Physical activity and the environment

Evidence Reviews Appendix 2: Evidence tables

Review 1

Public Transport

Bergman 2010

Study details	Population	Intervention/ comparator	Results	Notes
Reference Bergman 2010 **Quality score** + **Study type** Cohort study (authors describe as a Quasi-experimental natural experiment) **Location** Sweden - Stockholm **Study aims** To evaluate the effect of a congestion road tax on physical activity. **Length of follow up** Approx. 2 years 8 months between	**Number of participants** Intervention site: 165 Comparison site: 138 **Participant characteristics** No baseline differences between groups were observed for sociodemographic characteristics and for PA levels. <u>Intervention site</u> 46.7% male, 53.3% female, 19.4% aged 18-34, 46.7% aged 35-54, 33.9% aged 55-74. 53.4% were normal weight, 39.3% were overweight, and 7.4% were obese. 39% had university or college education. 11.2% earned less than 100,000 SEK (£8954), 32.9% earned more than 300,000SEK (£26,864). <u>Control sites</u> 44.9% male, 55.1% female. 23.2% aged 18-34; 40.6% aged 35-54; and 36.2%	**Intervention** A congestion tax was placed on 18 roads going in and out of Stockholm for a 6-month trial period. Automatic pay stations on all roads made sure that all cars crossing in or out were registered. The tax amount varied by time of day (more expensive in morning and evening rush hour), ranging from 10 to 20 SEK (£0.9 to £1.80) and a max cost per car per day capped at 60 SEK (£5.37). The tax was in effect on working days between 6:30AM and 6:29PM. **Comparator** Two large city regions (Gothenburg and	**Intervention:** Congestion tax region **Control:** Matched city regions with no congestion tax **Outcomes** Moderate PA (defined below): Intervention group reported more moderate physical activity (p = 0.036, no effect size reported – not calculable from paper) at 5 month follow-up. No difference in PA levels for comparison group. Sitting time: Intervention group reported less time spent sitting (p = 0.009, r = 0.03) at 5 month follow-up. No difference in PA levels for comparison group. Overall PA: Intervention group reported more moderate physical activity (p = 0.015, no effect size reported) at 5 month follow-up. No difference in PA levels for comparison group. **Analysis** PA was measured from the previous 7 days using a short self-administered version of the International Physical Activity Questionnaire (IPAQ). Physical activity levels were categorised into 4 types: vigorous intensity (8 metabolic equivalent of task (MET)), moderate intensity (4 MET), walking (3.3 MET) and sitting. Questionnaires were mailed to participants and pre-paid postage was provided for returning the questionnaires. The IPAQ is shown to have acceptable test-retest reliability (p= 0.8) and criterion-related validity compared to accelerometers (p=0.3).	**Limitations identified by the author** Some of the observed changes in PA could have been due to other environmental variations within the city (researchers could not control for this). A major road opened in the intervention site which was not included in the congestion tax. Other changes to physical environment such as cycle paths or footpaths were not evaluated. No information on participants' other physical activity interventions was collected Large time lag between baseline and follow-up data Seasonal variation in PA could explain the changes seen in intervention group (however, this would also be expected in comparison group) **Limitations identified by the review team** Participation rate: For intervention group, approx 54% returned baseline surveys. For comparison group it was 69%.

Study details	Population	Intervention/ comparator	Results	Notes
baseline and follow-up. Follow-up data taken during the 5th month of the 6 month intervention trial period. **Source of funding** Stockholm County Council (Public Health Funds) The European Union to the Project ALPHA in the framework Swedish National Centre for Research in Sports.	aged 55-74. 64.7% were normal weight, 30.9% were overweight and 4.4% were obese. 38% had university or college education. 17.3% earned less than 100,000 SEK (£8954), 24.1% earned more than 300,000SEK (£26,864). **Inclusion criteria** Adults aged 18-74 who took part in the Physical Activity Prevalence Study in 2003 and who agreed to take part in the follow-up questionnaire for this study. Participants were only included if they had access to at least one vehicle. **Exclusion criteria** Those not providing follow-up data and those without access to at least one vehicle.	Malmö) where there was no congestion tax.	For comparisons in demographic characteristics at baseline, a Pearson chi-squared test was calculated. Comparisons of PA between sites at baseline were made with a Mann-Whitney U test. Differences between baseline and follow-up levels of PA were analysed with the Wilcoxon signed-rank test for the intervention and comparison groups separately. Effect sizes of the differences were calculated by the Z-value calculated from the Wilcoxon signed-rank test divided by the square root of n in each of the groups. An effect size of up to 0.1 is considered small and around 0.3 is considered moderate. Above 0.5 is considered a large effect.	Loss to follow-up: 14% in intervention and 16% loss in comparison group. Reasons for loss to follow-up not reported – this could be due to baseline data being collected as part of a larger study previously. No between-group comparison reported. Missing effect sizes on some of the within group differences. Outcome assessors may not have been blinded to the exposure status of participants – details not reported in the paper. Results for vigorous PA are not reported. **Other comments** Other outcomes: Although outcomes of vigorous physical activity and walking are mentioned in the paper, they are not reported on. No other outcomes in the study. Participants were not informed of the research question when they were contacted for follow-up. All outcomes: Change in moderate PA, sitting time, vigorous PA and overall PA in previous 7 days in mins/day.

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10 Brockman and Fox 2011

Study details	Population	Intervention/comparator	Results	Notes
Full citation Brockman and Fox, 2011 **Quality score** - **Study type** Uncontrolled before and after study **Location and setting** UK - Bristol **Study aims** To assess the impact of the Bristol University Transport Plan which restricted parking spaces, on car usage and employee levels of walking and cycling to work. **Length of follow up** Follow-up surveys conducted 0, 2, 4,	**Number of participants**: 1998: 2,292 2001: 2,332 2003: 1,950 2005: 2,647 2007: 2,829 **Participant characteristics:** Only characteristics collected in 2007 are provided below (1998-2005 did not include this information). 2007: 43.3% of respondents were male, 56.7% were female. 5.1% were 25 or under; 59.8% were 26-45; 21.2% were 46-55; 13.9% were 56 or over. 11.7% earned under £15,000 per year; 9.5% earned over £50,000. **Inclusion criteria**	**Intervention:** The Bristol University Transport Plan, launched in 1999. Strategies included heavily limiting parking spaces and conditions for permits (from Aug 2000), increased parking charges (from Aug 2000), improving changing facilities for walkers and cyclists, new secure cycle storage, a subsidised cycle purchase scheme, a car-sharing scheme, a free university bus service which served local train and bus stations, and discounted season tickets on buses. In 2001, availability of non-resident parking in areas surrounding the University were reduced. **Comparator:** No comparator **Data Collection:** The survey was a self-administered questionnaire. It was distributed by post in November 1998 and 2001; and by e-mail for online completion in November 2003, 2005 and 2007. The 1998 survey was compared with a 1993	**Intervention: (I)** Bristol University Transport Plan increasing parking charges and decreasing parking spaces, meanwhile improving facilities for active commuters **Control: (C)** No control **Outcomes** <u>Changes in active commuting</u> *Walking:* Between 1998 and 2007, percentage of people reporting that they usually walk to work increased from 19% to 30%. The difference between 2007 figures and each other surveys (1998, 2001, 2003) were statistically significant (P=<0.01) apart from the 2005 survey. No confidence intervals reported. *Cycling:* The percentage of people reporting that they usually cycle increased from 7% to 12% between 1998 and 2007, but this was not statistically significant (P value not reported). Both cycling and walking percentages were higher for each subsequent survey. *Car users:* The percentage of people who usually commuted by car decreased from 50% to 33% (P=<0.001). Other: Percentage change within the "other" category (including public transport and other motorised vehicles) was not significant (P value not reported)	**Limitations identified by the author:** Change within individuals cannot be established due to repeated cross sectional survey style. Survey response rates were generally low (1998: 54.5%; 2001: 45.5%; 2003: 37.5%; 2005: 49.9%; 2007: 49.2%). However, 2007 demographic results were representative of the whole workforce. Responses could be biased to represent more health-conscious active commuters. No control group means causality is less clear. Authors stated that findings of increases in active commuting are against national trends. Authors were unable to identify another change within the survey period which could be responsible for observed changes. Effects of individual strategies within the plan could not be identified, so relative effects of different measures cannot be determined. Intensity of physical activity of commuting cannot be determined, so it cannot be ascertained whether participants are meeting the "moderate" intensity required. **Limitations identified by the review team**

and 6 years after intervention completion. 9 years between baseline survey (1998) and final follow-up survey (2007). Follow-up surveys were undertaken periodically throughout the period (1998; 2001; 2003; 2005; 2007). **Source of funding** None declared	University of Bristol employees submitting a completed Bristol Travel Survey. **Exclusion criteria** Individuals who were not employees at University of Bristol during the time of data collection.	University of Bristol and a 1997 Bristol City Council survey, and mode of transport splits were found to be similar in all three surveys. Summary data was used for 1998 and 2001 analysis, raw data was used for 2003, 2005 and 2007 analysis. All surveys (1998-2007) measure: location of work; residential postcode; commuting habits; car parking arrangements; motives for reducing car usage. Transport mode determined by question "How do you travel to work" (categorised by 'usually' [4-5 times]; sometimes [2-3 times] and 'occasionally' [1 or fewer times per week]). Categories of 'walk', 'cycle', 'car user', and 'other' were created.	<u>Contribution towards Physical Activity (from 2007 data)</u> Of those who are usual active commuters, 67% of walkers (n=849) and 63% of cyclists (n=333) met >80% of their weekly physical activity requirement through their commute. Of sometimes active commuters, 73% of walkers and 75% of cyclists met >40% of weekly physical activity requirement. There is no comparison of this data with other groups, as this only relates to physical activity through commuting. **Analysis** <u>Statistical Analysis</u> Percentages of respondents using each transport type were calculated. Differences in proportions between each year and the final year (2007) were calculated and significance was tested using two-tailed Z-tests. 2007 survey data was cross-tabulated and chi-squared tests assessed group differences for gender, age and salary band (post-hoc subgroup analysis). A survey question asking for that day's commuting time to and from work was used to calculate daily time spent in active commuting of usual, sometimes, and occasional walkers and cyclists in the 2007 survey.	Calculations of time spent in active commuting appear to use commute time of that day, assuming that active commuting was undertaken that day. In reality usual, sometimes and occasional active commuters might have commuted another way on that particular day, making active commuting calculations inaccurate / unreliable. **Other comments** Other outcomes: Transport mode differences by gender and age, but gender and age data was only collected at one time point, so change over time is not available. Therefore not extracted. Power not reported. Statistical significance ≤0.05. Comparisons of age-splits over time were not possible as only the 2007 survey included age. Likewise only 2005 and 2007 included gender and salary questions. Study aims to restrict parking rather than improve health outcomes.

13 **Boarnet 2013**

Study details	Population	Intervention/ comparator	Results	Notes
Reference Boarnet 2013 **Quality score** + **Study type** Controlled before and after **Location** USA – Los Angeles **Study aims** To assess the effect of new "Exposition (Expo) Line" light rail line on travel behaviour and physical activity. **Length of follow up** Follow-up took place between 3 and 7 months post intervention. Approx 1 year between baseline survey and follow-up Expo Line opened in 2 phases: April	**Number of participants** 204 households (n = 390 in both groups) Experimental neighbourhood (per household): n = 103 Comparison neighbourhood (per household): n = 101 Accelerometer data (per individual): experimental n = 38, control = 44 **Participant characteristics** Statistical significance for differences in demographic data not provided by authors. In the intervention areas, 51.8% were Hispanic, 27.7% were African American, 11.5% were White, and 5.8% were Asian. 27.5% were under 20 years old and 9.2% were 65 or older. 29.8% of households earned less than $25,000 while 13.5% earned $100,000 or more (2010 Inflation-adjusted Dollars). In the control areas, 32.7% were Hispanic, 46.4% were African American, 12.5% were White, and 5.3% were Asian. 25.4% were under 20 years old and 12.0% were 65 or older. 31.9% of	**Intervention** Experimental households that were within ½ mile of the newly opened Expo line. The Expo line in the Los Angeles metropolitan area is 8.7 miles long and has 12 stations (10 of which are newly constructed). The line is open from 5am to 12:30am. **Comparator** Matched comparator households that lived between ½ a mile to 2 miles away from the Expo line.	**Intervention:** households within ½ mile of Expo line **Control:** households between ½ mile and 2 miles from Expo line **Outcomes** <u>Groups at baseline analysis: Travel behaviour (in previous 7 days) at baseline (experimental vs control)</u> There were no statistical differences between intervention and control households at baseline in terms of any outcomes (vehicle miles travelled (VMT), car driver trips, train trips, bus trips, bicycle trips, walking minutes, bicycle minutes, walk minutes). <u>Groups at follow-up analysis: Travel behaviour (in previous 7 days) at 3-7 month follow-up (between 3-7 months after intervention implemented) (experimental vs control)</u> Train trips: significantly more in experimental households (mean 0.27) than control (0.12), mean difference 0.15, t=2.05, p<0.05. Cohen's d: 7.112 (calculated by reviewers) Walk trips: significantly more in experimental households (mean 1.86) than control (1.31), mean difference 0.55, t=2.03, p<0.05. Cohen's d: 2.315 (calculated by reviewers) Walk minutes: more in experimental households (mean 41.38) than control (27.81), mean difference 13.57, t=1.65, p<0.10 (difference not significant). No difference between groups for other travel behaviours (bus trips, bicycle trips, bicycle minutes) <u>Experimental over time analysis: Travel behaviour (in previous 7 days) for experimental group (baseline vs 3-7 month follow-up)</u> Significantly more train trips at 1 year follow-up (mean 0.27) compared to baseline (mean 0.09), mean difference 0.18, t=2.88, p<0.01. Effect size not calculable. No difference between baseline and follow-up for other travel behaviours. No difference between baseline and follow-up for the control group. <u>Groups v Time analysis: Comparison of mean differences (baseline vs 3-7 month follow-up, experimental vs control)</u>	**Limitations identified by the author** Loss to follow up: In total, 284 households completed the baseline survey and 204 of these completed the survey at follow-up (loss of 28.17%). In control group, loss of 30.82%. In experimental, loss of 25.36%. **Limitations identified by the review team** Study power: not reported Short follow-up period (min 3 months, max 7 months). Risk of contamination: households that lived ½ mile away from intervention could have been classified as control or experimental – so there may be some crossover between groups regarding exposure to intervention. All data on travel behaviour was self-report and therefore subject to human error and reporting bias. **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
2012 and June 2012. Baseline data taken between Sept 2011-Feb 2012. Follow-up data between Sept-Nov 2012. **Source of funding** 2011 data collection: University of California and Lincoln Institute of Land Policy 2012 data collection: Haynes Foundation funding to the University of Southern California Expo Line funded by L.A. Metropolitan Transportation Authority	households earned less than $25,000 while 14.6% earned $100,000 or more **Inclusion criteria** Experimental neighbourhoods were chosen around particular stations that were only served by the Expo line rather than the other lines in the transit network. Comparison neighbourhoods were chosen to match the demographics of the experimental neighbourhood. **Exclusion criteria** Stations close to the University of Southern California campus were excluded because these areas have a very different sociodemographic profile to the neighbourhoods to the west. Households that moved out of the study area.		Between-group differences were not significant for train, walk and bicycle trips - all increased over time for experimental and control groups. Difference-in-difference (DID) analysis showed general trends for more train, walk and bicycle trips in the experimental groups at 1 year follow-up – however the DID estimators for these changes are not significant. This result is the same for ITT and per protocol analysis). <u>Physical activity (7 day accelerometer) (baseline vs 3-7 month follow-up)</u> No difference between baseline and follow-up PA for either group **Analysis** Travel behaviour data was collected via online and paper surveys. The surveys included questions on travel behaviour in a 7-day travel log. Authors do not state whether questionnaire was validated. PA was measured using accelerometers. Between group differences and within group differences between baseline and follow-up were analysed with t-test. Difference-in-differences analysis was used to test effect of the intervention per group over time.	Significant results found for vehicle miles travelled (VMT) and driver trips also measured but not reported for the purposes of this review. Other outcomes: Outcomes not reported are changes in vehicle miles travelled, changes in car driver trips as these are outside of scope of the guideline.

Brown and Werner 2007, Brown and Werner 2009

Study details	Population	Intervention/ comparator	Results	Notes
Reference Brown and Werner 2007 Brown and Werner 2009 **Quality score** - **Study type** Uncontrolled before and after study **Location** USA – Salt Lake City, Utah **Study aims** To assess whether adding a new light-rail stop has an effect on rail ridership (Brown, 2007) To assess whether there are significant differences between non-riders, new riders and continuing riders of light rail after a new	**Number of participants** n = 51 (51 provided survey data and 47 provided accelerometer data) **Participant characteristics** Brown 2007: 47% of the longitudinal sample was female, and 53% male. 55% lived in single-family detached housing and had lived in the neighbourhood about 5 years. 79% were white, 16% Hispanic. 35% had children at home. 32% were married, 42% were single (not divorced or widowed). 27% were Mormon. Gender, ethnicity, and home ownership were comparable with Salt Lake City averages (census statistics). Average household incomes ($24,000) were significantly lower than the Salt Lake City average ($43,367). Brown, 2009 averages: Non-riders (N = 15): 53% female. 47% homeowners. Av. income $35,000. 73% employed. 87% White, 7% Hispanic. Average age 36.8. Meters to closest light rail stop at point one: 873.65. At point 2: 410.79.	**Intervention** A new rail stop was added between two existing stops. Participants completed surveys at both time points, which included reports on how often they had ridden light rail in the prior 2 weeks. They were also required to wear accelerometers which gave an objective measure of PA (counts per minute – cpm) **Comparator** No comparator.	**Intervention:** new rail stop **Control:** No comparison (one group pre- and post-intervention) **Outcomes** **Brown 2007:** <u>Rail ridership changes</u>: The addition of a rail stop significantly increased ridership from 50% to 68.75% paired t (47) = -2.65, p=0.011). Authors report a baseline average number of rail rides 3.72 rides (SD= 6.46) increasing to 5.02 rides (SD 7.90) at 7-11 month follow-up. At both time points rail ridership is related to accelerometer-measured bouts of moderate activity (baseline = 3.12, p=0.018; follow-up =4.71,p=0.002). The moderate –activity bouts at baseline were related to bouts at follow-up, at follow-up rail rides (r=0.46, beta=0.39, p =0.01) and larger households (r=0.15, beta=0.43, p=0.01) accounted for the significant variance beyond the effects of baseline activity levels <u>PA changes</u>: - Moderate bouts* of PA per hour were similar at both time points (baseline 0.06 (SD = 0.09); at 7-11 month follow-up 0.06 (SD = 0.08). No statistical comparison reported (not calculable) - The proportion of the moderate bouts that were related to walking to rail stop increased from an average of 0.1 (SD=0.21) to 0.15 (SD=0.31). No statistical comparison reported (not calculable). **Brown 2009:** Between-group comparison, combining baseline and follow up data from one year later (7-11 months after intervention), with standard errors: <u>Mean moderate activity bouts</u>** Non-riders (reviewer assume both time points combined): 1.07 (SE 0.76) New riders (1 year follow-up): 1.77 (SE 0.83) Continuing riders (both time points combined): 3.68 (SE 0.60) Results are significantly different between groups (F = 3.89; *p* = 0.03). Time effects are not significant (F = 1.28; *p* = 0.26).	**Limitations identified by the author** Small sample size. This may limit power to detect effects. 215 approached, 102 participated at (47.44% participation rate) Loss to follow-up: 51 out of 102 completed survey at both time points (50% loss to follow-up). Reasons for follow-up included: 38 participants had moved, 10 refused, 1 became ineligible due to health problems) Authors state that the study may underestimate the effects of light-rail introduction on both rail use and PA because of pre-existing rail use and the neighbourhood's lack of varied and attractive walking destinations. Self-report of transit use and attitudes may be inaccurate. Selection effect could have occurred: pro-transit individuals may have moved to the neighbourhood anticipating the new service.

