1 (0%)	2/6 (33%) 2/4 (50%)	---	---	---
Driving	2/8 (25%) 2/7 (29%)	---	2/8 (25%) 2/7 (29%)	0/3 (0%) 0/2 (0%)	4/14 (29%) 3/8 (38%)	---	---	2/8 (25%) 1/4 (25%)

[a] None of the retrospective longitudinal studies had a quality score $\geqslant$5.

[b] Unweighted consistency score: the percentage of associations coded "+" out of the total number of associations; weighted consistency score: applied weighting to results from the same study by a factor of 1/total number of results from the same study in one cell.

Supplementary Table 8. Summary of existing literature reviews[a] on built environments and physical activity/travel behaviour among adults (n=28)

First author (year)	# of articles included (Search period)	Design of included studies	Scope of study	Main findings
Arango (2013)	15 (1990 – August 2012)	All cross-sectional	To review the association between perceived environment and adult PA in Latin America	Majority of associations were non-significant. Strongest evidence found for leisure-time PA with safety during the day and transport PA with presence of street lighting. Studies were from Brazil and Colombia only. Some inconsistencies with findings from high-income countries elsewhere.
Bancroft (2015)	20 (1990 - June 2013)	17 cross-sectional, 3 prospective longitudinal	To review the association between access to parks and objectively measured PA in US (all ages)	Associations varied between studies. Self-reported park characteristics and smaller buffer sizes were more predictive of PA.
Barnett (2017)	100 (2000 - September 2016)	95 cross-sectional, 5 prospective longitudinal, 1 quasi-experimental	1) To review and meta-analyse the association between attributes of BE and PA and/or walking that is not specific to a single domain among older adults; 2) to examine potential moderators of the association	Associations differ by BE attributes and PA measures. The strongest evidence exists for: walkability, safety from crime, access to destinations, recreational facilities, and parks/public open space. No consistent moderators found.
Butler (2011)	29 (2005 - December 2009)	All cross-sectional	To review PA studies which included one or more GIS measure of the BE	There was an increase in studies using GIS for measuring PA-relevant BE attributes but there was a lack of standardisation among BE, making it difficult to synthesise evidence and identifying BE features that may explain PA.
Casagrande (2009)	10 (1966 - July 2007)	All cross-sectional	Review of BE association with PA, diet and obesity among adult African Americans	All BE PA studies (n=7) measured perceptions of BE. Associations varied between studies. Safety from crime had the strongest association with PA among urban dwellers, but this was not consistent across studies. Presence of light traffic and sidewalks were more often positively associated with meeting PA recommendations in metro and non-metro areas.
Cerin (2017)	42 (2000 – September 2016)	All cross-sectional	Review and meta-analysis of BE associations with active travel in older adults (aged ≥ 65 years)	Strong links between neighbourhood BE and older adult active travel. Sufficient evidence for positive associations between total walking for transport and residential density/urbanisation, walkability, street connectivity, overall access to destinations/services, land use mix, pedestrian friendly features and access to several types of destinations. Littering/vandalism/decay was inversely related to total walking for transport. Main weakness of available evidence is cross-sectional design. Sampling bias evident in over 70% of studies.