stop was added (Brown, 2009). **Length of follow up** Follow-up data collected between 7 and 11 months after intervention. Intervention was implemented in Autumn 2005. Baseline data taken summer 2005. Follow-up data taken Summer 2006 **Source of funding** University of Utah's Institute of Public and International Affairs University Research committee Research Experience for Undergraduates Program National Science Foundation	New riders (N = 11): 55% female. 55% homeowners. Av. income $21,360. 73% employed. 90% White, 27% Hispanic (unclear how this is possible). Average age 46.36. Meters to closest light rail stop at point one: 763.66. At point 2: 293.55. Continuing riders (N = 22): 36% female. 24% homeowners. Av. income $18,300. 59% employed. 70% white, 14% Hispanic. Average age 40.55. Meters to closest light rail stop at point one: 677.54. At point 2: 302.27. Sociodemographic attributes are comparable between groups, except from income, which was significantly different (0.01). **Inclusion criteria** Residents of neighbourhood where new rail stop was built. No inclusion criteria stated but authors report main reasons for ineligibility (described below). **Exclusion criteria** Not explicitly stated but authors cite reasons the following for ineligibility: - Too young (not adult) - Non-ambulatory - Language barriers - Relocation		<u>Leisure walks (mean number in preceding 2 weeks)</u> Non-riders: 7.29 (SE2.13) New riders (point 2): 9.63 (SE 2.35) Continuing riders: 8.90 (SE 1.70) Results are not significant between different groups (F = 0.28; p = 0.76). Time effects are significant (F = 12.68; p = 0.00). <u>Pro-transit-oriented development attitudes (1 lowest, 7 highest)</u> Non-riders (reviewers assume both time points combined): 5.13 (SE 0.24) New riders (7-11 month follow-up): 6.23 (SE 0.26) Continuing riders (both time points combined): 6.38 (SE 0.19) Results are significant between groups (F = 8.35; p = 0.00). Time effects are not significant (F = 0.00; p = 0.98) **Analysis** Brown, 2007: All self-reported rail rides and moderate bouts of PA were log transformed. Moderate bouts were calculated per hour the accelerometer was worn to provide comparable time frames across participants. *Moderate PA defined as at least 1952 counts per minute. Moderate bouts defined as accumulations of 8 or more moderate minutes. Participants met with researchers at the end of the week to discuss moderate bouts and whether they were related to walking to transit. Brown 2009: As income was significantly different between groups, income and employment status (reasoned as being linked) were controlled for in the analysis. Authors tested for differences between three groups, tested for differences over time, and tested for group-by-time interaction effect using a three (groups) by two (time) General Linear Model in SPSS. **Moderate activity bouts measured as log transformed/100 hours Favourable attitudes towards transit-oriented development was explored in the survey, using five questions all with scale answers 1 – 7 (1 low, 7 high) *Cronbach alpha for Time 1 = .78, Time 2 =.79 (this is measuring internal consistency within this category)* 1. TRAX makes Salt Lake City a . . . Less liveable place (1) to more liveable place (7) 2. Because of TRAX, I like Salt Lake City . . . Less (1) to more (7) 3. Because of TRAX, I am . . . Less (1) to more (7) interested in going downtown 4. Because of TRAX, I am . . . Less (1) to more (7) interested in living near TRAX 5. Because of TRAX, I . . . Don't (1) to do (7) want to know what is near TRAX stops	**Limitations identified by the review team** Short follow-up period: post-intervention data taken as little as 7 months after intervention was implemented. Maximum follow-up time after intervention was approx 11 months. This may not have been long enough to detect any changes in commuting decisions and physical activity behaviours. No power calculation reported. **Other comments** Other outcomes: Brown and Werner 2007: no other outcomes reported in study. Brown and Werner 2009: no other outcomes reported in study . Brown 2007: Participants received $20 for participating at each time point. Brown 2009: "new riders were not frequent bus users either at point 1 or point 2, showing that they are not simply switching from one method of public transport to another. Obese residents were least likely to ride transit.

16 Brown et al 2015, Miller et al 2015, Brown et al 2016

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Brown et al 2015

Miller et al 2015

Brown et al 2016

Quality score
-

Study type
Uncontrolled before and after study

Location
USA – Salt Lake City, Utah

Study aims

To evaluate changes in survey and accelerometer-measured physical activity after a “complete streets” intervention which included extending a light</td>
<td>Number of participants
n = 537

(Brown et al 2016 reports n = 536)

Participant characteristics

49% male, 51% female, mean age 41.72 (SD 0.64), 25% Hispanic, 37% were college graduates, 46% were married.

For the near/far comparison reported in Brown et al 2016, near participants were significantly less likely to have cars (83% vs 92%, p<0.01) and they reported lower household incomes (p<0.01).

Inclusion criteria

Aged 18 or over, ability to walk a few blocks, intention to stay in the neighbourhood at least 1 year, not pregnant, ability to speak Spanish or English, ability to wear devices and fill out survey.</td>
<td>Intervention
“Complete streets” intervention included 5 new residential ‘TRAX’ stops along a new line extension, a bike lane, and improved sidewalks.

Participants were surveyed at both time points and required to wear accelerometers which gave an objective measure of PA (counts per minute – cpm)

Comparator

No comparator.</td>
<td>Intervention: “complete streets” intervention
Control: No comparison (pre- and post-intervention), however, Brown et al 2016 compared distance effects.

Outcomes
<u>Change in total physical activity between baseline and 7-11 month follow-up* (measured by accelerometer. Unit = counts per minute (±SE)) in the different ridership categories (Brown et al 2015)</u>
<table>
<tr><th></th><th>Baseline (2012)</th><th>Follow-up (2013)</th><th>Change</th><th>Cohen’s d (calculated by reviewer from means and SD)</th></tr>
<tr><td>All (n = 537)</td><td>322.64 (6.30)</td><td>311.40 (6.46)</td><td>8.76 (5.20)</td><td>0.076</td></tr>
<tr><td>Never-riders (n = 393)</td><td>308.36 (6.63)</td><td>320.33 (7.11)</td><td>11.97 (5.50)</td><td>-0.088</td></tr>
<tr><td>Continuing riders (n = 51)</td><td>391.05 (27.15)</td><td>376.93 (23.18)</td><td>-14.13 (18.87)</td><td>0.079</td></tr>
<tr><td>Former riders (n = 41)</td><td>361.08 (27.63)</td><td>317.96 (25.73)</td><td>-43.12 (20.44)**</td><td>0.252</td></tr>
<tr><td>New riders (n = 52)</td><td>333.23 (20.75)</td><td>381.04 (23.73)</td><td>47.81 (22.33)</td><td>-0.298</td></tr>
</table>
*follow-up surveys taken between 1-7 months post-intervention. One year gap between baseline and follow-up surveys.
** p<0.01 effect size not reported but calculated by the reviewer.

<u>Change in transit-related PA between baseline and 7-11 month follow-up * (measured by accelerometer. Unit = minutes of PA per 10hours wear) in the different ridership categories (Miller et al 2015)</u>
New riders: average increase of 3.46 mins (95% CI 2.20, 4.72; p<0.0001, effect sizes not calculable) between baseline and follow-up
Former riders: average decrease of 2.34 mins (95% CI -3.56, -1.08; p=0.0005, effect sizes not calculable) between baseline and follow-up
No significant change in transit-related PA for never riders or continuing riders.</td>
<td>Limitations identified by the author

Authors did not collect data on reasons for transit use stopping. It is therefore not clear whether there was an unintended consequence of the intervention

Measurements of PA from the accelerometers were taken from only 1 weeks’ worth of travel. Therefore the study does not take into account any variations in ridership patterns (i.e. never-riders may have actually been occasional riders outside of data collection periods)

Loss to follow-up: 12.55% loss. 939 participants were recruited before intervention construction. 283 people were verified as movers or did not respond to follow-up attempts, 34 people refused to take part at follow-up, 8 became ineligible. In total, 537 out of 614 participants provided valid GPS data at both time points (Brown et al 2016 reports n = 536) and were included in the analysis.</td>
</tr>
</table>

rail line, adding a bike lane, and improving sidewalks. **Length of follow up** Follow-up data collected between 1 and 7 months after intervention. Intervention was implemented in April 2013. Baseline data taken March – December 2012. Follow-up data taken May – November 2013 **Source of funding** National Cancer Institute Robert Wood Johnson Foundation	For the GPS data to be used, participants needed to have at least 3 days of valid accelerometer wear in 2012, defined as at least 10 valid hours of wear time per day. **Exclusion criteria** None stated		<u>Comparing PA change of never-riders with PA change of other ridership groups – results of the post-hoc multivariate regression analysis (Brown et al 2015)</u> - Significant difference between PA of former riders (who decreased their PA) vs never-riders (who increased their PA): (t = -3.30; p = 0.001, Cohen's d calculated by reviewer -0.542) - New riders accrued significantly more PA than never-riders (t = 2.72; p = 0.007, Cohen's d calculated by reviewer 0.401) - Continuing riders change in PA not significantly different to never-riders PA intensity (still in comparison to never-riders) - MPVA: Former riders accrued 6.37 fewer minutes (SE = 2.01; t = -3.17; p<0.01; 95% CI = -10.31, -2.43, Cohen's d calculated by reviewer -0.52), new riders accrued 4.16 more minutes (SE = 1.84; t = 2.26; p<0.05; 95% CI = 0.54, 7.78, Cohen's d calculated by reviewer 0.333), no significant differences for continuing riders. - Light PA: No significant differences compared to never-riders - Sedentary PA: Former riders accrued 16.38 more minutes (SE = 6.09; t not reported; p<0.01; 95% CI = 4.41, 28.35, effect size not calculable), New riders accrued 12.83 fewer minutes (SE = 5.59; p<0.05; 95% CI = -23.82, -1.85, effect size not calculable), no significant differences for continuing riders <u>Time and distance effects. Change in transit trips, non-transit walk trips, and bike trips – pre- vs post intervention, near (<800m) vs far (≥801-2000m) groups (Brown et al 2016)</u> For all analyses, post-intervention data of the 'near' group is used as a reference. Therefore there is no baseline vs follow-up for the far group only. Transit trips (including light rail, bus, and/or commuter rail trip): For residents living <800m away from the intervention, transit trips were significantly more likely at one-year follow-up compared to baseline (baseline odds ratio when compared to follow-up 0.61 (95% CI 0.4 to 0.93), p≤0.02). Residents living <800m away from complete streets intervention were more likely to take transit trips than those living further away (odds ratio for far group 0.60 (95% 0.37 to 0.97), p≤0.04). Non-transit walk trips: For residents living <800m away from the intervention, non-transit walk trips were significantly more likely at one-year follow-up compared to baseline (baseline odds ratio when compared to follow-up 0.55 (95% CI 0.39 to 0.78), p≤0.00). Residents living <800m away from complete streets intervention were more likely to take non-transit walk trips than those living further away (odds ratio for far group 0.27 (95% 0.18 to 0.4), p≤0.00).	Reasons for not having valid GPS data included mechanical malfunction, participant failure to wear or recharge or turn on equipment, lack of GPS signal. The 77 excluded from the analysis were more likely to be female and have more household members. In Brown et al 2016, the authors state that although a number of sociodemographic variables were controlled for, there may have been some unmeasured variables that were influential. **Limitations identified by the review team** Short follow-up period: post-intervention data taken as little as 1 month after intervention was implemented. Maximum follow-up time after intervention was 7 months. This may not have been big enough to detect any changes in commuting decisions and physical activity behaviours. **Other comments** Power calculation (reported in Brown 2016): sample size of 210 needed to detect 5-10% change (80% power for an alpha level of 0.05).

			Bike trips: For those living <800m away from the intervention, there was no significant difference in number bike trips between baseline and follow-up (baseline odds ratio when compared to follow-up 0.86 (95% CI 0.49 to 1.53), p≤0.62). There was also no significant difference in number of bike trips between near and far groups (odds ratio for far group: odds ratio 0.69 (95% 0.37 to 1.3), p≤0.25). **Analysis** Participants were categorised into 4 ridership groups: 1. Never-riders: residents who never rode transit, or who used transit outside of street buffer, or who biked and walked only 2. Continuing riders 3. Former riders: residents who had complete-street transit trips at baseline but not at follow-up 4. New riders: residents who only had complete-streets transit trips at follow-up. Authors used ordinary least squares regression analysis to compare the difference in PA between never-riders against the 3 other categories. Control variables included gender, age, Hispanic ethnicity, college graduation, marital status, employment change, health change, temperature change, and days between data collection. Physical activity was categorised into 3 different levels (calculated per 10 hours of accelerometer wear – according to intensity thresholds taken from previous research): 1. Moderate-to-vigorous PA (MVPA): 2020 cpm 2. Light PA 3. Sedentary PA <u>Additional analysis in Brown et al 2016 – time and distance effects</u> Rather than the commuter types listed above, participants were classed as ‘near’ or ‘far’. ‘near’ residents were those living <800m away from the intervention street and ‘far’ residents were those living ≥801-2000m away. Comparisons were made pre- and post-intervention as well as comparing near and far participant groups. Generalised linear mixed model was used to test for time and distance effects.	Other outcomes: Study also reports BMI changes but not reported here as outside scope of the guideline

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18 Collins and Agarwal 2015

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Collins & Agarwal 2015

Quality score
-
Study type
Uncontrolled before and after study

(authors describe as ‘longitudinal study’)

Location
Canada – Kingston, Ontario

Study aims
To assess whether the introduction of an express transit service (and employer-subsidised monthly transit pass) in Kingston, Ontario, had an effect on transit use and PA in non-student</td>
<td>Number of participants
N = 656

Participant characteristics

At baseline in 2013, the sample was 34% male, 66% female, 49% were over 50 years of age, 35% had a household income of <90k (Canadian $), 70% had no children under 14 years.

In terms of commuting variables, 82% worked 5 days a week, 44% worked flexible hours, 88% had access to a vehicle for the commute, 38% had a permit to park at Queens University, 45% lived within 5km of Queens.

Between baseline (2013) and follow-up (2014), the number of respondents reporting to have no children under the age of 14 increased from 70% to 72%. There were no other significant changes in the measures over time.

Inclusion criteria</td>
<td>Intervention

Introduction of an express route which provides a more frequent service to Queen’s University. The University also introduced an employer-subsidised monthly transit pass mid intervention (6 months after express route opened).

Comparator
No comparator</td>
<td>Intervention: Express route with subsidised monthly pass
Control: no control

Outcomes

Participants were categorised post-hoc based on their commuting behaviour. These categories are:
1. Exclusively passive: drove own vehicle, or carpooled, or got dropped off
2. Somewhat passive: as above, but who parked off-campus and walked to University
3. Transit: public transit users
4. Active: walk or cycled to work
5. Varies by season: did not employ the same route all year round

<u>Change in commute mode over time (n = 656)</u>
<table>
<tr><th>Commuter group</th><th>% at 13 months post-intervention</th><th>% change</th></tr>
<tr><td>Exclusively passive (n = ~267)</td><td>40.7</td><td>-0.6</td></tr>
<tr><td>Somewhat passive (n = ~56)</td><td>8.5</td><td>-0.7</td></tr>
<tr><td>Transit (n = ~56)</td><td>8.5</td><td>3.0*</td></tr>
<tr><td>Active (n = ~93)</td><td>14.2</td><td>-0.7</td></tr>
<tr><td>Varies by season (n = ~185)</td><td>28.2</td><td>-0.9</td></tr>
</table>
Note: n for each group calculated by reviewers from percentages in paper so figures are approximations.
*Statistically significant at 99% level, no further details reported

<u>Characteristics of employees shifting commute modes (post-hoc analysis comparing ‘shifters’ (n = 23) with ‘non-shifters’ (n = 591)</u>

Shifters significantly more likely to be female (p=0.036), have a lower household income (<0.001), not have a drivers licence (<0.001), have a transit pass (p<0.001), not have a permit to park at work (<0.001).
In terms of attitudes towards transit, shifters responded more favourably to the improvements and the subsidised transit pass (both p<0.001) and were more willing to spend >30 mins on the commute (p<0.001).

<u>PA levels – comparison of different commuting categories</u></td>
<td>Limitations identified by the author
Loss to follow up: 1356 employees completed the baseline survey and 656 of these completed the survey at follow-up (loss of 51.6%)

Risk of selection bias: those who shifted transit use and wanted to report on their experiences may have been more likely to complete the survey. This risk was minimised by researchers presenting the survey as a one about health and commute modes.

PA measured by self-report survey which has potential for measurement error. Further inaccuracy may have been caused by the calculation of total PA during weekly commute time – whereby authors assumed commuting would be consistent across the week.

PA measurements were only captured in follow-up survey so a comparison cannot be made. However, a third round of surveys is due to be taken</td>
</tr>
</table>

Study details	Population	Intervention/ comparator	Results	Notes
employees at Queen's University. **Length of follow up** 1 year between baseline survey and follow-up Baseline survey taken in Oct 2013, express route opened in Sept 2013, follow-up survey in Oct 2014. **Source of funding** Queen's University	Non-student employees of Queen's University living within the geographic area served by the transit route. Postcodes and diagram of area given in paper. **Exclusion criteria** Students at the University.		On the weekly commute, the commuter groups had significantly different levels of PA (F = 276.38, p<0.001), with active commuters showing the highest levels (140.3 mins ± 5.8 SE), transit users showing lower (79.2 mins ± 6.4 SE) and entirely passive commuters showing the lowest (no PA took place). When PA levels from the commute and recreational activities were combined, there was still a significant difference between groups (F = 52.56, p<0.001), with active commuters showing the highest levels (296.3 mins ± 10.9 SE), followed by somewhat passive commuters (237.4 mins ± 23.9 SE), transit users (183.3 mins ± 15.5) and the lowest levels being amongst entirely passive commuters (135.1 mins ± 7.8 SE). **Analysis** Data was collected via online survey (took approx. 12 mins to complete). Surveys at both time points included questions on commuting behaviour, household attributes, attitudes about public transport. PA data was only collected in the later survey so no comparison could be made. Cross-tabulations and chi-square statistics were generated for analyses of sample characteristics and changes in commute modes over time, and for tests of differences between 'shifters' and 'non-shifters'. Comparisons of physical activity levels by commute mode employed ANOVA. 95% Confidence Intervals used.	and results published in future will include this measure. **Limitations identified by the review team** Study power: not reported The baseline data is taken one month after express route opened - not strictly a before and after study. **Other Comments** Other outcomes: No other outcomes were reported in the study.

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20 Foley et al 2017

Study details

Reference
Foley et al, 2017 (was academic in confidence, now published)

Quality score

-

Study type
Longitudinal cohort with two distinct cross sectional samples

Location

UK - Glasgow

Study aims

To evaluate the effects of a new motorway built through deprived neighbourhoods on travel behaviour in residents.

Length of follow up
8 years

Population

Number of participants

Time point 1 (T1): 1,141
Time point 2 (T2): 1,206
Longitudinal cohort (returned surveys at T1 and T2): 365
The remaining 980 (T1) and 978 (T2) participants together formed the repeat cross-sectional sample.
Response rate: 16.1% at T1 and 15.8% at T2.

Participant characteristics
No significant sociodemographic differences between study areas in the longitudinal cohort. However, in the T2 repeat cross-sectional sample, on average participants in the North (no motorway) study area were older, and participants in the South (new motorway) had lived fewer years in their locality, than those in the other areas (there were no significant differences at T1).

T1	Total	North	East	South
n	360	124	111	125
Age yrs (sd)	50.4 (13.6)	49.0 (13.3)	51.3 (13.3)	51.0 (14.1)
% male	43.5	37.6	44.1	48.8
% home ownership	61.1	60.8	61.3	61.3
% car ownership	58.5	61.6	52.3	60.8
% working*	58.5	60.8	54.6	59.7

Intervention/ comparator

Intervention
The M74 motorway extension was built through or close to mainly residential areas and opened in 2011.

Participants living in the area of the extension were recruited prior to motorway construction in 2005 (T1), and approximately two years after the motorway opened in 2013 (T2). At each time point, a postal survey was mailed to a random sample of private residential addresses drawn from each of the three study areas using the Royal Mail Postcode Address File. At baseline, participants were given the option to be contacted again in the future. Yearly contact was

Results

Outcomes
Cohort analysis
Compared to those in the North (no motorway) study area, cohort participants in the South (new motorway) were significantly more likely to undertake travel by any mode at follow-up (odds ratio [OR] 2.1, 95% confidence interval [CI] 1.0 to 4.2), and those in the East (existing motorway) were significantly more likely to use the bus at follow-up (OR 2.4, 95% CI 1.1 to 5.2). However, there were no differences between study areas for either time spent travelling in general, or time spent using any mode of transport in particular.
Within the South (new motorway) study area, participants living closer to a motorway junction were more likely to use a car and to undertake travel by any mode at follow-up than those living further away, but only the finding for any travel remained statistically significant in the maximally adjusted model (OR 4.7, 95% CI 1.1 to 19.7).
Within the East (existing motorway) study area, a significant interaction was found by car ownership. Stratified analysis indicated that in participants who owned a car, those living closer to a motorway junction were more likely to use the bus at follow-up than those living further away (OR 4.5, 95% CI 0.9 to 21.5), an effect not found in those without a car.
Longitudinal associations between exposure to a motorway and change in travel behaviour. Data collected in Glasgow at T1 (2005) and T2 (2013).

	Travel		Bus		Car		Walking	
Exposure	*n*	*min/day IRR (95% CI)*	*n*	*min/day IRR (95% CI)*	*n*	*min/day IRR (95% CI)*	*n*	*min/day IRR (95% CI)*
Area: East	193	1.0 (0.7, 1.5)	59	1.1 (0.7, 1.7)	119	1.0 (0.7, 1.6)	100	1.4 (1.0, 2.0)
Proximity within East study area	-	-	-	-	-	-	-	-
Area: South	193	0.8 (0.5, 1.1)	59	1.0 (0.6, 1.7)	119	0.9 (0.6, 1.3)	100	0.9 (0.6, 1.4)
Proximity within South study area	-	-	-	-	-	-	-	-

		Travel	Bus	Car	Walking

Notes

Limitations identified by the author

Collection of only one day of travel data, which raises the possibility that travel on a given sampled day was not typical and increases the variability in the data.

Comparatively low response to the survey, which limits the external validity of

Study details | **Population** | **Intervention/ comparator** | **Results** | **Notes**

Study details

Source of funding

National Institute for Health Research Public Health Research programme

Centre for Diet and Activity Research

NHS Greater Glasgow and Clyde and Glasgow Centre for Population health

British heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council, Wellcome Trust

Population

Years lived in local area	18.3 (15.3)	16.9 (13.1)	17.5 (13.5)	20.3 (18.4)

T2	Total	North	East	South
n	363	126	112	125
Age yrs (sd)	58.5 (13.6)	57.3 (13.4)	59.4 (13.3)	59.0 (14.1)
% male	44.4	38.9	44.6	49.6
% home ownership	62.5	62.7	62.5	62.4
% car ownership	60.5	65.9	55.4	59.7
% working*	48.1	50.4	46.4	47.2
Years lived in local area (sd)	24.9 (16.6)	22.7 (14.1)	24.9 (14.0)	27.0 (20.3)

	Repeat cross-sectional sample (T1 n=980; T2 n=978)

T1	Total	North	East	South
Age yrs (sd)	48.8 (18.3)	49.7 (18.2)	48.5 (18.7)	48.1 (17.8)
% male	37.1	36.2	34	41.3
% home ownership	47.9	46.3	51.1	46.4
% car ownership	48.8	49.4	49.4	47.6

Intervention/ comparator

maintained with those who agreed, and all who could still be contacted were mailed a survey at follow-up.

Comparator
Area-level exposure was defined as residence in the South (new motorway), East (existing motorway) or North (no motorway) study area. In addition, the distance in metres from the weighted population centroid of the unit postcode for each participant's home address by road network to the nearest motorway junction was calculated. The final measure represented proximity to the motorway, whereby a higher value reflected greater exposure and a unit change in exposure

Results

Exposure	n	*yes/no OR (95% CI)*	*yes/no OR (95% CI)*	*yes/no OR (95% CI)*	*yes/no OR (95% CI)*
Area: East	277	1.8 (0.9, 3.6)	**2.4 (1.1, 5.2)***	1.1 (0.6, 2.2)	1.6 (0.8, 3.1)
Proximity within East study area	83	1.6 (0.6, 3.9)	1.3 (0.6, 3.0)	1.2 (0.5, 3.0)	1.7 (0.8, 3.6)
Area: South	277	**2.1 (1.0, 4.2)***	1.3 (0.6, 3.0)	1.4 (0.7, 2.7)	1.2 (0.6, 2.3)
Proximity within South study area	91	**4.7 (1.1, 19.7)***	2.1 (0.3, 13.1)	2.3 (0.7, 8.1)	2.0 (0.5, 7.6)

Reference is north for the above.
*CI – confidence interval; IRR – incidence rate ratio; min – minutes; n – number; OR – odds ratio *p<0.05, **p<0.01, ***p<0.001*
Two-part model adjusted for age, sex, home ownership, car ownership, working status, years lived in the local area and baseline value of the outcome of the model in question

<u>Repeat cross sectional analysis</u>
There were no significant differences between study areas for either likelihood of, or time spent using, any or all modes of travel. However within the South (new motorway) study area, participants living closer to a motorway junction were more likely to use a car at follow-up than those living further away (OR 3.4, 95% CI 1.1 to 10.7). The sensitivity analysis did not substantially change these findings. Repeat cross-sectional associations between exposure to a motorway and change in travel behaviour. Data collected in Glasgow at T1 (2005) and T2 (2013).

	Travel		**Bus**		**Car**		**Walking**	
Exposure	*obs*	*min/day IRR (95% CI)*	*obs*	*min/day IRR (95% CI)*	*obs*	*min/day IRR (95% CI)*	*obs*	*min/day IRR (95% CI)*
Area: East (reference: North)	1252	1.1 (0.9, 1.3)	451	1.3 (0.9, 2.0)	669	1.0 (0.7, 1.3)	717	1.0 (0.7, 1.4)
Proximity within East study area	424	1.1 (0.5, 1.5)	165	0.8 (0.5, 1.2)	223	1.4 (0.9, 2.2)	230	1.4 (0.8, 2.3)
Area: South (reference: North)	1252	0.9 (0.7, 1.1)	451	0.9 (0.6, 1.3)	669	0.7 (0.5, 1.0)	717	0.9 (0.7, 1.3)

Notes

the findings

Limitations identified by the review team

Natural experiment design limits robustness of this study.

Other comments

Other outcomes: no other outcomes were reported in this study.

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr><td></td><td>

% working*	48.3	47.2	48.9	48.9
Years lived in local area	18.2 (18.0)	18.9 (18.7)	18.2 (16.9)	17.3 (18.4)

T2	Total	North	East	South
Age yrs (sd)	52.6 (16.5)	54.6 (16.0)	51.8 (17.0)	51.2 (16.4)
% male	42.8	43.3	40.2	45.1
% home ownership	49.6	50.3	48.6	50
% car ownership	53.4	54.8	52.3	53
% working*	48.3	44.4	49.7	51
Years lived in local area (sd)	19.0 (17.4)	19.7 (16.9)	20.7 (18.1)	16.3 (17.1)

</td><td>corresponded, for example, to the difference between those living 100 metres and 300 metres from a motorway, or between those living 300 and 800 metres away.

Inclusion criteria
Residence in one of three census zones in Glasgow:
North – no motorway
East – pre-existing motorway
South – New motorway extension into area
Aged 16 or over
Responded to postal survey delivered to home address

Exclusion criteria
Blank records</td><td>

Proximity within South study area	406	1.3 (0.9, 2.1)	140	1.9 (0.8, 4.3)	212	1.1 (0.5, 2.3)	249	1.2 (0.7, 2.0)

CI – confidence interval; IRR – incidence rate ratio; min – minutes; obs – observations;

		Travel	**Bus**	**Car**	**Walking**
Exposure	*obs*	*yes/no OR (95% CI)*	*yes/no OR (95% CI)*	*yes/no OR (95% CI)*	*yes/no OR (95% CI)*
Area: East (reference: North)	1655	0.9 (0.4, 1.6)	1.2 (0.7, 2.1)	0.8 (0.4, 1.5)	0.9 (0.6, 1.5)
Proximity within East study area	548	0.7 (0.3, 1.8)	0.8 (0.4, 1.7)	1.0 (0.4, 2.3)	0.7 (0.3, 1.5)
Area: South (reference: North)	1655	1.0 (0.5, 1.9)	1.0 (0.6, 1.8)	1.1 (0.6, 2.0)	0.8 (0.5, 1.4)
Proximity within South study area	534	0.8 (0.3, 2.7)	0.9 (0.3, 2.4)	**3.4 (1.1, 10.7)***	1.1 (0.5, 2.7)

OR – odds ratio *p<0.05, **p<0.01, ***p<0.001
Two-part model adjusted for age, sex, home ownership, car ownership, working status and years lived in the local area. North – study area containing no motorway infrastructure; East – study area containing existing M8 motorway; South – study area containing new M74 motorway
Analysis
Descriptive analyses of the longitudinal cohort and repeat cross-sectional sample were undertaken at baseline (T1) and follow-up (T2). Differences in demographic and socioeconomic characteristics between study areas and across time points were investigated using one-way ANOVA, t and chi-squared tests as appropriate, and those between the longitudinal cohort and the rest of the baseline sample were explored using t and chi-squared tests. Analyses were carried out using Stata 13 to assess the relationships of (a) study area, and (b) individual-level exposure stratified by study area, with (i) travel and travel time, (ii) bus use and bus time, (iii) car use and car time and (iv) walking and walking time. The final models were adjusted for age, sex, home ownership, car ownership, working status and years lived in the local area. For all analyses using study area as the exposure, the North (no motorway) study area was used as the reference category</td><td></td></tr>
</table>

21 **Jones et al 2013**

Study details	Population	Research parameters	Results	Notes
Full citation Jones et al 2013 **Quality score** ++ **Study type** Qualitative interview and participant observation (authors describe as an 'ethnographic study') **Location and setting** UK - Cambridgeshire **Aim of the study** To evaluate the views and experiences of users of the new Cambridgeshire guided busway, focussing on whether and how it became integrated and normalised. **Source of funding**	**Number of participants** Number of participants not mentioned but trips were taken on 20 mornings and 21 afternoons or early evenings. Data collection ceased when data saturation was reached, that is when new data no longer generated new themes. **Participant characteristics** No participant characteristics reported **Inclusion criteria**	**Data collection** Data collection took place using "Participant observation" method. Interviews took place 1-4 months after the busway opened. An experienced social science and public health researcher travelled on the busway at varying times in the weekday observing and interacting with the passengers. Trips were taken on 20 mornings and 21 afternoons or early evenings – during these trips the researcher spoke to multiple passengers and observed others without speaking to them. There was no formal topic guide, participants were encouraged to discuss any aspect of their experience on the busway. However, participants were asked to expand on their reasons for using the busway and how it fitted into their everyday lives.	**Key themes** 1. <u>Early experiences of the busway</u> Early experiences were important in determining ease of use and compatibility with existing practices. The ease with which the busway could be integrated into existing daily routines was significant: *"I sat next to a man on the bus. [He said that the first time he used the busway he] was going out after work for some drinks and he didn't want to drive. So he got a lift to the busway, took the busway to work, got the busway back after the drinks, and got a taxi from St Ives bus stop to home. He did it that time so he could drink. But it worked out well, it was easy, so he decided to use the busway more. So he's been going on it to work."* However, confusion around ticketing was common because two different bus companies operate on the busway. A ticket valid on one bus is not valid on the other bus company. Because passengers are expected to buy their ticket before travel (which is in itself unusual in the UK), people are either getting confused by this and having to wait for long periods of time. Alternatively, experienced passengers are feeling frustrated with new passengers trying to buy tickets on board and causing delays: *"[A lady got on the bus and sat next to me.] When she first got on the bus she was unhappy about it – she said they couldn't work the tickets out, it was a faff and they probably shouldn't have bothered. They bought Whippet tickets, then the next Whippet bus wasn't for an hour and they couldn't wait that long, so they'd had to buy another, Stagecoach, ticket. Two buses had gone past while they were at the ticket machine and hadn't waited for them to get on."* 2. <u>Collective learning</u> Many of the passengers perceived the busway to be a novel feature that required experience and learning:	**Limitations identified by author** - Findings not generalizable because the data collection took place on a specific context for a specific intervention that is not seen elsewhere. Also Cambridge is relatively affluent and well-educated. - data collection took place during autumn and winter due to the need to collect data immediately after the busway opened. Attitudes may vary across the seasons. - No data from people who did not use the busway – however future research will cover this. **Limitations identified by review team**

Developed and initially funded by Centre for Diet and Activity Research (CEDAR). Also by the British Heart Foundation, Economic and Social Research Council, Medical Research Council, NIHR and the Wellcome Trust, under the auspices of the UK Clinical Research Collaboration, Now funded by the NIHR Public Health Research programme.	Passengers on the guided busway **Exclusion criteria** None stated	During data collection it emerged that participants' previous travel modes were important so later data collection asked the participants to expand on this point. **Method of analysis** Data analysis and interpretation were inductive. Data collection ceased when data saturation was reached, that is when new data no longer generated new themes. Codes were developed and segments of the field notes were assigned to these by the researcher. Codes were then grouped into broader themes identified from patterns in the data. Interim descriptive accounts of the data and analysis were discussed between the authors throughout the fieldwork period, to guide further data collection and analysis and to validate the emerging findings.	*"A group of 4–5 people (aged around 60 years) were standing together near the bus stop discussing busway tickets and routes. One of the women went to look at the information displayed on the bus stop; she came back and told the rest of the group that they could have got on the previous bus after all. She hadn't realised it would have stopped where they'd wanted. ''You live and learn,'' she said."* Passengers were often observed learning how to use the busway collectively, sometimes with information sharing happening between strangers and bus drivers. 3. <u>Two distinct passenger groups</u> Two groups included those who had previously travelled by bus and those who had mainly travelled by car. Previous bus users, whose regular service had been discontinued, tended not to describe the busway positively and in some cases perceived it to be worse than before: *''it actually takes longer because it stops at more stops along the way''; ''the bus gets really crowded and noisy''.* They were disappointed that the busway was not superior to the regular service, or was in fact inferior – *''for people like me, who used to have a good bus service, it's frustrating that now it's slower and you can't always get a seat''.* For those that had previously travelled by car, the busway was described more positively: ''*it's cheaper than driving to work*''; ''*I can sit on the bus and relax, not worry about the traffic''*; ''*it's easier, more convenient*''. These passengers appeared to be experiencing the benefits of public transport in general for the first time. Many of their positive remarks might have been applied to other forms of public transport and were not specific to the busway; for example, not having to concentrate on driving, and the reduced cost of travel. Once previous bus users got used to the busway they rapidly began to perceive it simply as an extension of other public transport systems: *One early evening I was waiting amongst a group of other passengers at a bus stop at Addenbrooke's Hospital to get a guided bus towards the city centre and St Ives. A bus arrived and people began to board. One lady got on and showed her ticket to the driver, who said that it was not valid for this bus. She got off again, and a man who was also at the bus stop explained to her that she had a ticket for a regular bus (not a guided bus) and would have to go to the bus stop for regular buses, even to reach the same destination (the city centre). A third passenger who was waiting at the bus stop said ''I thought a bus is a bus''. ''Ah, but this is a guided bus'' the man said, with raised eyebrows.* Conversely, some passengers experienced the busway so positively that they switched from car travel to busway for commuting after trying the busway outside of work time.	- Coding technique is only briefly described. - It is not entirely clear how and when the researcher chose to interact with passengers, and when they decided to simply observe them. - Possible risk of context bias in that the attitude of the passenger will be largely dependent on the performance of the busway on the day they are observed/approached. **Other comments** Other outcomes: no other outcomes or themes are reported in the study.

22 Karlstrom and Franklin 2009

Study details	Population	Intervention/ comparator	Results	Notes
Reference Karlstrom and Franklin 2009 **Quality score** - **Study type** Uncontrolled before and after study **Location** Sweden - Stockholm **Study aims** To investigate the impact of congestion charging on roads into and out of Stockholm centre on commute mode, commute departure time, and equity. Only the former is relevant to this review.	**Number of participants** N = 1550 **Participant characteristics** Participants split into four categories post-hoc: tolled (the selected commute journey observed was made by car both at baseline and follow-up); untolled (the selected journey was made by public transit at both data collection points); Tolled-off (at baseline the journey observed was made by car, and at follow-up the journey observed was made by public transit); and tolled-on (at baseline the journey observed was made by public transit, and at follow-up the journey observed was made by car). Tolled: n = 607. 50% female, mean age at baseline 48.6. Untolled: n = 794. 70% female, mean age at baseline 47.7. Tolled-off: n = 86. 51% female, mean age at baseline 48. Tolled: n = 63. 57% female, mean age at baseline 43.8. **Inclusion criteria**	**Intervention** Congestion charging pilot scheme in Stockholm, Sweden. The scheme began on 3rd Jan 2006. Substantial public bus service enhancements and new park and ride lots were introduced nearly a year previous to the intervention (after the baseline data collection). Tolling began at 06:30 and ended at 18:30 each weekday. Costs were 10 SEK per cordon crossing – shoulder periods (07:00 – 09:00 and 15:30 – 18:00) rose to 15 SEK and peak periods (07:30 – 08:30 and 16:00 to 17:30) rose to 20 SEK. Buses, taxis, motorcycles and emergency vehicles were exempt. **Comparator**	**Intervention:** Congestion charging into and out of Stockholm centre **Control:** No control **Outcomes** <u>Percentage of participants in each group crossing the toll cordon on their journey</u> (the journey is from same origin to same destination for each individual at both baseline and follow-up – group definitions under “participant characteristics”) Tolled: 20% Untolled 49% Tolled-off: 51% Tolled on: 44% Those that used to drive and now use transit (Tolled-off) have a higher rate of crossing cordon than those who have not shifted from car to transit (tolled) indicating mode choice change. <u>Matched analysis:</u> About 25% of car drivers crossing the toll cordon (treated individuals) switch to transit, while only 10% do so in the control group (car drivers not crossing the toll cordon). Initial car drivers crossing the toll cordon had a 15% higher rate of switching to public transit compared with those car drivers not crossing the cordon. It is noted that for all travellers there are about 8-11% that switch modes even though their routes are unaffected by the toll. It is not clear whether this is of the whole population (including treated), or the population minus treated group). This illustrates that other factors impact on choice to change mode. **Analysis** Only change between car and public transit were investigated rather than cycling or walking activities due to the recognised seasonality of these latter two modes in Stockholm. Car and public transport are considered to be similar in terms of seasonal use.	**Limitations identified by the author** High drop-out rate between baseline and 18-month follow-up data collection. However this is tested and population is not found to be significantly different from sample. **Limitations identified by the review team** Long time between baseline data collection and intervention means that outcome measures may have changed between these times as a result of factors other than the intervention. Original dataset was very large (75000+) and has been reduced to 1550 by specific inclusion criteria. This makes the results less generalizable to wider groups. **Other comments** Other outcomes: Study also reports mode choice model considering gender, not reported, and changes in departure time between baseline and follow-up.