Cunningham (2004)	27 (1966-2002)	All cross-sectional	To identify theoretical models and key concepts used to predict the association between BE and seniors' PA	Research area in its infancy with limited number of studies focused on seniors (n=6). A range of theoretical models employed across studies. Methods of BE measurement varied. Positive relationships found for seniors' PA, safety and aesthetics, findings mixed for PA associations with presence of sidewalks or convenience of facilities.
Ewing (2010)	62 (up to 2009)	Not described	A meta-analysis of the associations between BE and travel (Vehicle Miles Travelled, walking, transit)	Travel variables are generally inelastic with respect to change in measures of the BE. Walk trips are most strongly associated with the design (intersection density) and diversity (distance to a store, job housing balance) dimensions of BEs. Few studies control for residential preferences and attitudes.
Ferdinand (2012)	169 (1990 – April 2011)	All observational – quantitative (164), qualitative (5)	Review relationship between BE and PA or obesity rates (all ages)	89.2% of studies found a beneficial relationship between BE and PA. Studies using objective measures of PA were 18% less likely to identify a beneficial relationship with BE than self-report or other measures of PA.
Foster (2008)	41 (up to July 2007)	All cross-sectional	(1) To summarise the individual, social and BE characteristics that are associated with perceived safety; (2) to examine the association between real and perceived crime-related safety, including factors known to influence crime-related safety, and their association with PA	Perceived safety tends to affect the PA of groups already known to exhibit greater anxiety about crime (women, elderly). BE PA findings inconsistent, likely due to measurement limitations. More specific measures warranted.
Fraser (2011)	21 (up to June 2009)	8 cross-sectional, 7 surveys with experimental measures, 2 retrospective, 2 ecological, 1 pre-post, 1 qualitative	To review observational and experimental studies examining association between objectively measured BE and cycling behaviour (all ages)	No studies rated strong on study quality and none from low or middle income countries. Significant positive findings found for objective BE measures and higher rates or frequency of cycling in 11 studies, including cycle routes (on and off road), Safe Routes to School initiatives, proximity of destinations, separation from traffic, population density, proximity of cycle paths and presence of green space or recreational land. Significant negative findings with cycling included traffic danger, sloping terrain and long trip distance. Ten studies found no positive association between BE and cycling.
Frost (2010)	20 (up to June 2008)	19 cross-sectional, 1 longitudinal	To review the association between BE and PA in adults in rural settings	Positive associations found among pleasant aesthetics, trails, safety/crime, parks, and walkable destinations. Measures of PA varied.
Grasser (2013)	34 (up to August 2010)	33 cross-sectional, 1 prospective longitudinal	To review objectively measured walkability and active transport and weight-related outcomes in adults	BE measures consistently associated with walking for transport were gross population density, intersection density and walkability indexes. Results on weight-related measures were inconsistent. Most studies conducted in US
Heath (2006)	Three separate reviews (see scope of study)	Cross-sectional quasi-experimental Time series	To review studies which addressed the following environmental and policy strategies to promote PA: 1. Community scale urban design and land use (n=12, 1993-2003)	Two interventions were effective in promoting PA (community-scale and street-scale urban design and land use policies and practices). Evidence is insufficient to assess transportation policy and practices to promote PA.

			2. Street-scale urban design and land use (n=6, 1987-2003) 3. Transportation and travel (n=1, 1990-1998)	
Humpel (2002)	19 (up to 2002)	18 cross-sectional, 1 prospective longitudinal	To review the relationships between BE attributes and PA behaviours in adults	Self-report BE studies more frequent than studies incorporating objective BE. Variables representing access to facilities and specific opportunities for PA were associated with PA. Significant associations also found for aesthetics. Composite variables less likely to be statistically significant.
Kaczynski (2007)	50 (1998-December 2005)	All cross-sectional	To review what types of PRSs are most related to PA and how proximity to PRSs is related to PA (all ages)	Diverse operationalisations of both parks or recreation and PA were employed (e.g. proximity definitions) as were a range of PA variables. Mixed associations were observed for different types of PRSs, with parks, trails and other open spaces (e.g. golf courses) having more consistent positive relationships. Proximity to PRSs were generally found to be associated with increased PA.
Kaczynski (2008)	50 (1998-December 2005)	All cross-sectional	To review what types of PRSs are most related to PA and how PRSs were related to different functions and intensities of PA (all ages)	PRSs were more likely to be positively associated with PA for exercise or utilitarian functions than for recreational PA. PRSs were commonly associated with walking, but mixed results found with moderate and vigorous PA.
Mayne (2015)	37 (January 2005-January 2014)	13 natural experiments, 24 quasi-experiments	A review of studies in the medical literature relating to natural- or quasi-experiments in obesity research (all ages)	PA studies (n=17) generally found stronger impacts when the intervention improved infrastructure for active transportation or had a longer follow-up period (greater than 6 months).
McCormack (2004)	12 (2000-2004)	All cross-sectional	A review of associations between BE and PA among adults incorporating self-report and objective measures of BE and PA	Positive associations were found between both perceived and objectively measured BE and PA. Availability, access and convenience of destinations, neighbourhood functionality and aesthetics were associated with PA. However, a lack of association between specific types of PA and specific setting in which it is performed. Concluded that prospective study designs which incorporate both objective and perceived BE data are needed.
McCormack (2011)	33 (1996-2010)	20 cross-sectional, 13 quasi-experimental studies	To review the relationship between objective measures of BE and PA among adults for studies attempting to control for neighbourhood self-selection	BE PA associations were either in the expected direction or null. Land use mix, connectivity, population density and overall neighbourhood design were important determinants of PA. BE was more likely to be associated with transport-related walking than other types of PA. In three of the 20 cross-sectional studies that accounted for self-selection found that the adjustment attenuated relationship between BE and PA.
Moran (2014)	31 (1996-2012)	All qualitative	To review qualitative studies of BE and PA in older adults	Studies of BE factors impact on PA in older adults combined interviews with spatial qualitative methods (photo-voice, observations, walk-along interviews). Qualitative spatial methods added depth to understanding of BE PA relationships. Themes