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up Follow-up data collected 2 months into congestion charging pilot. Baseline data collected October 2004, intervention pilot began 3 Jan 2006, follow-up data collected March 2006. **Source of funding** VINNOVA (Swedish national road administration) and Stockholm municipality	Individuals age 12 – 84 who reported making at least one commute trip from the same home location to the same work location during morning rush hours in both baseline and follow-up data collection. **Exclusion criteria** Those with major life changes (home location, work location) between baseline and follow up.	No comparator	Survey: survey was the official evaluation of the Stockholm Trial (travel survey). Surveys were sent (method of sending is not stated). It is implied (but not explicitly stated) that the survey only asks for commuting details for the day of the survey, both at baseline and follow-up. For each individual, one commute instance assessed at baseline, and one instance at follow-up. Therefore two journeys were assessed for each individual. Matching estimators were used to address impact of congestion charges on initial car drivers (tolled and tolled-off groups). This compares treated and untreated individuals. Treated are those who are initial car drivers passing the toll cordon and who are eligible to pay the toll. Each treated individual is matched with an untreated individual who is similar – control group. Propensity score system used for matching.	No significant differences between non-response group and response group, other than few trips being generally made – "these differences do not affect the present studies since we consider commuting trips conditional on the trip occurring and on the mode being car or transit"

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24 Kesten et al 2015

Study details	Population	Research parameters	Results	Notes
Full citation Kesten et al 2015 **Quality score** ++ **Study type** Qualitative semi-structured interviews **Location and setting** UK - Cambridgeshire **Aim of the study** To investigate the ways in which passengers on the new Cambridgeshire Guided Busway experienced and responded to the new infrastructure, and how such experiences were or were not translated into meaningful travel behaviour change. **Source of funding**	**Number of participants** N = 38 **Participant characteristics** 44.7% male, 55.3% female, 18.4% aged 30-39, 15.8% aged 40-49, 42.1% aged 50-59, 18.4% aged 60-69, 5.3% aged 70 and over. 92.1% were employed, 50% had higher education. 50% lived in the intervention area and 50% in the control area (details in Panter et al 2016) **Inclusion criteria**	**Data collection** Participants were recruited from the main cohort study and also via an intercept survey. Semi-structured interviews were conducted between 18 and 22 months after the busway was introduced, either at participant homes (26.3%) or workplace (60.5%) or at the research institute (13.2%). Interviews followed a flexible topic guide which allowed participants to shape the direction of the interview and lasted between 18 and 71 minutes. Initially the focus was on experience using different modes of transport and how they chose the options available, then the focus was on facilitators and barriers to travel behaviour change. There was then a more specific question of the perceived impact of the busway (if not already discussed previously). Two vignettes were used at the end of the interview. Vignettes were constructed using the "following a thread" procedure for mixing methods and based on pre-existing quantitative data and qualitative data collected	**Key themes** 1. <u>Places created by environmental change</u> The busway cannot be considered as a singular change to the environment that affected everyone's choices and opportunities in the same way. Proximity, accessibility and convenience were important aspects. Some were not affected by the busway because they did not live near it or the feeder modes that linked to it. However for others the busway was conveniently located on their commuting route and they were able to replace previous options with the new infrastructure. For those that described the busway as convenient, they appreciated that compared to other public transit, there were fewer stops and the route was more direct. The maintenance track was also praised for having fewer road junction stops, a smooth cycle track and an easy to use route away from roads. Passengers expressed frustration at the busway when it reached the city centre, where the route goes along a road shared with other vehicles, so the speed and reliability is compromised. For some, the stress of driving and parking has been relieved from using the busway: *"I've worked on this site for about 15 years, and over the years it's been <u>very</u> stressful getting a car parking place, even if you come in early. And I just can't start my day in a stressful way, so Park and Ride is really good for me, getting on the [guided] bus is very, very good."* 2. <u>Ambiguous spaces created by environmental change</u> Rather than the place of this new infrastructure, it was the space that it created which elicited either acceptance or objection from participants. Barriers included proximity to others and over-crowding when considered alongside the price of tickets. However, some felt the opposite:	**Limitations identified by author** A higher proportion of cohort members (71.9 %) than intercept survey participants (15.0 %) agreed to be interviewed. This could reflect a greater investment and commitment already made to the study. Within the main cohort, a large proportion had been educated to degree level, although the characteristics of the purposively recruited intercept participants somewhat offsets this. No data from adults aged under 30, who may respond differently to particular attributes of the busway such as internet access, or have different predispositions to

Developed and initially funded by Centre for Diet and Activity Research (CEDAR). Also by the British Heart Foundation, Economic and Social Research Council, Medical Research Council, NIHR and the Wellcome Trust, under the auspices of the UK Clinical Research Collaboration, Now funded by the NIHR Public Health Research programme.	Aged over 16 Lived within the study area Reported their level of educational achievement (to enable researchers to purposely oversample from lower social groups) **Exclusion criteria** None stated	previously in the study. Further details in the paper. Vignette 1 focussed on positive attitudes towards travel and use of public transport. Vignette 2 depicted the experience of car use and was developed using data related to inverse of the quantitative predictors. Full text of the vignettes are given in the paper and not reported here. Interviews ended when theoretical saturation had been reached. **Method of analysis** Inductive thematic qualitative analysis was performed using QSR NVivo 8. Reflective field notes, recording the main points of interest and unrecorded talk (e.g. before and after audio recording), were completed after every interview. The field notes were referred to for context before, during and after analysing each transcript. Initial codes, categorising the content within each line or section, were generated systematically across all the transcripts, and duplicate codes with synonymous meanings were collapsed. The content of all the codes was read, and these contents were compared to each other to iteratively refine and group codes into potential themes. To continue the refinement process the content of each theme was used to produce a written description of each theme.	*"If I catch it [the busway] at five to seven, I'm usually in my office by about twenty or quarter to eight. So it's a little longer, maybe, than driving at that time of the morning, but it's much more pleasant."* – illustrates some are willing to compromise on time due to it being a more pleasant experience. The advertised features of the busway including free internet and power sockets which some did not regard as assets: *"[…] plugging your laptop in [on the bus] and starting to work, I can't think of anything worse […]."* Regarding the cycle track, some claimed that a barrier to using the cycle path was that they didn't like wearing a helmet. Others had positive remarks about the safety as it is off-road. However a lot expressed frustration that the busway was not lit and not sheltered, impacting severely on safety of cyclists and pedestrians and increasing potential for floods. <u>3. Adapting to and adopting environmental change</u> Novel aspects of the busway in particular, such as the ticketing procedure and two separate bus operators, meant that planning—especially for those new to public transport—was required: *"I have the utmost sympathy for anybody that's not a regular bus user because it's almost like having to be inducted into some sort of secret society because people […] worry about "Do I need the right money?" […] I mean this business about the stops in town, you pay on the bus, the stops outside town actually on the busway you have to pay at a machine before and then the machine asks you, "Which bus company do you want to travel with?" Not "Where are you going?"* The process of incorporating the busway into commuting patterns appeared to be influenced by whether the anticipated benefits of changing were achieved or not over time. *"I think you think it's quite a long way. I know when I first started doing it [walking along the busway to the park and ride site] I thought, 'OH, I'll do it once a week, twice a week,' which is what I did, actually. […] And then I thought, 'Well actually, I can do it every day,' but it was a question of building up to it."* The busway interacted with participants' circumstances in a complex manner which is challenging to assimilate across many voices and lived experiences.	particular travel behaviours such as cycling. The selection of participants who had changed their travel behaviours relied on one survey item which may not have provided a valid reflection of changes in travel behaviours over time. **Limitations identified by review team** No reporting on record keeping No reporting on role of researcher and the relationship with the participants (particularly the intercept survey). Paper does not describe how the research was presented to the participants. **Other comments** Other outcomes: no other outcomes or themes reported in this study

25 Loader and Stanley 2009

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference

Loader and Stanley 2009

Quality score

-

Study type

Controlled before and after study

Location

Australia

Study aims

To assess the effect on bus patronage of a city-wide bus service improvement programme in Melbourne particularly focussing on more deprived suburban areas, compared with unchanged routes in the same city.</td>
<td>Number of participants

No participant numbers given: growth provided in percentage points only.

Participant characteristics

No participant characteristics reported.

Inclusion criteria

Individuals using unchanged or changed bus services in Melbourne in 12 months to August 2006, or 12 months to August 2007.

Exclusion criteria

None reported</td>
<td>Intervention

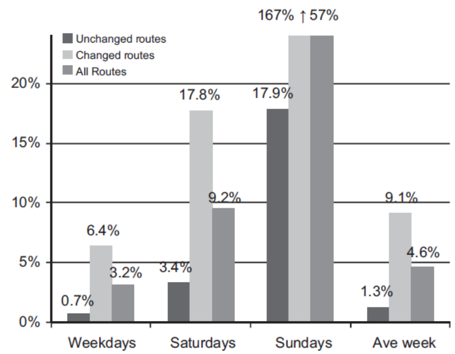
First year of 10-year bus improvement programme starting in 2006 (Meeting Our Transport Challenge).

30 bus routes were upgraded in September and October 2006. By October 2007, 72 bus routes had been upgraded, 69 of which in middle-outer suburban areas. They now run hourly from 6am-9pm weekdays, 8am-9pm Saturdays and 9am-9pm Sundays.

Upgrades to 3 existing ‘crosstown’ SmartBus services, which includes upgraded stops to show real-time passenger information, and increased frequency to every 15min during weekdays, 30-60mins on weekday evenings, and 30-40min on weekends. SmartBus runs 6am-midnight.</td>
<td>Intervention: Meeting Our Transport Challenge programme in Melbourne: increasing bus frequency and upgrading SmartBus routes.
Control: Unchanged routes in the same city.

Outcomes
<u>Underlying bus patronage growth (%)</u>
Follow-up data shows total bus patronage growth of 4.6% between August 2006 and August 2007. Unchanged routes grew by 1.3% in the same period.

<u>Bus patronage growth by day (follow-up compared with baseline)</u>



Unclear whether “changed routes” includes SmartBus routes. Patronage on changed routes increased by an average of 9.1% across all days, compared with 1.3% on unchanged routes. The largest change was seen on Sundays (changed routes increased by 167%) – this is attributed largely to free Sunday travel for seniors (see “other comments”).

<u>Bus patronage growth by area (follow-up compared with baseline)</u>
Greatest increases in use of changed routes are seen in the Central Business District (CBD) and outer regions (13.8% and 10.8% respectively). A decrease is seen in usage of unchanged routes in the outer area (-0.9%). See graph below. No standard deviation reported. Not calculable.</td>
<td>Limitations identified by the author

None identified.

Limitations identified by the review team

Authors note that the following will also affect bus patronage growth: introduction of free Sunday travel for seniors (date of introduction not reported); elimination of a fare zone which reduces cost of travel that crosses zone boundaries (date of introduction not reported); increasing petrol prices and mortgage interest rates; strong employment growth in central district; population growth of around 1%/annum. Authors report that this will affect outer suburbs disproportionately

No estimates of range (standard deviation) or significance were made by the authors.

No description of data collection methods is given (brief description for survey). Unable to judge risk of bias.</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Length of follow up

Intervention began in 2006 (month not reported).

Baseline data average of 12 months to August 2006. Follow-up data average of 12 months to August 2007.

Source of funding

Bus Association Victoria</td>
<td></td>
<td>Comparator

Unchanged bus routes (routes for which the frequency of buses have not been increased, nor upgraded to SmartBus status).

Number of routes which form this group not specified by authors. No characteristics specified.</td>
<td>Of unchanged routes, it is reported that those with more frequent service (higher service level) increased in patronage, while those operating only 5 or 6 days a week decreased over the data collection period. Data not given.

<table>
<tr><th rowspan="2">Area</th><th colspan="2">Change in bus patronage between baseline and follow-up (%)</th><th rowspan="2">Difference in change scores (calculated by NICE team) (%-points)</th></tr>
<tr><th>Unchanged routes</th><th>Changed routes</th></tr>
<tr><td>CBD-based</td><td>3.0</td><td>13.8</td><td>10.8</td></tr>
<tr><td>Inner</td><td>1.8</td><td>1.8</td><td>0</td></tr>
<tr><td>Middle</td><td>1.2</td><td>8.5</td><td>7.3</td></tr>
<tr><td>Outer</td><td>-0.9</td><td>10.8</td><td>11.7</td></tr>
<tr><td>All routes</td><td>1.3</td><td>9.1</td><td>7.8</td></tr>
</table>

<u>Bus patronage growth by time, Saturdays only (follow-up v. baseline)</u>
For buses whose finishing times had previously been between 4pm and 5pm (n = 2), their afternoon validations “more than doubled” after extension of running hours. For buses whose previous finishing time was between 5pm and 6pm, afternoon demand has risen by around 20%, and new evening demand is emerging. (Actual figures in average validations per hour presented in charts – exact numbers not clear).

<u>Survey responses: replaced method of travel (n=41)</u>
Of those using evening bus routes, 2 would have cycled and 7 would have walked previously. 35 would have used a different method of public transport, taken a taxi or drive, or got a lift. 2 would have travelled earlier, and 7 would have travelled either less often or not at all.

Analysis

Methods of data collection for counts not reported in the paper at all.
Survey: data collected from 101 respondents in the evening at a) a shopping centre b) a train-bus interchange and c) onboard a bus travelling between the previous two sites.</td>
<td>Other comments

Other outcomes: The study also aims to assess the impact of the intervention on social exclusion. This is outside of the scope of this guideline. Intention was partly to reduce “the risks of mobility-related social exclusion” – no outcomes measure mobility.

Meeting Our Transport Challenge Programme: The programme intends to extend bus operation hours on over 200 local routes ($A650 million funding) and to introduce SmartBus routes ($A750 funding).

No power reported. No standard deviation reported. Not calculable.

Adverse effect information available in replaced method of travel survey data.</td>
</tr>
</table>

27 Panter et al 2016, Heinen et al 2015

Study details	Population	Intervention/ comparator	Results	Notes
Reference Panter et al 2016 Heinen et al 2015 **Quality score** - **Study type** Uncontrolled before and after study (as referred to by authors "Quasi-experimental analysis nested within a cohort study") **Location** UK - Cambridge **Study aims** Heinen et al 2015: To investigate the effect of the Cambridgeshire Guided Busway on changes in commuting transport mode share.	**Number of participants** Heinen 2015: n = 470 Panter 2016: n = 469 **Participant characteristics** <u>Heinen 2015</u>: Participants were mainly recruited through workplaces. 33.4% male, 66.6% female, 12.4% aged ≤30, 23.7% aged 31-40, 29.6% aged 41-50, 26% aged 51-60, 8.3% aged 61+. 74.6% were educated to degree level and 78% were homeowners. 92.1% had a driving licence and 86.51% access to a bicycle. 8.3% had a limiting health condition, 1.1% had difficulty walking. 67.4% lived in the urban environment. 32.4% did not have parking availability	**Intervention** The CGB is a major transport infrastructure project comprising a new bus network and an adjacent 22km traffic-free walking and cycling route in and around Cambridge. For the majority of the route, the buses run on a guideway completely segregated from other traffic. But in the city centre stretch (approx. 5km), the buses use the existing road network. The path can be accessed at bus stops and other points along the route. **Comparator** No comparator	**Intervention:** CGB **Control:** No control **Outcomes** **Heinen et al 2015 (**<u>Change in commute mode share)</u> <u>Association between exposure to the CGB and changes in active travel mode share over 3 year follow-up</u> *Changes in active travel mode share were grouped as follows: Large decrease (30- 100%), Small decrease (<30%, No change, Large increase (30-100%), Small increase (<30%)* Figures reported: Relative risk ratio (95% confidence interval) *p<0.01 Maximally adjusted model: Large decrease / Small decrease / Small increase / Large increase 1.08 (0.77,1.50) / 0.47 (0.28, 0.81)* / 0.69 (0.38,1.26) / 1.80(1.27,2.55)* <u>Association between exposure to the CGB and public transport mode</u> share Figures reported: Relative risk ratio (95% confidence interval) *p <0.05 *Changes in public transport mode share were as follows: Decrease, no change, increase* Unadjusted model: Decrease / Increase 0.82 (0.68, 0.99)* / 0.94 (0.77, 1.14) Maximally adjusted model: Decrease / Increase 0.91 (0.66, 1.24) / 1.26 (0.92, 1.72) Sub group analysis: - Having a bicycle or higher self-rated physical health reduced the likelihood of a decrease in public transport mode share (RRR 0.45 (95% CI 0.21, 0.98), p<0.05; and RRR 0.95 (95% CI 0.90, 0.99), p<0.05 respectively). - Living in villages or smaller settlements rather than urban areas predicted an increase in public transport mode share (RRR 2.53 (1.06, 6.05), pp<0.05)	**Limitations identified by the author** Large loss to follow up: (59%) Self-report measure of PA are subject to large measurement error Women and graduates were over-represented in a sample of mostly healthy commuters compared to local resident population Sample reported higher levels of PA compared to respondents of East England in the 2008 Health Survey. However authors state this may be due to differences in PA measurement. It was not possible to compare with control group due to the nature of the natural experiment. Exposure was based solely on the participants' home addresses and did not account for workplace location or the commute route. For Heinen et al 2015: There was a relatively low proportion of public transport trips made by the sample at baseline and a shift from conventional bus use to the

Panter et al 2016: To test the effect of the "Cambridgeshire Guided Busway" (CGB) on time spent walking and cycling on the commute and overall levels of physical activity.

Length of follow up

3 years between baseline survey and follow-up.

Baseline survey in May and Oct 2009, CGB opened in Aug 2011, follow-up survey in 2012 (no month given)

Source of funding
Developed and initially funded by Centre for Diet and Activity Research (CEDAR). Also by the British Heart Foundation, Economic and Social Research

at work, 30.7% had paid car parking, 36.9% had free parking at work.

Panter 2016:
At baseline (n=1,143), participants were aged between 20-71 years (mean = 42.3, SD = 11.4), 67% female, 33% male, 75% had degree level education, and 88% had at least one car in the household.

There was a large loss to follow up (approx. 59% loss). Those who provided follow-up data were more likely to be older (mean age = 44.3 vs 40.9, p=0.001), and more likely to own their own home (78.2% vs 69.2%, p=0.001) than those who did not.

Inclusion criteria
Adults aged 16 or over who work in areas of Cambridge served by the CGB

- No evidence of differential effects on active commuting was found for any of tested population subgroups or on overall PA p>0.1

Panter et al 2016
Average time spent in active commuting (minutes in previous 7 days)

Activity	% (n) reporting any activity at baseline	Time spent in activity (min/week) Median (IQR)		
		Baseline	**Follow-up***	**P-value**
Active commuting	77.6 (364)	120 (33-200)	100 (0-170)	0.001
Walking	27.8 (131)	0 (0-20)	0 (0,25)	0.487
Cycling	56.6 (266)	70 (0-150)	40 (0,150)	0.016
Recreation	83.3 (391)	75 (28-150)	79 (30,180)	0.640
Walking	78.0 (366)	57 (15-135)	60 (0,150)	0.551
Cycling	32.6 (153)	0 (0-22.5)	0 (0,19)	0.416
Total	95.7 (449)	207 (120-332)	200 (110,340)	0.261
Walking	83.2 (390)	75 (30-203)	100 (30,180)	0.630
Cycling	65.0 (305)	90 (0-180)	73 (0,169)	0.064
Total recreational PA	99.3 (466)	282 (150-532)	279 (146,480)	0.282
Total PA	100 (469)	423 (232-675)	407 (240,631)	0.117

IQR, interquartile range; p for differences between baseline and follow-up using a Wilcoxon signed-rank test
*follow-up period could be between 6-18 months post-intervention – exact time not reported

Association between exposure to intervention (measured as proximity of participants' residence to the CGB) and PA

Outcome	n	Change in min/week, M (SD)¥	RRR (95% CI)
Active commuting	454		
No change	122	0 (0)	
Increase	136	80.7 (70.9)	1.14 (0.90, 1.46)
Decrease	196	-81.8 (69.0)	1.07 (0.83, 1.37)
Walking on commute	456		
No change	297	0 (0)	
Increase	76	73.4 (66.6)	0.90 (0.69, 1.18)
Decrease	83	-84.7 (70.8)	1.13 (0.83, 1.55)
Cycling on the commute	468		
No change	214	0 (0)	
Increase	108	86.6 (74.0)	1.34 (1.03, 1.76)*
Decrease	146	-85.9 (67.6)	1.00 (0.73, 1.37)

guided bus way would not have been captured. This may be reflected in the findings of no significant effect on overall public transport mode share.

Limitations identified by the review team

In Panter et al 2016, authors report on car ownership, but not bike ownership – which could be an important factor in whether people cycle.

A cycling culture is already well-established in Cambridge, so generalisability of findings to other cities may be difficult.

Authors do not comment on background trends in cycling popularity and how this could have had an impact on results.

Length of follow-up period post-intervention is unclear due to delay in CGB opening.

Other comments

Other outcomes: Heinen et al 2015: In addition to changes in commute mode share(active travel mode share and public transport mode share), the study also reported changes in number of trips made entirely by car, changes in number of commute trips and changes in commute

Council, Medical Research Council, NIHR and the Wellcome Trust, under the auspices of the UK Clinical Research Collaboration, Now funded by the NIHR Public Health Research programme.	and live within a radius of approximately 30km of the city centre but not within the same immediate area of the city as their workplace. **Exclusion criteria** <u>Heinen</u>: Respondents who returned a blank 7 day travel diary in either the pre-intervention or post intervention wave of the survey (n=28) or who accounted for less than 3 days of the week (n=2). <u>Panter</u>: Participants currently taking part in another experiment that involves measuring their PA or if they live in on-site staff accommodation associated with their workplace.		*p<0.05; **p<0.001 ¥follow-up period could be between 6-18 months post-intervention – exact time not reported RRR: adjusted relative risk ratios (RRR) and 95% confidence intervals for a change in weekly duration of the outcome per unit of proximity to busway (calculated by square root of distance) Results shown are from the model which adjusted for age, sex, education, car ownership, home ownership, children in the household, health condition, BMI, urban-rural status, distance to work, workplace car parking provision and baseline value of outcome for the model in question, plus any change in home or work location. Note: Two other models were used which provided slightly different results, these are reported in the paper. <u>Total time spent on walking and cycling for commuting and recreation (RPAQ results):</u> no significant effect of the intervention on walking and cycling in combination, but a significant effect on total time spent cycling (RRR = 1.32, 95% CI = 1.04, 1.68, p<0.05). No significant effect of intervention on total time spent in either recreational or overall PA was found. <u>Subgroup analysis – baseline active commuting</u> The effect of the intervention on active commuting was moderated by baseline active commuting levels (p=0.02 for interaction). There was a significant effect on total active commuting only for those who reported the lowest levels of active commuting at baseline (RRR = 1.76, 95% CI = 1.16, 2.67). **Analysis** <u>Heinen et al 2015:</u> Commute mode share was calculated from a 7 day travel diary kept by participants in both waves of the survey (pre- and post -intervention). Diaries recorded: day of the week; hours of work; mode of travel to and from work; and whether they did not go to work on a specific day. An objective measure of exposure to the intervention was derived for each individual, based on the proximity of their home postcode at baseline to the nearest bus stop or access point to the pathway. Changes in mode share were grouped into 5 categories. Changes in public transit share grouped into 3 categories (see above). Effect of CGB on mode share was tested with multivariable multinomial logistic regression models, progressively adjusted as follows: (1) unadjusted, (2) adjusted for commute characteristics, (3) adjusted for commute and sociodemographic characteristics, and (4) maximally adjusted for commute, sociodemographic and spatial characteristics. Age and gender were always included, and other explanatory variables associated with the outcome at p < 0.25 in unadjusted models were included in the adjusted models [32]. Interaction	distance. These are not reported here as these outcomes are not included in the protocol for this review. For Heinen et al 2015: In addition sensitivity analyses were carried out on the maximally adjusted models including: baseline outcomes as a continuous dependent variable; workplace parking and car ownership; participants who did not move home between baseline and follow up; and participants who had completed travel diaries ‘perfectly’. However these did not indicate any difference in findings to the main results. In the study protocol published elsewhere, authors refer to ‘control’ and ‘intervention’ groups. An *a priori* ‘control’ area is defined as ‘areas with similar socioeconomic and spatial characteristics to those of the urban parts of the ‘intervention area’ but with no direct access to the CGB’. However, they also allow for a *post hoc* categorisation of exposure to intervention, which involves including distance as a covariate. The power calculation is based on the *a priori* groupings described above. Power calculation: 394 needed in each group at follow-up (788 in total), which gives 80% power to

			effects were included only if significant at $p < 0.05$. None of the interaction effects met that condition. <u>Panter et al 2016:</u> Participants received a baseline postal questionnaire (devised by the authors) and follow up data was collected with another survey after the busway was opened. In each survey, participants reported all travel modes used on the commute in the previous 7 days as well as amount of time spent in each mode. Participants also completed the Recent Physical Activity Questionnaire (RPAQ) to give measures of total weekly time spent: walking and cycling for recreation, in recreational moderate-to-vigorous PA, and in overall physical activity. Initial analysis tested for differences between the sample with valid outcome data at baseline and follow up vs the remainder of baseline used t-test, chi-squared, and signed-rank test. Only data from those who took part in baseline and follow-up were included in the main analysis. For the purposes of the multivariable multinomial logistic regression model, primary outcome of PA change over time was categorised as 'no change', 'increase' and 'decrease'. This was used to assess the relationships between exposure to the intervention and outcomes.	detect standardised mean difference between intervention and control of 0.2 using a 2 sample t-test (α=0.05). See comments above regarding study group.

30 **Sharaby and Shiftan 2012**

Study details	Population	Intervention/comparator	Results	Notes
Full citation Sharaby and Shiftan, 2012 **Quality score** - **Study type** Longitudinal cohort study (authors call study an impact analysis) **Location and setting** Israel – Haifa **Study aims** To evaluate the impact of fare integration on travel behaviour and transit ridership. **Length of follow up** Baseline 1 survey was held 6 years before intervention.	**Number of participants**: N = 14,341 **Participant characteristics:** 3% of participants were 14 or younger, 16% were 15-18, 57% were 19-44, 17% were 45-64, and 7% were 65+. 38% of participants were students, 40% were employees, 5% were not working, 8% were retired, and 9% were soldiers. This information describes only the 2008 population. No gender information was given. **Inclusion criteria** Must be a passenger on a form of public transport in Haifa. No other criteria given. **Exclusion criteria**	**Intervention:** Integration of public transport fares in January 2008 as part of major public transport reforms in Israel. The old fare system was pay-per-boarding, charging for transfers. Fare systems were complicated. New fares are zone based, origin-destination, and time-based. I.e. fares remain the same regardless of number of transfers made between buses within the time for which the fare is active. This reduced fares for many passengers, particularly those travelling to / from rural areas where necessary transfers previously meant increased costs. **Comparator:** No comparison group	**Intervention: (I)** Public transport fare integration in the city of Haifa **Control: (C)** No comparison group **Outcomes** Findings below based on self-reported information from surveys. <u>Daily Passenger Boarding (brackets are number of people per day)</u> This increased by 19% between baseline 2 (3 years before intervention) (213,400) and 11 month follow-up (253,200); and by 7% [calculated by research team] between Baseline 1 (6 years before intervention) (236,100) and 11 month follow-up. No other statistics provided. <u>Daily Passenger Trips (brackets are number of trips per day)</u> This increased by 9% between baseline 2 (3 years before intervention) (155,000) and 11 month follow-up (167,000); but decreased by 9% [calculated by research team] between Baseline 1 (6 years before intervention) (182,700) and 11 month follow-up . <u>Average Boarding Per Trip</u> This increased by 10% between baseline 2(1.38) and 11 month follow-up (1.52); and by 18% [calculated by research team] between baseline 1 (1.29) and 11 month follow-up. The authors reported that during the study period there was no growth in population size, suggesting the results are not an artefact of an increasing population size. The authors state that the new policy managed to negate the downward trend in transit ridership (comparing baseline 1 and 2). **Analysis** <u>Survey</u> On board surveys of passengers were undertaken 11 months after the	**Limitations identified by the author:** Self-reported boarding per trip was slightly higher than on-board counts, possibly owing to sampling bias (sample biased towards passengers benefiting more form reform) or response bias. However, difference is small. Long-term impacts of this reform have not been captured in this study – more research is required. **Limitations identified by the review team** We cannot be certain that the same people are taking part in each survey. No demographic data is given for the two earlier studies. **Other comments** 23% of those surveyed stated that without the reform, their current bus journey would have been a bus/walk mix.4% would have travelled entirely by walking. Therefore fare integration could be seen to be reducing opportunities for walking in passengers.

Baseline 2 survey was held 3 years before intervention. Follow-up survey took place 11 months after intervention. 6 years 11 months between Baseline 1 and follow-up. **Source of funding** Not specified	Non-passengers excluded. None other given.		reform launch in December 2008. Passengers using public bus transport in Haifa were targeted. 17% of weekday trips and 14% of weekend trips were sampled: it is assumed that this takes place over one week. Responses were compared with previous surveys in 2002 and 2005. The survey used self-reporting questionnaires to collect socio-economic data; trip details; number of transfers; trip frequency, change in bus usage as a result of the reform and alternative transport that would have been used if reform had not taken place. Passenger counts by fare and ticket type were also collected as part of this survey.	Other outcomes: Data was also collected on people's opinions of whether they would be riding the transit if the intervention had not taken place – this was then combined in a multinomial model. The results of this model can be found in the paper but are not reported in detail here as not a comparison with baseline. To summarise, authors state that results suggest fares most likely to shift people from car or taxi to bus and least likely to shift to bus from walking and this was strongest for commuter trips. As well as survey data, ticket sales were also recorded but not extracted for the purposes of this review as no baseline data reported. To summarise, paper reports tickets sales increased around 7-8% over the first year following launch of reforms. No power reported.

32 Transport for London 2008

Study details	Population	Intervention/ comparator	Results	Notes
Reference Transport for London, 2008 **Quality score** + **Study type** Longitudinal uncontrolled before and after study **Location** UK - London **Study aims** To describe the impact of congestion charging in and around central London, particularly the extension of the congestion charge zone. **Length of follow up**	**Number of participants** Not stated. However, an indication is given by the recording of around 253,000 vehicles (cars and minicabs, vans, lorries, taxis, buses and coaches, powered two-wheelers and pedal cycles) entering the western extension zone during charging hours (average of counts taken in 2006) **Participant characteristics** See below **Inclusion criteria** Participants measured at vehicle level, not individual level for vehicle counts. Those beginning or ending a journey	**Intervention** On 19 Feb 2007, the congestion zone, which charged as tax £8 per day, was extended to include some of West London. Charging hours are 07:00 – 18:00 on working weekdays. A “free passage” route passes through the charge zone, along the boundary between central and western charging zones, and is free to vehicles with origin and destination outside the charging zone. Various data collection methods were used. Automatic plate recognition is used for charging purposes. Free passage vehicle population was calculated from	**Intervention:** Extension of congestion charge zone from central London into western London **Control:** No control **Outcomes** **Vehicles** <u>Vehicle Population on the free passage route (percentage change between baseline (2005-2006) and follow-up (2007) figures). Absolute numbers in 000s.</u> As with the original central London scheme there have been some differential effects on traffic composition, with substantial reductions to potentially chargeable vehicles (cars, vans and lorries) being partly offset by increases to non chargeable vehicles (taxis, buses and two-wheeled vehicles). Chargeable: Cars and minicabs decreased by 3% (120 to 116). However, vans and lorries increased by 9% and 5% respectively (44 to 48, and 13 to 13). Non Chargeable: Licensed taxis increased by 9% (42/year population to 46/year population), buses and coaches by 5% (18 to 19), powered two-wheelers by 12% (11 to 13) and pedal cycles by 18% (6 to 7). This reportedly brings overall numbers of vehicles back to 2005 levels after a dip in 2006. No information given on whether these changes are statistically significant. <u>Traffic make-up in vehicle-kilometres driven (% of total) within western extension zone during charging hours</u> Cars (chargeable): baseline = 60%, 1 year follow-up = 54% (↓6%) Vans (chargeable): baseline = 13%, 1 year follow-up = 15% (↑2%) Lorries and others (chargeable): baseline = 3%, 1 year follow-up = 4% (↑1%) Licensed taxis (non-chargeable): baseline = 11%, 1 year follow-up = 13% (↑2%) Buses and coaches (non-chargeable): baseline = 3%, 1 year follow-up = 4% (↑1%) Powered two-wheelers (non-chargeable): baseline = 5%, 1 year follow-up = 6% (↑1%) Pedal cycles (non-chargeable): baseline = 5%, 1 year follow-up = 6% (↑1%) Total chargeable: 76% to 72% (↓4%) Total non-chargeable: 24% to 28% (↑4%) **Public transport Passengers** <u>Bus patronage changes between baseline and 1-year follow-up</u> Bus passengers entering the charging zone increased by 6% (96,500/day to 102,000 /day) in charging hours, and 9% during morning peak period (34,100 to 37,200) (07:00-10:00). Increases for exiting the charging zone were 5% (90,100 to 94,200) and 2% (24,300 to 24,900) for charging hours and peak hours respectively. Percentages and absolute figures are slightly mismatched, likely to do with rounding of absolute figures.	**Limitations identified by the author** National Rail passenger counts are vulnerable to on the day events affecting rail networks. Household survey results rely on recall and have small sample sizes. **Limitations identified by the review team** Increased bus users could be a result of increased capacity in advance of the changes, rather than as a result of the intervention itself (extended charging zone). Other changes/existing trends occurring in London could impact on outcomes, such as an existing trend of increasing use of underground. It is not possible to detect car sharing arrangements from vehicle counts.

<table>
<tr>
<td>1 year.
Baseline data collected for the two years preceding the intervention (2005 and 2006)
Intervention launched in Feb 2007. Monitoring conducted through 2007.

Source of funding

Transport for London</td>
<td>within the western extended area of the congestion charge zone, or undertaking part of their journey within the zone.

Exclusion criteria

Pedestrians

Those beginning and ending journeys without entering either the western extension or central London charge zone, or using the free passage route in between zones.</td>
<td>counts taken at 14 sites covering all major links. Bus patronage is calculated from one-day bus counts – frequency not reported.

Comparator

No comparator</td>
<td>Bus network capacity was increased by around 17% prior to the change, to accommodate for predicted increased use. However, bus performance indicators (reliability, bus kilometres lost due to traffic delays) show no overall benefit to bus passengers as a result of the intervention.

<u>National Rail patronage changes</u>
The two main stations within the extension zone, passenger flows (in 000s):
<table>
<tr><td>Victoria</td><td>2002</td><td>2003</td><td>2006</td><td>2007</td></tr>
<tr><td>Inbound (7AM-10AM)</td><td>52</td><td>58</td><td>50</td><td>60</td></tr>
<tr><td>Outbound (6AM-8PM)</td><td>97</td><td>88</td><td>103</td><td>91</td></tr>
</table>
<table>
<tr><td>Victoria</td><td>2002</td><td>2003</td><td>2006</td><td>2007</td></tr>
<tr><td>Inbound (7AM-10AM)</td><td>20</td><td>18</td><td>21</td><td>25</td></tr>
<tr><td>Outbound (6AM-8PM)</td><td>53</td><td>46</td><td>49</td><td>52</td></tr>
</table>
<u>Traffic Collisions</u>
Reported collisions involving personal injury in Western extension zone: Mar-Dec, 2006 and 2007:
<table>
<tr><td></td><td>Weekdays 7AM-6PM</td><td>Weekdays (midnight-7AM; 6PM-midnight</td><td>Weekends all day</td></tr>
<tr><td>2006</td><td>337</td><td>187</td><td>150</td></tr>
<tr><td>2007</td><td>339</td><td>159</td><td>161</td></tr>
</table>
Main change seen in weekday night hours (reduction of 28). Authors state these are preliminary results to be treated with caution.

<u>Household behaviour survey (response number not recorded)</u>
Around half of residents outside the new charging area would not continue to drive to the extension zone in order to avoid the charge. Of these, about 40% are estimated to have changed travel mode, and 30% would not make the trip at all.

Analysis
Vehicles automatically identified using number plate recognition cameras, checked against a database
Vehicle Population on free passage route: Counts taken on 14 sites covering all major links on the free passage routes 4 times per year. Percentage change figures are based on an average of spring and autumn counts (“neutral period”). Counts appear to be rounded to nearest thousand.
Bus patronage: One-day western extension bus counts.
National rail patronage: TfL undertook one day passenger counts in Spring 2006 and Spring 2007 at all rail stations in or on the boundary of the extension zone.</td>
<td>Other comments

Other outcomes: Study also reports on social impacts of the intervention; bus network speeds; bus network reliability.

Residents of the extended charging zone received a 90% discount on the charge

Various roads were measured – reported here are those judged to be most affected by the extension change during the period of study (free passage route and within western extension).

It was not possible to reliably measure the impact of the intervention on traffic collision data due to consistency issues with available time-series.</td>
</tr>
</table>

Review 2

Ciclovia

D'Haese et al 2015

Study details	Population	Intervention/ comparator	Results	Notes
Reference D'Haese et al., 2015 **Quality score** + **Study type** Controlled before and after study (authors call this a non-equivalent control group pre-test and post-test design) **Location** Belgium - Ghent **Study aims** To test the effectiveness of *Play Streets* – set periods where neighbourhoods become traffic-free during school holidays – for increasing children's moderate- to vigorous-intensity physical activity (MVPA) and for decreasing their sedentary time.	**Number of participants** N = 126 Intervention = 54 Control = 72 **Participant characteristics** It is not stated whether differences between groups were significant. Intervention: 59.3% male, 40.7% female. Mean family socioeconomic status (SES) low for 38.9% Mean age was 8.7 ± 2.2 years. Control: 51.4% male, 48.6% female. 36.1% Mean family SES was low for 36.1%. Mean age was 9.3 ± 2.0 years. **Inclusion criteria**	**Intervention** 19 Play Streets: an event where within a neighbourhood, motorised traffic is prohibited and children are permitted and encouraged to play in the street. The 19 Play Streets selected lasted at least 7 consecutive days. Play streets take place at times between 14:00 and 19:00. Children in the intervention wore accelerometers for 8 consecutive days (authors state "half a week" during a normal week [baseline], and "half a week" during a Play Street week [follow-up]). Children on half of the intervention streets underwent the intervention for the first half of the time period, followed by normal conditions for the second half. The other half of the children were measured under normal conditions for the first half, and intervention conditions for the second half of the 8 days. Numbers of streets included in each half not given by authors.	**Intervention:** 19 Play Streets neighbourhoods **Control:** Matched control neighbourhoods with no Play Streets **Outcomes** Intervention: 80.5% of children in intervention used the Play Street during the intervention. <u>Sedentary Time differences between baseline and follow-up, measured between 14:00 and 19:00. Mean daily minutes (Standard Deviation)</u> Control: baseline = 156.49 (41.69), follow-up = 164.61 (40.10) Intervention: baseline = 146.30 (38.36), follow-up = 137.74 (35.43) X^2 = 3.896 The intervention group had significantly greater reduction in sedentary time than the control group between baseline and follow-up (p = 0.048). <u>Moderate and Vigorous Physical Activity (MVPA) differences between baseline and follow-up, measured between 14:00 and 19:00 Minutes (Standard Deviation)</u> Control: baseline = 26.91 (16.92), follow-up = 24.32 (13.47) Intervention: baseline = 26.70 (13.51), follow-up = 35.79 (24.93) X^2 = 3.626 The intervention group showed a significantly greater increase in MVPA than the control group between baseline and follow-up (p = 0.057). These changes remained significant when measured over the whole day (sedentary p = 0.012; MVPA p = 0.010) This was tested to ensure that intervention groups were not compensating for changes over the rest of the day (results are significant at ≤0.1. "Higher significance levels are used for interaction terms as they have less power").	**Limitations identified by the author** Previous literature indicates differences in compensatory action between boys and girls – no gender specific analysis was conducted here. Small sample size limited subgroup investigation. Power not reported. Short measurement period Only one valid day was required for inclusion of a child (this was done to retain sufficient power in analysis). **Limitations identified by the review team** Play Streets are a self-selected group, which applies for the intervention. They could therefore be systematically different. This study controls for SES but in a simplified way (either high or low: high if one

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up Data collection lasted 8 consecutive days during which both baseline measures (normal conditions) and follow-up measures were collected. **Source of funding** Research Foundation Flanders (FWO). Faculty of medicine and health Sciences, Department of Movement and Sports Sciences, Ghent University. Department of Public Health, Ghent University.	Children were recruited if they were in primary school, including those who were starting primary school after the summer school vacation or had finished school that year (aged 6-12). Children must be living at home during the one-week measurement period. Streets are eligible to become Play Streets in Ghent if they are: residential; have a maximum speed limit of 50km/hr; have no significant passing traffic; and the surrounding streets remain accessible whilst Play Street is running. **Exclusion criteria** Children on holiday or away for part or all of the study time. Children outside of the specified age range.	**Comparator** For each included Play Street, a control neighbourhood with comparable walkability characteristics and annual household income (National Institute of Statistics, Belgium 2008) in Belgium was selected. Children from these neighbourhoods formed the comparator group. Each control street was measured at the same time as its respective intervention street. **Parental questionnaire** Parents completed a demographic questionnaire before baseline, and a questionnaire about Play Streets after follow-up. Questionnaire 2 was different for control group.	In intervention children, MVPA during intervention period contributed more to entire day Physical Activity (53.4%) than during normal period (48.6%). No significance stated. **Analysis** All 19 intervention neighbourhoods were grouped to give intervention scores. All control neighbourhoods were grouped to give control scores. Study controlled for age, sex, family SES; average temperature, average rainfall, number of valid days and valid wear time. <u>Analysis Methods:</u> Only children with at least one day were included in the analysis. One day is defined as having 8 hours accelerometer wearing time Four-level (neighbourhood – household – child – time of measurement (no intervention or during intervention)) linear regression analyses with random intercept and fixed slopes were conducted to investigate intervention effects. Iterative Generalised Least Squares (IGLS) estimation method was used to conduct multilevel regression analyses. Analysis was conducted firstly for activity between 14:00 and 19:00, and then secondly for the entire day to see whether changes caused by the intervention were compensated for throughout the rest of the day.	parent or more went to university). 25% drop-out is not explained (although similar rates from each group). **Other comments** Other outcomes: no other outcomes were reported in the study. Baseline measures are taken outside of Play Street time. Follow-up measures are taken while Play Streets are taking place. Statistical significance ≤0.1. Power not reported.