				identified included pedestrian infrastructure, safety, access to facilities, aesthetics, and environmental conditions. Mixed method, multi-disciplinary studies are recommended.
Ogilvie (2004)	22 (up to end of 2002)	3 RCTs, 7 non-randomised controlled prospective longitudinal, 11 uncontrolled prospective longitudinal, 1 controlled retrospective longitudinal	To review the effects of population level interventions to promote a shift from using cars towards walking and cycling	Engineering measures were not found to be effective in a modal shift from cars to walking and cycling.
Owen (2004)	18 (up to 2004)	16 cross-sectional, 2 prospective longitudinal	To review association between objective and perceived environment and walking	Aesthetics, convenience of facilities for walking, accessibility, level of traffic and composite measures of the BE were associated with walking for different purposes. Attributes associated with walking for exercise were different from those associated with walking to get to and from places.
Pucher (2010)	139 (1990-2010), (65 peer-reviewed)	Cross-sectional, prospective longitudinal (specific numbers were not provided)	To review interventions targeting increased levels of cycling. Provided description and categorisation of interventions, their levels of implementation and their impact.	Most studies reviewed suggested positive impacts of interventions, but increases in cycling are generally small. Large variation in estimated impacts by type of intervention and study design, location and timing. Most studies limited due to study design adopted.
Saelens (2003)	14 (up to 2003)	All quasi-experimental/cross-sectional	Review of transport, urban design and planning literature to determine associations between BE variables and walking and cycling for transport	Higher density, greater connectivity and more land use mix is associated with higher rates of walking and cycling for transport. Transport, urban design and planning fields can contribute to multidisciplinary research on environmental contributions to PA levels in the population.
Saelens (2008)	Review of 13 reviews (2002-2006) and of 29 more recent primary studies (2005-May 2006)	Cross-sectional	To review the evidence of BE correlates of walking	Previous reviews and newer studies document positive walking for transport relationships with density, distance to destinations and land use mix. Associations between network connectivity, parks and open space and personal safety and transport walking are mixed. Relationships with recreational walking are less clear.
van Cauwenberg (2011)	31 (2000-March 2010)	28 cross-sectional, 3 longitudinal prospective	To review the association between BE and PA in older adults	Results were inconsistent with most of the BE characteristics reporting non-significant relationships with PA. This may reflect limited number of studies and methodological issues such as

				definition and measurement of PA, and variation in approaches to BE measurement.
van Holle (2012)	70 (January 2000-August 2011)	69 cross-sectional, 1 longitudinal prospective	To review European specific studies on the relationship between BE and different PA domains in adults	Convincing evidence on positive relationships with several PA domains: walkability, access to destinations and composite factor environmental quality. Transport PA is more consistently related to BE. Lack of association with domain specific PA and access to recreation facilities, aesthetics, crime and traffic-related safety contrasts with earlier non-Europe specific reviews.

BE = built environment, GIS = Geographic Information System, PA = physical activity, PRSs = parks and recreational settings, RCT = randomised controlled trial, US = United States.
[a]The reviews were selected from previous reviews of reviews,[67 68] and an updated literature search using the same methodologies outlined in this paper.