Montes et al 2011

Study details	Inclusion / exclusion criteria	Population	Intervention / comparison	Method of analysis	Results	Notes
Full citation Montes et al 2011 **Quality score** - **Study type** Cost benefit analysis **Aim of the study** To calculate the cost-benefit ratios of physical activity of the Ciclovia programs of Guadalajara in Mexico and San Francisco in the USA. **Location and setting** Mexico, USA (and Colombia – not included in this extraction as non-OECD) **Source of funding**	**Inclusion criteria** Ciclovia events in the four specified locations. Ratios are conducted using data from adults only. **Exclusion criteria** Ciclovia events in other locations. Children participating in included events.	**Number of participants** Total participants were estimated from "different local surveys". Adult users were calculated as a proportion of these. The proportion used was not explained – likely to have been extrapolated from surveys. <u>Guadalajara</u>: Total participants per event: 140,000 Total adult participants per event: 51,761 <u>San Francisco</u>: Total participants per event: 25,000 Total adult participants per event: 15,000	**Intervention** Ciclovia programs. Events where streets are closed to motorised traffic for the purpose of increasing physical activity. San Francisco: Sunday Streets. Began in 2008. 2 events in 2008, 6 in 2009, 9 in 2010. Six sections of road are closed, varying in length from 7.3km to 9.7km. Guadalajara: Via RecreActiva. Began in 2004. By 2009 ran 52 events/year on every Sunday. Same 25km circuit. [Note - 2 locations in Colombia (non	<u>Counts</u>: Estimation of numbers of users obtained from different local surveys: Guadalajara conducted regular counts during every event in 2009. Sal Francisco took three counts in 2010, from which counts in this analysis are based. <u>Direct Health Benefit (DHB):</u> San Francisco – calculated by estimating the difference in the direct medical cost for active persons and their inactive counterparts in the USA (data was from 1987 so adjusted based on inflation). Guadalajara – medical cost data unavailable. Used alternative adjusted equations. <u>Costs</u>: Operational Costs: data obtained from directors and managers. Fixed (employee salaries, logistical and technical support, truck rental costs etc) and variable (traffic signals, cones, security tape, lane dividers, bags, first aid kits, salary for field employees, equipment). User costs: consist of equipment, weighted by users of that equipment at each location's events. Costs of roads etc. are not included, as they are assumed to be pre-existing. <u>Cost-Benefit Ratio</u>:	<u>Activity Types:</u> Guadalajara: of 51,761 adult participants per event 84% (51,761) were bicyclists, 13% (416) were pedestrians, and 3% (22) were skaters or other. San Francisco: of 15,000 adult participants per event, 46.2% (3,004) were bicyclists, 35.5% (2,308) were pedestrians, and 18.2% (1,185) were skaters or other. <u>Direct Health Benefit (DHB) / person / year:</u> USA = $626.6 Guadalajara = $51.1-$62.7 (based on DHB of 8%-10% of the USA DHB). <u>Sensitivity Analysis</u>: Range was determined by the lower limit value for the DHB being such that the cost-benefit ratio is equal to 1, and the upper limit represents 10% of the DHB of USA. *DHB lower limit to upper limit:* Guadalajara: $51.1-$62.7 San Francisco: $269.4 to $626.6 <u>Guadalajara</u>: Annual Costs: $908,582 Annual cost per capita (user): $6.5 Benefit cost Ratio (BCR): DHB must be $51.1 (8.2% of USA's DHB) to obtain a cost-benefit ratio >1.	**Limitations identified by author** Count methods and number of surveyed days differed between programs. This could result in either under- or overestimation. Prevalence of physically active individuals is self-reported and could be subject to bias. Direct health Benefits were estimated for Mexico, as data was not available. This is not likely to overestimate cost-benefit. Other benefits (outside of DHB) were not assessed, for example indirect benefits accrued from health promotion materials at events, meaning the benefits are likely to have been underestimated. **Limitations identified by review team** Classification of adult participants by activity type does not allow for multiple activity types to be undertaken by each individual. No discounting applied to calculations.

Study details	Inclusion / exclusion criteria	Population	Intervention / comparison	Method of analysis	Results	Notes
Center for Interdisciplinary Studies in Basic and Applied Complexity, CeiBA (Bogotá, Colombia) La Universidad de los Andes in Bogotá Centers for Disease Control and Prevention Pan American Health Organization		**Participant characteristics** Surveys collected information on sex, age, and type / frequency of activities conducted per week. Sex and age information not reported.	OECD) also included, but are outside of the scope of this guideline so are not included here]. **Comparison** No comparison	Equation took into account number of physically active adult pedestrians per event (averaged over year), number of physically active adult bicyclists per event (averaged over year), and number of other physically active adult users per event (averaged over year). Sensitivity analysis: Scenarios were tested to test sensitivity with relation to DHB. The DHB which would be needed for the cost-benefit to be 1 was tested as a lower limit. Upper limits were valued as DHB representing 10% of USA DHB (for Guadalajara only, not San Francisco) HEAT (Health Economic Assessment Tool) estimates benefit based on mortality prevention per bicycling. It is separate from the overall cost-benefit analysis.	According to the HEAT model, the mean annual benefit for mortality prevention ranged from $664,727 to $10,146,740. Benefit cost ratio: 1.02-1.23 San Francisco: Annual Costs: $1,763,368 Annual cost per capita (user): $70.5. Benefit cost Ratio: 2.32 ($2.32 saved in direct medical costs for every $1 invested in the program if the program occurs regularly every week). DHB must be more than $269.4 to achieve a benefit cost ratio over 1. More than 11,200 users must take part for the benefit cost ratio to be greater than 1. According to the HEAT model, the mean annual benefit for mortality prevention ranged from $5,107,159 to $5,837,363.	Not clear from what sources estimates of costs are derived. **Other comments** Other outcomes: no other outcomes reported in study. All $ are US$. San Francisco events are assumed to take place once per week, 52 times per year in order to calculate cost-benefit ratios. Actual event frequency has varied between 2 and 9 events per year. No incremental approach was taken because data on adjusted supply prices and opportunity costs of public expenditure were not available. Analysis for 2 events in Colombia are excluded (not OECD so out of scope of guideline). For Medellin, the benefit cost ratio was 1.83. For Bogota, the ratio ranged from 3.23 to 4.26 (due to range of adult users at events).

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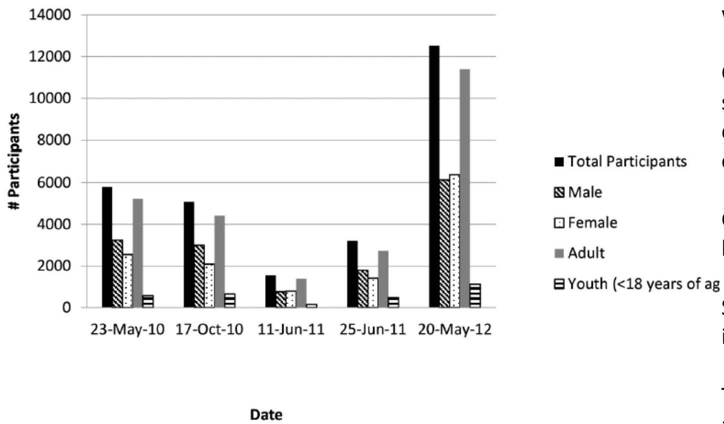
42 **Torres et al 2016**

Study details	Population	Intervention/ comparator	Results	Notes
Reference Torres et al 2016 **Quality score** - **Study type** Repeated cross sectional observational study **Location** USA - Atlanta **Study aims** To better understand the influence of Atlanta Streets Alive (ASA) events on physical activity levels and perceptions of safety through evaluating the first five ASA events. Perceptions of neighbourhoo	**Number of participants** Survey: 627 respondents, 589 complete responses. Count: Actual count not given – sample count data used to estimate overall participation. **Participant characteristics** Survey: Mean age – 34 years. White 60.4%, Black 20.5%, Latino 5.4%. 75% had bachelors degree or above. 63% had annual income of ≥$45,000 per year. Atlanta Streets Alive (ASA) 5 participants were more likely to have higher educational attainment (bachelor's degree or above: ASA5 81.4%, ASA2: 70.9%, ASA1: 72.9%), to have a higher income (≥$45,000/year: ASA5 64.4%, the others not reported), to be white (ASA5 75.1%, ASA2: 56.1%, ASA1: 56.6%)to have walked or cycled to the event (as opposed to car or tram system) (ASA5: 66.8%, ASA2: 46.5%, ASA1: 39.8%). Statistical significance not given for these figures, but all differences remained statistically significant when	**Intervention** Atlanta Streets Alive (ASA) events. Sections of city streets are closed to vehicular traffic in order to encourage people to engage in PA. The first five of these events to be carried out in Atlanta are analysed in this study. **ASA1**: 23/5/10. Edgewood Ave. 1.5 miles. 13:00-18:00. Counts and survey. **ASA2**: 17/10/10. Edgewood Ave. 1.5 miles. 13:00-18:00. Counts and survey. **ASA3**: 11/06/11. Edgewood Ave, Auburn Ave. 2 miles. 10:00-14:00. Counts only . **ASA4**: 25/06/11. Edgewood Ave, Auburn Ave. 2 miles. 16:00-20:00. Counts only. **ASA5**: 20/05/12. Highland Ave. 2 miles. 14:00-18:00. Counts and survey. **Comparator** No comparator	**Intervention:** Five Atlanta Streets Alive (ASA) traffic-free events **Control:** No control **Outcomes** [To note - surveys only conducted at ASA1, 2, and 5. ASA3 and 4 have counts only]. Transport to event (self-reported) Use of Metropolitan Atlanta Rapid Transit Authority (MARTA) was significantly higher on ASA 1 and 2 (almost 19% at each event – more specific information not given) compared with ASA 5 (1.3%). Significance not reported. Below table shows all 5 ASAs: no further descriptive statistics given.  Participants meeting recommended PA (150 minutes) during ASA event (self-reported) 23.3% of survey respondents met the PA recommendation of doing 150 minutes or more of moderate to vigorous physical activity, during the ASA event. 20.0% met the recommendation in ASA2, and 16.4% in ASA5. The average over the three events was 19.4%	**Limitations identified by the author** More research needed to understand whether events reach physically inactive people. Limited scheduling and short routes mean events can be said to have potential health impacts rather than certain health impacts. Counts and surveys were conducted by volunteers, some with limited training. Counting method not validated for shorter routes – likelihood of double-counting / overestimation of participation is increased. Convenience sampling of surveys limits generalisability of findings. Self-reporting estimates relied on in surveys. This study is descriptive so cannot assess associations. "future studies should address these limitations and move beyond cross-sectional evaluation to pre-and post-assessments"[Reviewers note: we have kept this study is as repeat cross sectional surveys over time, though not possible to calculate change between events]

Study details	Population	Intervention/ comparator	Results	Notes
d social capital were also investigated but this is outside the scope. **Length of follow up** Two years between first and fifth (final) ASA event. Data collection taken at each event. **Source of funding** School of Public Health, Georgia State University. Atlanta Bicycle Coalition, Atlanta, GA.	ASA1 and ASA2 were combined and compared with ASA5. Count: Actual numbers not given – numbers shown here are for "estimated overall participation", derived from counts. Estimated participation is 28,143 across all 5 events. Of those participants observed at events, distribution of men and women were consistent, majority adult participants (youth accounted for between 9% and 15%) **Inclusion criteria** Individuals participating in ASA events. Age range not specified. **Exclusion criteria** None specified	**Data Collection** Counts were carried out by eight trained observers at each event, split between two spots. Counts recorded number of participants, type of activity performed, apparent gender, and approximate age. Counts were taken in first 15 mins of each hour, for four hours. Count was used to estimate total participation using pre-defined formulas. Surveys contained 22 questions covering physical activity, transport mode to the event, location of residence, characteristics of participation, demographics (and other questions which are not relevant to the content of this guideline and so are not recorded here). Participants were classed as either meeting / not meeting recommended PA (150 mins for whole week) at the event.	<u>Survey respondents' total minutes spent performing PA at ASA event: minutes (standard deviation) (self-reported)</u> ASA1: 109 (55) ASA2: 97 (66) ASA5: 95 (55) Statistical significance can't be calculated as these are separate events in separate locations and no change is measured. Thirty-four percent of respondents in ASA 1, 49.6% in ASA 2, and 54.4% in ASA 5 indicated they would be engaged in a sedentary state at home—indoors, watching TV, or on the computer—if they were not participating at the ASA event ($\chi 2 = 19.84$, $P = .001$). Study does not state whether this was an open or closed question. **Analysis** Data analysis included participant counts (at all five events) and a participant survey (at the first, second, and fifth event) (see below). Pearson X^2 and *F* tests were used to compare demographics among 3 events surveyed.	**Limitations identified by the review team** Differences between ASA 1 and 2, and ASA 5 could be due to location. ASA 1 and 2 were held at the same location; ASA 5 was held elsewhere. Statistically significant differences in participants could confound effects seen. ASA 2 was conducted in October whereas the remainder of the events were conducted in May/June. Weather differences could be responsible for some observed differences. **Other comments** Other outcomes: study also reported on perceptions of neighbourhood social capital which has not been extracted here. Not panel data – no guarantee participants are the same across events. Statistical significance: $p \leq 0.05$ Power not reported

Safe Routes to School

Hoelscher et al 2016

Study details	Population	Intervention/ comparator	Results	Notes
Reference Hoelscher et al 2016 **Quality score** - **Study type** Controlled before and after study **Location** USA – Texas (multiple) **Study aims** The goals of this study were to determine the effects of differing Safe Routes to School funding allocation methods (infrastructure vs. non-infrastructure) on student Active Commuting to School (ACS), student physical activity and psychosocial antecedents, and parent ACS-related	**Number of participants** Surveys were collected from 78 schools at baseline and 73 schools at follow-up (drop-outs 4 from comparison, 1 from non-infrastructure, 0 from infrastructure). At baseline: Infrastructure schools n = 23 Non-infrastructure schools n = 21 Matched comparison schools = 34 **Participant characteristics** Statistical significance of difference between groups at baseline not supplied. Infrastructure: 46.2% female, 53.8% male. 19.8% White, 6.6% Black or African American, 70% Latino or Hispanic.	**Intervention** The study was quasi-experimental using a repeated cross-sectional sample, with three conditions: (a) schools with awarded infrastructure (I) projects, (b) schools with awarded non-infrastructure (NI) projects, and (c) control schools (C). Non-infrastructure projects were funded for development of a local SRTS plan or local implementation efforts which were behavioural in nature. Infrastructure projects were awarded grants for engineering projects (e.g. improving pavements or crossings). Elementary (equivalent to primary) schools that received funding awards were randomly selected based on funding type, location (urban/rural across Texas), race/ethnicity, and socioeconomic status (SES). **Comparator** Comparison schools were matched demographically and regionally to infrastructure and non-infrastructure schools but received no SRTS funding. **Data Collection** Within schools, fourth-grade students and their parents were recruited to obtain at least 50 students/school.	**Outcomes** The primary outcome for the study was student ACS (reported as changes in the percentage of students engaging in ACS between baseline (2009) and follow up (2012)); secondary outcomes included psychosocial antecedents of ACS, including self-efficacy, perceptions and social support, as well as student physical activity. There were no statistically significant differences between child gender or ethnicity between all participants combined at baseline and all participants combined at follow-up measurement periods (difference between groups not supplied). <u>Changes in % of students engaging in ACS between baseline and follow-up 2012 - Morning</u> Morning percentages of ACS in infrastructure and non-infrastructure schools were statistically significantly higher than in comparison schools across time ($p = .024$, $p = .013$, respectively). Non-infrastructure schools had statistically significantly decreased percent ACS group by time interaction compared with control schools ($p = .014$). Across the three types of schools, no significant overall linear trend was noted for morning percentages of ACS ($p = .746$). Actual figures for results not reported. <u>Changes in % of students engaging in ACS between baseline and follow-up 2012 : Afternoon</u> Afternoon percentages of ACS in non-infrastructure schools decreased statistically significantly more over time compared with control schools ($p = .009$), although overall, non-infrastructure schools had higher (but non-significantly) afternoon ACS compared with control schools ($p = .084$). For afternoon percentages of ACS, there was an overall statistically significantly increasing trend across all types of schools ($p = .015$). Actual figures for results not reported. Results not reported for infrastructure schools <u>Changes in % of students engaging in ACS between baseline and follow-up 2012 : Total day</u>	**Limitations identified by the author** Study limitations included bias in selectivity of the school sample, timing of the measurement period, and measures of implementation of SRTS programs in the schools. Because study schools (infrastructure and non-infrastructure) had to apply for funding, there are likely to be inherent differences in these schools compared with those schools that did not apply, leading to potential biases, which undermines our ability to infer causation.

Study details	Population	Intervention/ comparator	Results	Notes
psychosocial constructs and behaviours. **Length of follow up** 3 years between baseline and follow-up data collection points. No information given on when interventions were implemented within this 3-year timeframe. **Source of funding** Robert Wood Johnson Foundation, with partial funding from the Michael & Susan Dell Foundation to the Michael & Susan Dell Center for Healthy Living, and contributions from The University of Texas School of Public Health, Texas A&M Health Science Center School of Public Health, Texas Health Institute, Live Smart Texas, and the Texas Department of State Health Services.	Non-Infrastructure: 48.9% female, 51.1% male. 28.2% White, 6.8% Black or African American, 62.0% Latino or Hispanic. Comparison: 49.5% female. 50.5% male. 24.8% White, 7.2% Black or African American, 50% Latino or Hispanic. **Inclusion criteria** Non-infrastructure schools had to submit an SRTS plan by 2008, although implementation of the plan was not required. Infrastructure schools were required to have an SRTS plan in place prior to any structural changes and had several years to complete the planned environmental changes. **Exclusion criteria** None reported: assumed to be schools other than elementary.	ACS counts were obtained by student 2-day self-report via survey at baseline (2009), interim (2010, 2011), and follow-up (2012) time periods for before school (morning) and after school (afternoon) commutes. Authors report that questionnaires were adapted from other survey tools with “acceptable psychometric properties”. Data also collected from parents: Parent survey items were adapted from the National SRTS and other surveys which authors report demonstrate validity and reliability. Validity and reliability of the tool used is not given. As part of the survey, children completed a written tally sheet in class which included eight categories for transport to school in the morning and afternoon (walk with an adult, walk without an adult, bike, metro bus, school bus, carpool, car, and other). Student–parent convergent validity for written tallies versus parent report was high, and ranged from 100% for same day records to 92% for 3-day recall. Weather data were obtained from meteorological reports for specific locations and dates of data collection.	Infrastructure schools had marginally higher ($p = .078$) and non-infrastructure schools had statistically significantly higher total day ACS (0.036) compared with control schools. Total day percent ACS in non-infrastructure schools showed a decreased trend over time compared with control schools ($p = .002$). Adverse weather decreased total day ACS ($p = .017$). Actual figures for results not reported. Students from non-infrastructure and comparison schools reported more days with 30 min or more of daily outdoor physical activity at follow-up compared with baseline ($p < .05$). Infrastructure schools change was not significant ($p = 0.162$) At follow-up, comparison school students reported greater perception of parent supported physical activity (7.8 to 8.2 on a 1 to 15 scale where higher is better; p .001) and an increased number of friends who walked or rode bikes to school (1.3 to 1.4 friends; p 0009) compared with baseline. Self-efficacy in comparison schools increased from 25.2 to 26.1 (p 0.010). Students from infrastructure schools also reported an increase in their perception of parent-supported physical activity (7.9 to 8.1; p 0.025) compared with baseline. Authors report that self-efficacy for ACS increased over time for students in the non-infrastructure schools, but report results of a change from 27.7 to 26.6 which is a significant decrease (p 0.026) (scale is a self-efficacy scale – no further information given). **Analysis** Morning and after school ACS count data were averaged to obtain total (day) ACS for each school. Time effects (baseline to follow-up) were tested using dependent samples *t* tests for each school type. Data were further analysed using mixed linear regression and controlled for random and fixed effects, and other independent variables. Growth curve models were fit to represent the repeated measures of percentage of fourth grade students using ACS as a function of time and school type, controlling for weather. Analyses are controlled for % economically disadvantaged, % White, mean precipitation, mean heat, and mean wind speed.	**Limitations identified by the review team** Counts of past 2-day ACS obtained by self-report are subject to bias as a subjective measure. It is unclear whether figures reported are parent-reported or student-reported. Actual figures for results not reported, just P values. **Other comments** Other outcomes: No other outcomes reported in the study. Statistical significance ≤0.05 Power not reported.

48 Muennig et al 2014

Study details	Inclusion / exclusion criteria	Population	Intervention / comparison	Method of analysis	Results	Notes
Full citation Muennig et al 2014 **Quality score** + **Study type** Cost effectiveness study **Aim of the study** To evaluate the cost-effectiveness of a package of roadway modifications in New York City funded under the Safe Routes to School (SRTS) program both for school-aged children, and for all users at all times (the sum of both is societal	**Inclusion criteria** School age children travelling to and from school, or adults using SRTS intersections. Intersections were high risk intersections only (these are the ones targeted by SRTS programme). **Exclusion criteria** Areas outside of New York City (NYC). Children younger than 5. Intersections not targeted by SRTS (including low-risk intersections).	**Number of participants** 40,525 school-aged children (5-19y) using the intersection were included in the analysis. 181,148 adults using the intersection were included. **Participant characteristics** No participant characteristics given.	**Intervention / comparison** Safe Routes to School (SRTS) is a programme which funded transportation departments to build new pavements, bus lanes, and crossings to calm traffic, and improve signage to decrease risk of injury for children. **Data Collection** Injury data from Center for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System. Cost of child's transport to school from US Department of Education (active transport if walking is free).	<u>Costs:</u> Costs assigned to all: SRTS capital costs (whole population, SRTS arm only), change in bussing costs (if child). Costs assigned in the event of injury: Medical costs associated with injury, small risk of death, changes in burial costs. The SRTS and control arms are the same except: the SRTS arm has a reduced risk of injury, reduced costs associated with active transport, and upfront costs associated with SRTS. Lifetime societal costs estimated by multiplying annual costs by a 50-year time horizon and discounted by 3%/year. <u>Injury Risks</u>: Annual probability of pedestrian injury at an SRTS intersection: school-aged children 0.0008, adults using intersection 0.002. Risk ratio of injury at an SRTS intersection (assumed to be compared to status quo): children 0.67, adults using intersection 0.86. Probability of hospitalisation (assumed to be out of those injured): 0.12. Case fatality ratio 0.001. Health Related Quality of Life (HRQL) of injured: 0.95 <u>Cost inputs:</u>	<u>Per User Costs and QALYs:</u> For the first cohort of intersection users, school-aged SRTS users had net societal savings of $224 and an incremental gain of 0.0004 QALYs over their lifetimes (per individual user). For all pedestrians (societal costs), net societal savings per individual were $226 and incremental QALYs gained 0.0008. <u>Total NYC Costs and QALYs</u>: When users of the SRTS intersections over a period of fifty years are considered, total benefit for school-aged SRTS users in New York City is estimated as $220,826,117, with incremental gain of 417	**Limitations identified by author** SRTS funded some education programs (approx. 10% of funding). The effects of these are not included in the analysis. However, the cost is which means cost effectiveness is likely to be underestimated. Estimates exclude social or health benefits associated with increased exercise – this is likely to lead to underestimate effect. Some threats to internal validity (and therefore generalisability) due to data sources not from RCTs **Limitations identified by review team** Costs of the programme are not

cost), compared with status quo. **Location and setting** USA, New York city **Source of funding** National Center for Injury Prevention and Control Centers for Disease Control and Prevention National Institute on Drug Abuse National Institutes of Health Center for Injury Epidemiology and Prevention and Columbia University			Costs associated with death (burial / cremation) from 2009 National Funeral Director's survey. Quality of Life for QALE estimated by two surgeons at Columbia University Medical Center experienced at working with adults who had been in vehicle accidents as children, using EQ5D-5L.	Total programme cost (NYC): 10,298,000. Per capita programme cost (NYC): school-aged children: $254, adults using intersection: $57. Injury cost: if hospitalised $50,832. If not hospitalised $1,170. Cost of death: project year 1: $6,351. At end of life/school-aged children $930. Bus transit (3 years – assumed to be the length of time a child is at any one school): $2,016. <u>Quality-adjusted life expectancy (QALE):</u> Product of cohort's mean health-related quality of life (HRQL) and life expectancy. Injured children (weighted measure of hospitalised and non-hospitalised) were estimated to undergo a change in QALE (from 1.0 to 0.95). One-way sensitivity Analysis: As SRTS was calculated as being cost saving even in annual model, sensitivity analysis only conducted on annual (not lifetime) model. Inputs varied by errors (i.e. standard errors) if known, or estimates otherwise. Analysis varied the probability of injury, bussing costs, risk reduction, HRQL results, and discount rate.	QALYs. For all pedestrians, the net societal savings was $230,047,354, and the incremental QALYs were 2,055. This demonstrates that investing in SRTS saves money, and creates QALYs. <u>Sensitivity Analysis:</u> Authors state that this analysis is robust to all sensitivity analyses using a willingness-to-pay threshold of $100,000 per life year gained (predetermined for this sensitivity analysis only).	broken down so cannot be assessed for quality. Indirect health outcomes from increased exercise not considered. **Other comments** Other outcomes: no other outcomes reported in the study. Benefits are discounted at a rate of 3% per year. Costs all adjusted to 2012 USD. Method of transforming QALE into QALY not outlined. Analysis considers both children (the policy target) and all users (societal benefits) in cost-effectiveness calculations.

50 Orenstein et al 2007 (controlled before and after)

Study details	Population	Intervention/ comparator	Results	Notes
Reference Orenstein et al 2007 **Quality score** - **Study type** Controlled before and after study **Location** USA - California (multiple) **Study aims** To evaluate 125 of the 570 Safe Routes to School (SRTS) projects in California, to evaluate their effectiveness in reducing crashes, injuries, and fatalities involving children in comparison control areas. **Length of follow up**	**Number of participants** 125 projects (encompassing 350 schools) Surveys sent to 231 projects, 130 responses (some duplicates), response rate of 56%. **Participant characteristics** No individual-level characteristics given, and no comparison between control and intervention schools. No statistical significance reported. Of schools affected by intervention (n = 350), 69% were elementary schools (ages approx. 5-12), 21% were Middle / Jnr High Schools (11-13), 7% were high schools (14-18), 4% were other. **Inclusion criteria** Any projects in California which had received funding to implement SRTS interventions in waves 1 to 3 of funding (2001-2003), and whose	**Intervention** Safe Routes to School (SRTS) programme funding aims to reduce child injuries and fatalities near schools, and to increase walking and bicycling activity among students from 5-18. Of the 125 projects in the sample, 89 funded sidewalk improvements, 26 funded traffic calming and speed reduction, 25 funded traffic signals, 53 funded crossing upgrades, and 15 funded bicycle paths or other facilities (some projects funded more than one intervention). After the first wave, funds could be used for education / awareness programmes (not relevant to this review). **Comparator** Nearby areas that were unlikely to be affected by the SR2S improvements (all intersections in the city boundary that were not included as an SRTS intersection). **Data Collection** For mobility outcomes (walking and cycling), baseline data came	**Intervention:** SRTS interventions implemented in/around 350 schools **Control:** Nearby areas without SRTS interventions **Outcomes** Outcomes were: rates of walking, rates of bicycling, collisions. <u>Mobility</u>: 3 schools provided counts of pedestrians / bicyclists both before and after intervention through direct observations. As data was collected by schools, methods are heterogeneous. ▪ School a) increase of 48.5% in morning peak time walking (33 to 52) and 33.3% increase in biking (3 to 4). Increase of 292.7% in afternoon peak time walking (24 to 94) and 100% in biking (1 to 2). Negative is that all users were counted, not just students. ▪ School b) increase of 304.5% in morning peak time walking (22 to 89) and 160.0% increase in biking (10 to 26). Increase of 295.5% in afternoon peak time walking (22 to 87) and 0% in biking (13 to 13). All users counted, not just students. ▪ School c) it is reported that there was an 8% increase in children walking and cycling to and from school – no further data given. No standard deviations reported – it appears counts were undertaken on one day only. <u>Injuries in children– change over time</u>: Between 1998 and 2005, average annual injuries decreased in control groups by 36% for children age 5-12, and by less than 9% for children 13-18 (no standard deviation given). Overall for both age groups, this was a decrease of 15%. In SRTS areas, between baseline and follow-up (1998-2005), there was a 13% (95% CI* -2% to 23%) annual decrease in numbers of injured child pedestrian / bicyclists. For cyclists alone, there was an 11.6% decrease (CI -5.8% to 26.4%), for pedestrians a 13.9% decrease (CI -1.1% to 26.8%). Severity of injury saw a 28% increase in fatal or severe injuries (CI -14.5 to 90) and a 16.1% decrease in	**Limitations identified by the author** Safety analysis: Collisions are rare events so confidence intervals are high, and results could be the result of random chance. Number of pedestrians and vehicles has not been assessed, so we cannot tell how high the risk (exposure) for pedestrians was. Collisions are only one aspect of safety: near misses, perceptions of safety etc are not assessed here. **Limitations identified by the review team** No methods specified for collection of mobility data – methods likely to vary between schools. Outcome assessors at schools may be those who applied for funding originally and therefore could introduce bias. Schools are self-selected, having been selected for funding after having applied for it. These schools could be more likely to show positive results. Only 3 schools provided count data, out of 350. Not representative. **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
No information given on length of time between completion of interventions for each school, and follow-up data collection. Time period measured is 1998 to 2005. **Source of funding** California Department of Transportation (Caltrans)	interventions had been completed by December 31, 2005. **Exclusion criteria** Excluding projects given funding in waves 4 – 6. Interventions which had not been put in place by December 31, 2005. Projects in kindergartens or nurseries, or universities.	from application documents submitted by the project organisers and follow-up data from a post-construction questionnaire which gathered data on interventions (both qual and quant). For safety outcomes, data sources were the California Statewide Integrated Traffic Records System (SWITRS). This system collates data on events and codes by nearest intersection Additional information gathered from public sources (data on traffic safety and conditions) Information collected was: demographic, costings, details of intervention, observations of traffic and pedestrian behaviour and interactions (including collisions).	minor injuries (CI 4.9% to 26.1%). There was a decrease of 27.6% (CI 13.9% to 39.4%) in accidents involving children 5-12, and an increase of 5% (CI -11.3% to 23%) among children 13-17. When compared with the control areas, the SR2S project areas did not show a greater decline in numbers of injuries. However, authors state that the context (decreases in active travel in control areas and simultaneous increases in intervention areas) means an estimated safety benefit of 0-49% decrease in collision rate among children (as data on mobility change was poor, mobility change was modelled at five possible levels: no difference from the rest of California (e.g. a decline in walking), and increases of 10%, 25%, 50% and 100% in numbers of children walking/bicycling. **Analysis** Safety analysis: Baseline data: defined as data collected between 01/01/1998 and the award date for the particular SRTS project. Follow-up data: defined as data collected between completion of construction on the project and 31/12/2005. Length of time of each data collection period varied depending on date of funding award and intervention completion. An estimate of the average yearly change in injury occurrence in the control areas was obtained by fitting a linear regression to collision injury counts. The changes in collision rates in the school areas were estimated with rate ratios obtained from a Mantel-Haenszel person-time rate ratio estimator and were adjusted by the change observed in the control areas over the same average time period.	Other outcomes: perceptions of changes to safety associated with SRTS was also assessed qualitatively, and costs were assessed quantitatively –these are reported in 2 separate data extractions. *CI is Confidence Interval. Authors state that the sample is similar to the population in terms of geographical location, temporal distribution, scope of the project, types of improvements made, schools and student populations affected, and costs. Paper includes a section summarising data from a 2003 paper. This is not included due to publication date being out of scope. No power reported

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52 Orenstein et al 2007 (qualitative)

Study details	Population	Research parameters	Results	Notes
Full citation Orenstein et al 2007 **Quality score** - **Study type** Qualitative survey **Location and setting** USA - California **Aim of the study** Study aims to assess perceptions of changes in safety associated with the Safe Routes to School (SRTS) programme qualitatively, through information provided by school and agency officials. **Source of funding** California Department of Transportation (Caltrans)	**Number of participants** 114 projects responded to the survey. Authors state that some project responses contained information about more than one school (projects sometimes covered an area and therefore multiple schools). Cannot separate these from other results. **Participant characteristics** All participants were adults and may be assumed to work on SRTS interventions for the project on whose behalf they responded. **Inclusion criteria** Respondents to the wider survey on outcomes of the SRTS programme. Criteria for being sent the wider survey were: Any projects in California which had received funding to implement SRTS interventions in waves 1 to 3 of funding, and whose interventions had been completed by December 31, 2005. **Exclusion criteria** Excluding projects given funding in waves 4 – 6. Interventions	**Data collection** Safe Routes to School (SRTS) programme funding aims to reduce child injuries and fatalities near schools, and to increase walking and bicycling activity among students from 5-18. 125 projects encompassing 350 schools were included in the wider study. Of the 125 projects in the sample, 89 funded sidewalk improvements, 26 funded traffic calming and speed reduction, 25 funded traffic signals, 53 funded crossing upgrades, and 15 funded bicycle paths or other facilities (some projects funded more than one intervention). A post-construction questionnaire which gathered data on interventions (both qual and quant). Assumed that this was sent by post. Follow-up phone calls made to encourage completion.	**Key themes** Thematic analysis was not carried out in a systematic way. Authors give examples of positive comments from people completing the post-construction questionnaire – these are likely to be the individuals / agencies which applied for the funding initially: *"We received emails from happy parents after the project was completed."* *"Nearly two years later, we are still being thanked for putting in this sidewalk. Students, parents, teachers, administrators and school bus operators all appreciate the increase in safety and easier access to school. Vehicle and pedestrian traffic from the school now has less impact on the neighborhood traffic flow."* Authors outline that some comments specifically address safety: *"The sidewalks have greatly increased the safety and comfort of our students and parents at Fair Oaks School. Since the vast majority of our students walk to school the sidewalks have improved their trip considerably."* *"Student pedestrian and bicycle traffic has been removed from the vehicle right-of-way, to the safety of the children."* Impressions were given about the effect of the SRTS interventions on collisions / near-collisions: *"The former exit led children through a small parking lot, causing congestion and direct competition of pedestrians, cyclists and drop-off vehicles. Near-misses were common. Now, dropoff vehicles are separated from pedestrians. Buses can now stop very near the new gate, allowing students to enter school grounds immediately."*	**Limitations identified by author** None identified **Limitations identified by review team** Some questions are not appropriate for qualitative analysis and attempt to measure quantitative-type data No methods outlined for analysis – thematic analysis not conducted. No thorough process for quotations given as examples. Participants were those who had applied for funding so are likely to be biased towards the project. **Other comments** Other outcomes: rates of walking, rates of bicycling, costs and collisions were also assessed quantitatively – these are reported in 2 separate data extractions. This questionnaire is part of a larger paper evaluating quantitative measures

	which had not been put in place by December 31, 2005.	Surveys asked about perceived safety for students; overall success; complaints or criticisms. **Method of analysis** None described.	Authors also report anecdotal evidence of increased walking and cycling to school (active transport). *"Wren Elementary School Faculty is very pleased with the increase bike usage and believes this is due to the increased safety."*	associated with SRTS. This qualitative section is therefore only a part of the analysis.

55 Orenstein et al 2007 (Cost benefit analysis)

Study details	Inclusion / exclusion criteria	Population	Intervention / comparison	Method of analysis	Results	Notes
Full citation Orenstein et al 2007 **Quality score** - **Study type** Cost Benefit Analysis **Aim of the study** To assess the effects of Safe Routes to School (SRTS) projects on walking and cycling, and the costs and benefits of these results. **Location and setting** USA. California, a variety of schools which had obtained Safe Routes to School (SRTS) funding. **Source of funding** California Department of Transportation (Caltrans)	**Inclusion criteria** Any projects in California which had received funding to implement SRTS interventions in waves 1 to 3 of funding (2001-2003), and whose interventions had been completed by December 31, 2005, and which provided or had available collision data for the area. **Exclusion criteria** Excluding projects given funding in waves 4 – 6. Interventions which had not been put in place by December 31, 2005. Projects in kindergartens or nurseries, or universities. An additional 13 projects were dropped for 'various reasons' – reasons not given.	**Number of participants** 99 projects (affecting 214 schools – some projects spanned multiple schools). Number of students affected is not known. **Participant characteristics** None given – schools in California, USA. A mix of elementary, Junior high, and high schools (students ages 5-18).	**Intervention/comparison** Safe Routes to School (SRTS) programme funding aims to reduce child injuries and fatalities near schools, and to increase walking and bicycling activity among students from 5-18. Of the 125 projects in the sample, 89 funded sidewalk improvements, 26 funded traffic calming and speed reduction, 25 funded traffic signals, 53 funded crossing upgrades, and 15 funded bicycle paths or other facilities (some projects funded more than one intervention). After the first wave, funds could be used for education / awareness programmes (not relevant to this review). **Data Collection** Data sources were the California Statewide Integrated Traffic Records System (SWITRS). This system collates data on events and codes by nearest intersection.	**Costs*:*** Costs are program costs of the 99 projects that contributed collision counts: $28.9 million. Costs are only costs of the initial program. No additional costs (maintenance, operation of safety improvements, staff costs etc) are included. Time Horizon: Authors state that due to variation in the types of interventions included, an effective service life could not be modelled. Authors consider number of collisions over 1-year timeframe. **Benefits**: Values assigned to fatalities and injuries avoided are: Fatal injury $3,927,372 Severe injury $198,899 Other visible injury $51,740 Complaint of pain $24,944	The benefits and costs of the SR2S program were estimated based on monetary values assigned to fatalities and injuries by Caltrans. The cost per collision reduced was modelled for the five levels of mobility change used in the safety analysis. Cost effectiveness is measured in "cost per collision reduced". <u>Benefit per year ($ millions) and cost per collision reduced with different percentage increases in walking / biking:</u> 10% increase in walking and biking: benefit of $8.33, cost per collision of $282,779. 25% increase in walking and biking: benefit of $21.43, cost per collision of $109,970.	**Limitations identified by author** Results of collisions is not part of data, and is not built into model. Impacts on air pollution not included, likely to increase benefits. Impact on physical activity of children (longer term benefits) not included, likely to increase benefits. Change to collisions involving pedestrians in general (rather than children only) not included, likely to increase benefits. Reduced speed and ease in traffic congestion as benefits not captured in analysis **Limitations identified by review team** The authors do not include costs other than initial program costs. The authors do not include benefits other than collisions reduced. This makes the cost benefit ratios seen here very simplistic and potentially inaccurate – cannot tell the direction of the inaccuracy due to missing information on both sides. **Other comments** Other outcomes: rates of walking, rates of cycling, perceptions of safety, and

			Additional information gathered from public sources (data on traffic safety and conditions) Questionnaires were sent to SRTS projects to fill in – this included information on collisions and costings. It is unclear which of these data collection methods is the source for each aspect of the cost-benefit model.	These figures come from Caltrans estimates from 1997, adjusted to 2006 dollars. Authors assumed that the SR2S program had no differential effect on types of injuries: the proportion of fatalities, severe injuries and minor injuries remained the same, the absolute figures reduced.	50% increase in walking and biking: benefit of $38.09, cost per collision of $61,858. 100% increase in walking and biking: benefit of $58.33, cost per collision of $40,397.	collisions were also reported. These are extracted in separate data extractions. This analysis is part of a larger paper evaluating quantitative and qualitative outcomes associated with SRTS. This cost-benefit section is therefore only a small part of the analysis, and is undertaken as an additional activity, therefore being simplistic in nature. The paper also details a Hazard Elimination Safety program, which it compares to the SRTS program. However, the results are reported originally in papers outside the timeframe of the scope of this guideline, so this is excluded.

58 Ostergaard et al 2015

Study details	Population	Intervention/ comparator	Results	Notes
Reference Ostergaard et al 2015 **Quality score** - **Study type** Controlled before and after study **Location** Denmark – Copenhagen and Funen **Study aims** To assess effectiveness of school cycling promotion programme "Safe and Secure Cycling to School" in Denmark for increasing school cycling, and to quantify incidence and predictors of injuries related to cycling to school.	**Number of participants** Control schools: 12 Intervention schools: 13 Control children: 1,105 Intervention children: 1,296 Total children: 2,401 **Participant characteristics** Difference in age and cardiorespiratory fitness between intervention and control were statistically significant (p = 0.023; p = <0.001 respectively). Other demographic differences non-significant. Control: 48.8% male; average age 10.9 (SD* 0.63)' cardiorespiratory fitness (mL O^2 kg^{-1} min^{-1}) 48.07 (SD 6.78). Intervention: 51.1% male; average age	**Intervention** 13 schools in Copenhagen, Fredericia, and the island of Funen (all Denmark). Interventions included both environmental (i.e. road surface, signposting and traffic regulation like one-way streets and car drop-off zones) and behavioural interventions (i.e. increasing motivation through competitions, monitoring, traffic policy, and training programmes). **Comparator** 12 schools in Copenhagen, Fredericia, and the island of Funen (all Denmark) which had no intervention or physical activity (PA) promotion projects during study period. **Data Collection:** Data (objective and self-reported measures) collected in schools by researchers. <u>Objective Data</u> Weight and height measured by researchers. Cardiorespiratory fitness measured using the Andersen aerobic fitness test. <u>Self-Reported Data</u>	**Intervention:** 13 "Safe and Secure Cycling to School" schools with environmental and behavioural interventions **Control:** 12 schools with no routes-to-schools related interventions **Outcomes** Commuter cycling, incidence of traffic injuries, characteristics of injuries were assessed. <u>Baseline outcome measures:</u> The control group was more physically active compared to the intervention group for the following measures: - long term school cycling (always or almost always cycle to/from school generally): Control = 60.6%; Intervention = 54.8%; p = 0.026) - short term cycling (average number of trips to and from school in past week): Control = 6.4 [SD 4.3]; Intervention = 5.8 [SD 4.4]; p = 0.002) - cycling beyond school (often or very often cycled last week outside of school: Control = 37.7%; Intervention = 31.7%; p = 0.002) <u>Changes in outcome measures between baseline and follow-up (intervention and control; control as reference) (beta-coefficient, 95% Confidence Interval [CI]); negative figures reflect a decrease, positive numbers reflect an increase:</u> Only change scores for cardiorespiratory fitness were statistically significantly different between intervention and control, and this measure changed in an unfavourable direction in the intervention group compared to the control group: - Change in LTPA: -0.09 (-0.21; 0.03); p = 0.124 (non-significant). - Change in long-term school cycling: -0.02 (-0.10; 0.05); p = 0.485 (non-significant). - Change in cycling last week beyond school cycling: -0.04 (-0.14; 0.05); p = 0.355 (non-significant). - Change in short term school cycling (trips last week): 0.15 (-0.25; 0.54); p = 0.463 (non-significant). - No actual numbers reported for any of the above outcomes at follow-up (baseline measures reported in section above). <u>Adverse events: all traffic accidents over the previous year (control n = 714; intervention n = 970: participants who responded at both baseline and follow-up)</u> - Authors report that the one year incidence of being involved in a traffic injury was about 25% (not reported whether this is baseline or follow-up). Of these, about 85%	**Limitations identified by the author** Interventions may not have been implemented fully: underestimation of work led to delay of school recruitment and varying degrees of engagement from schools. Although there were 1,105 control respondents and 1,296 intervention respondents, each individual measure varied in response rate (as low as 781 for control and 1,070 for intervention), potentially introducing bias. Authors report that schools in one geographical area (not named) were more engaged due to more project consultants being employed and less reliance on teacher participation. **Limitations identified by the review team**

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up Baseline: spring 2010. Follow-up: Spring 2011. Interventions presumed to be implemented at various points between baseline and follow-up. **Source of funding** TrygFonden (Danish non-profit foundation)	11.0 (SD 0.64); cardiorespiratory fitness (mL O^2 kg^{-1} min^{-1}) 49.41 (SD 6.48). **Inclusion criteria** All children in 4th and 5th grade in schools (age approx. 10 and 11) selected by the Danish Cyclists Federation to be either an intervention or control school. Children were in 5th and 6th grade at follow-up. Intervention schools were required to have local plans for infrastructural changes near schools. Control schools were required to not conduct any physical activity promotion projects during the study period. **Exclusion criteria** Children older or younger than the selected ages.	*Leisure time physical activity (LTPA)* is assessed by the child choosing whether they play sport several times per week where they train hard; about one time per week; are physically active but do not attend sports activities; do many forms of activity but not sport or exercise; or do not move very much but often watch TV, play computer games, or do other sedentary activity. *Physical activity from Cycling* is assessed by long-term cycling (asking how often the child cycles to or from school: always or almost always; sometimes; never or hardly ever); short-term cycling (asking how many times the child cycled *to* school in the last week, and *from* school in the last week); and out of school cycling (frequency in past week). *Traffic injuries*: children are asked whether they have sustained a traffic injury in the last year (yes, no, do not know/remember). If yes, the child was asked where the injury was sustained.	are "solo injuries" (not defined but NICE team assumes this does not involve another vehicle or bicycle). - No statistically significant differences were observed in incidence of traffic injuries at baseline (intervention = 23.8%; control = 23.3%; p = 0.787), or at follow-up (intervention = 24.1%; control = 23.6%; p = 0.812) between intervention and control. - No statistically significant differences were observed in severe injuries at baseline (intervention 3.0%; control 3.5%; p = 0.556) or follow-up (intervention 4.2%; control 3.6%; p = 0.521) between intervention and control. - No statistically significant differences were observed between intervention and control for injuries split by transport mode (walking, cycling, motorised), at baseline (p = 0.465) or follow-up (p = 0.251). Significance of difference in change scores not provided. - Authors report that when comparing differences in changes in injuries between control and the intervention group, no statistical difference in distribution of proportions of children was found (no P-values reported). Unclear whether this applies to both frequency of any injury, and frequency of serious injury. <u>Predictors of injuries taking place on journey to or from school (Odds Ratio [OR]; 95% Confidence Interval [CI]):</u> Having had one or more injury on a school transport journey in the last year was found to be a statistically significant predictor of school transport injuries: - Being in 6th grade (reference 5th grade): OR 0.96; CI 0.59; 1.64. - Route unsafe or very unsafe (child assessed) (reference "very safe"): OR 1.02; CI 1.46; 2.24. - Route unsafe or very unsafe (parent assessed) (reference "very safe"): OR 1.22; CI 0.58; 2.52. - 30+ mins travel duration (reference 0-5 mins): OR 1.78; CI 0.61; 5.22. - One or more injuries last year (reference no injury last year): OR 3.19; CI 2.03; 5.02. **Analysis** For continuous outcomes, differences between intervention and control tested with t-tests or adjusted multiple linear regression analyses. Delta variables derived from difference between baseline and follow-up variables (positive values indicate increase, negative indicate decrease). For dichotomous variables, multiple logistic regression analyses were used to calculate odds ratios. Beta-coefficient analysis (looking at changes in outcome measures over time between intervention and control) are adjusted for age, gender, and baseline value (as reported by authors: the meaning of "baseline value" is unclear: it could include all baseline characteristics and outcome measures)	At baseline, there were significant differences in cardiorespiratory fitness, long term school cycling, short-term school cycling, and cycling last week outside of school between intervention and control groups. Actual figures for outcomes at follow-up not reported (only beta-coefficients of adjusted analyses). Self-reported items subject to social desirability bias or recall bias. **Other comments** Other outcomes: no other outcomes are reported in this study. Statistical significance: p = ≤0.05. *SD is standard deviation. Paper also reported BMI but this is considered to be out of the scope of this guideline so is not extracted. Power not reported.

59 ## Stewart et al 2014

Study details	Population	Intervention/ comparator	Results	Notes
Reference Stewart et al 2014 **Quality score** - **Study type** Uncontrolled before and after study **Location** USA – Florida, Mississippi, Washington, and Wisconsin **Study aims** To assess changes in the rates of active school transport (AST) after implementation of a Safe Routes to School (SRTS) project, and to identify characteristics of projects which are associated with increased rates of AST.	**Number of participants** Out of 354 projects and 1,019 schools in the four states, 48 SRTS projects had complete data for before and after intervention (14% of all SRTS projects). Not all projects broke data down into school-level data (projects can involve multiple schools) so only **53** schools had school-level data (5% of the SRTS schools in these four states). For some results, *complete* data is not required, so data from more than 48 projects or 53 schools was included. Number of children not reported. **Participant characteristics**	**Intervention** SRTS projects in four states are included (Florida, Mississippi, Washington, and Wisconsin). Projects could include interventions of the following types: infrastructure, non-infrastructure, both infrastructure and non-infrastructure. Projects may involve multiple schools: therefore project-level data is broader and more high-level than school-level data. Infrastructure interventions included pavement / crossing construction; installation of signage, dropped curbs, bicycle rack installation, traffic calming, cycle lane installation etc. Non-infrastructure measures include behavioural interventions (campaigns, events, pedometer programmes etc). **Comparator** No comparator	**Intervention:** SRTS interventions (infrastructure and non-infrastructure) at 48 projects. **Control:** No control **Outcomes** Not every project (n=48) had data for each outcome. <u>Change in rates of all AST between baseline and follow-up (mean % [standard deviation SD]).</u> Project-level data (n = 45): Baseline 12.7 (11.3), follow-up 17.6 (13.8). Mean change 4.9 (CI* 2.6, 7.2) (p = <0.0001). School-level data (n = 50): baseline = 12.8 (11.2), follow-up = 19.8 (16.4). Mean change 7.0 (CI 4.3, 9.7), (p = <0.0001). <u>Change in rates of walking between baseline and follow-up (mean [standard deviation SD]).</u> Project-level data (n = 33): Baseline 9.0 (8.5) follow-up 11.7 (9.2) Mean change 2.8 (CI* 1.5, 4.0) (p = <0.0001). School-level data (n = 45): baseline = 8.8 (8.2), follow-up = 13.3 (11.2). Mean change 4.5 (CI 2.4, 6.6), (p = <0.0001). <u>Change in rates of cycling between baseline and follow-up (mean [standard deviation SD]).</u> Project-level data (n = 29): Baseline 1.6 (2.0) follow-up 2.4 (2.5) Mean change 0.9 (CI 0.2, 1.5)) (p = 0.011). School-level data (n = 42): Baseline 2.0 (3.2) follow-up 3.2 (4.2) Mean change 1.2 (CI -0.2, 0.2) (this confidence interval must be reported incorrectly in paper), (p = 0.085). When projects with baseline and follow-up data are combined with schools from outside of these projects which also had baseline and follow-up data (but for whose overarching project data for both time points was not available), larger increases are seen for walking, but smaller increases for cycling and therefore slightly smaller increases for AST overall: Rates of overall AST increased by 37% (or by 4.7 percentage points, from 12.9% to 17.6%) in the 52 projects and 80 schools with both baseline and follow-up data. Walking increased by 45% (from 9.8% to 14.2%) across the	**Limitations identified by the author** All projects with baseline and follow-up data included both an environmental and behavioural element of intervention – not able to differentiate between the two. Uncontrolled nature of the trial means changes to AST could be part of a wider trend. Authors state that appropriate data was available “only for a small convenience sample of SRTS schools and projects”. These tended to be more comprehensive projects focussing on fewer schools with lower baseline rates of AST. SRTS projects implemented and completed at various times – follow-up data is not a consistent time from implementation. Study does not assess safety, a key aim of SRTS. **Limitations identified by the review team** Data entered into the SRTS database system by project coordinators, and sometimes inconsistently – as either counts or percentages. Bicycling and walking mode share sometimes combined into a single AST mode figure. Results were not split by state, only presented overall. Presenting results by

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up Authors report that follow-up data generally collected “one to several months after project completion”. **Source of funding** Washington State Department of Transport (DOT). TransNow, the University Transportation Center at the University of Washington.	No characteristics given of individuals or of schools. **Inclusion criteria** SRTS projects which had baseline and follow-up data entered into the SRTS monitoring database (cut-off date not given). **Exclusion criteria** SRTS projects or schools with no data for either baseline or follow-up. SRTS projects outside of the four included states.	**Data Collection:** Project characteristics: collected from the SRTS database system, information from grant proposals. School-level variables collected from National Center for Education Statistics (NCES) (i.e. percentage of students eligible for free lunch program). Data collected in 2007-2008, mid-point of the study period. School neighbourhood variables obtained from 2000 US census for a mile buffer around each school. Changes in rates of AST / walking / bicycling at both the project and school level were extracted from grant applications and project reports. These documents obtained the data by direct observation or in-class tallies.	40 projects and 55 schools represented, and bicycling increased by 24% (from 2.5% to 3.0%) at the 36 projects and 50 schools represented. Discrepancy between school and project numbers in data above, and in narrative is not explained by authors. **Correlations:** A significant negative relationship was found between pre-project rates of bicycling to school and changes in rates of bicycling to school = 0.009, Pearson correlation = -0.40). No other significant correlations. **School neighbourhood characteristics:** The % of students from low income households and % of non-English speaking students (neighbourhood outcomes used by authors) was not significantly related to change in AST (p = 0.271, p = 0.995 respectively). **Analysis** Data was analysed at three levels: i) project level (some projects encompassed multiple schools), ii) school level, iii) school neighbourhood level. Changes in rates of walking, bicycling, and all AST modes were analysed. Changes in rates were assessed at project and school level using paired-samples t-tests. Bivariate analysis was used to examine relationship between project, school, and school neighbourhood characteristics and the change in rates of walking, bicycling, and all AST. Where data for a school/project was available for walking and for cycling but not AST total, the walking and cycling data were aggregated by the authors. If data was available for the school but not the project associated, if the project was only for that school, the school data was also used for that project. AST data could not be disaggregated into walking and cycling data.	state would limit power, but might indicate particular success areas. **Other comments** Other outcomes: no other outcomes are reported in the study. A second paper was identified in our literature searches (Moudon and Stewart 2012) but was excluded on the basis that it would be a duplication of this, more recent, paper. Authors, methods, analysis, and results are the same. *CI = 95% Confidence Interval Where bicycle and walking data was provided, this was aggregated to give overall AST data. Data from specific cycle / walk to school days were excluded. Non-infrastructure measures are outside of the scope of this guideline so specific analysis of their effect is excluded. However, where these are combined with infrastructure, their effects are by necessity included. SRTS projects with data tended to be smaller than those without data to be analysed, resulting in greater award per head. Response bias.

Trails

Adams and Cavill, 2015

Study details	Population	Intervention/ comparator	Results	Notes
Reference Adams and Cavill 2015 **Quality score** - **Study type** Uncontrolled before and after study **Location** UK - multiple **Study aims** To evaluate changes in pedestrian use of local routes in five of the 12 'Fitter for Walking' (FFW) areas following environmental changes implemented by Local Authority and community groups.	**Number of participants** <u>Survey (baseline and follow-up 1 only)</u>: Baseline = 278 (16% response rate); Follow-up 1 = 315 (30% response rate). Counts (baseline, follow-up 1 and 2): Baseline = 3083 Follow-up 1 = 2484 Follow-up 2 = 3541 **Participant characteristics** <u>Survey (5 areas combined)</u>: 55.2% male. 27.6% 16-34, 37.3% 35-54; 35.2% 55+. 92.8% White. 36.5% full-time employed, 15.0% part-time employed; 24.5% retired, 24.0% other. 51.6% excellent / very good health status. 39.3% meeting physical (PA) activity recommendations.	**Intervention:** Five of the 12 'Fitter For Walking' (FFW) sites (Barking and Dagenham, London; Newcastle, North East; Blackburn, North West; Wolverhampton, West Midlands; Rotherham, Yorkshire). FFW is a project delivered by Living Streets in partnership with local areas, to increase walking. Three areas: 1) infrastructural changes; 2) community activities such as bulb planting and street cleaning; 3) promotional activity (for example led walks to increase awareness of the new route). Only the first two are considered relevant to our scope. *Barking & Dagenham*: improved crossings, kerbs dropped to meet the road ("dropped kerbs"), improved signage, resurfacing *Newcastle*: Route display boards; removal of smoking shelter, blocking route. *Blackburn*: Additional lighting, pedestrianisation, removal of	**Intervention:** Improvements to routes implemented by five Fitter for Walking (FFW) towns **Control:** No control **Outcomes** <u>Total number of pedestrian route users over count days (baseline to follow-up 1 (1-11 months after intervention), percentage change:</u> *All days combined*: For all cities combined there was a 19.4% reduction. Reduction observed in London (856 to 736, -14%), Blackburn (621 to 376, -40.9%), Wolverhampton (280 to 162, -42.1%) and Rotherham (1197 to 1072, -10.4%). Observed increase in Newcastle (129 to 146, 14%). *Weekdays:* Overall, for all cities combined, decrease from 1531 to 1480, -3.3%. Decrease in use were observed in Newcastle (73 to 60, -17.8%), Blackburn (318 to 235, -26.1%) and Wolverhampton (128 to 81, -36.7%), with London and Rotherham seeing small increases (499 to 527 and 513 to 577 respectively) *Weekends:* Overall, for all cities combined, numbers decreased (1552 to 1004, -35.3%). Decrease observed in London (357 to 209, -41.5%), Blackburn (303 to 132, -56.4%), Wolverhampton (152 to 81, -46.7%) and Rotherham (684 to 495, -27.6%). Newcastle had an increase (56 to 87, 55.4%). No significance reported for these figures. <u>Total number of pedestrian route users over count days (baseline to follow-up 2 (3 to 19 months after intervention)), percentage change:</u> *All days combined*: Overall, there was a 14.9% increase. Increases were seen in all locations: London (856 to 964, 12.6%), Newcastle (129 to 205, 58.9%), Blackburn (621 to 732, 17.9%), Wolverhampton (280 to 378, 35.0%) and Rotherham (1197 to 1262, 5.4%). *Weekdays:* Overall, for all cities combined, increases (1531 to 1480) of 37.6%. Increases seen in London (499 to 636), Newcastle (73 to 103), Blackburn (318 to 451), Wolverhampton (128 to 214), Rotherham (513 to 702). *Weekends:* Overall, for all cities combined, there was a decrease (1552 to 1435) of 7.5%. Decreases in London (357 to 328), Blackburn 303 to 281), Rotherham (684 to 560). Increases seen in Newcastle (56 to 102, 82.1%) and Wolverhampton (152 to 164, 7.9%) only. No significance reported for these figures.	Linked to Sinnett and Powell 2012 **Limitations identified by the author** Financial constraints limited number of locations included, number of follow-up points. Delays due to natural experiment design led to shorter and more varied follow-up periods than desired. Surveys subject to self-selection bias as participants are already using the route. Individual behaviour change could not be assessed as data was not panel data. **Limitations identified by the review team** No survey was undertaken at follow-up 2. This means that the increase in use seen in count data at follow-up 2 cannot be explained or explored.

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up Follow-up 1: 1-11 months after intervention. Follow-up 2: 3-19 months after intervention. (1 year between baseline and follow-up 1) **Source of funding** Living Streets (funded through Big Lottery Fund's Wellbeing Programme). British heart Foundation National Centre for Physical Activity and Health School of Sport Exercise and Health Sciences Loughborough University	Characteristics reported for five areas separately: no statistical significance reported for difference between areas, however there appear to be substantial differences in age distribution, ethnicity, employment status, health status, and proportion meeting physical activity recommendations. No characteristics for count data. **Inclusion criteria** Count: all users of selected route (regardless of transport type) *(only pedestrian route users are analysed in count data).* Survey: >16 years of age, any transport method. **Exclusion criteria** Count: no exclusion criteria bar those walking on other routes. Survey: individuals younger than 16.	graffiti, footstep and play markings under a bridge *Wolverhampton*: Litter bins, removal of high kerb, footway maintenance, benches. *Rotherham*: Dropped kerbs, extension to path on an open green space. **Comparator** No comparator **Data Collection** <u>Manual route user count:</u> Trained staff took 2 12-hour counts (7am-7pm, one weekday, one weekend day) at the intervention route in each town. Counts were taken at baseline, follow-up 1, and follow-up 2. <u>Intercept Survey</u>: Baseline and follow-up 1 only. All route users observed as over 16 invited to participate (survey adaptation of existing Sustrans Research survey). Assessed: demographic characteristics; general health (6-point scale); physical activity levels (physical activity single item measure, 5 or more days per week counted as meeting recommendations); details of current journey; general use of route; perceived change to route in last 12 months (follow-up 1).	<u>Survey response changes (baseline to follow-up 1):</u> *Mode change*: There was no statistically significant change (p = >0.05) in mode of transport of current journey by survey participants overall (i.e. walking + bus, walking + trail, walking only). 'Walking only' was the dominant form at baseline and follow-up 1 (79.9% and 80.7% of journeys). All locations saw a decrease or no-change in those using a car in combination with their current walking journey (5.6% to 1.9% all cities combined). *Current journey length:* No statistically significant change (p = >0.05) in minutes spent walking on current journey (baseline: 24.47 ± SD 33.3; follow-up 1: 19.67 ± SD 21.7). *Journey Purpose*: Significant change in reported journey purpose (p = <0.05) overall, but with no discernible pattern. Changes different across locations and significance not reported for individual changes. *Weekly use*: Significant decrease in percent of survey respondents from all intervention cities combined using the route on at least a weekly basis during the day (94.5% to 90.4%), and at least weekly basis during the night (36.6% to 30.8%). *Perceived use change*: Overall, 18.6% of people thought that route use had increased over the past 12 months (highest results in Rotherham 24%, lowest in Blackburn 5.1%). 74.6% of respondents thought route use had stayed the same. 6.9% thought route use had declined (least in Rotherham 2.1%, most in London 12.2%). Significance not relevant as only measured at follow-up 1. <u>Percentage of route users aware of changes (follow-up 1, survey):</u> Authors assessed survey respondents' awareness of each intervention action, in the cities where that action was undertaken. Generally low awareness of interventions undertaken. Resurfacing had high levels of awareness in the four cities implementing (ranging from 9.6 to 50%), as did clearance of graffiti in the one city implementing (60.8%). Awareness of clearance of rubbish/glass in 3 cities implementing range from 11.5 to 49.0%, and awareness of removal of overgrown hedges in two areas ranged from 18.9 to 29.4%). Participants less aware of other interventions implemented in the 5 areas - dropped kerbs 3.8% to 16.0%), traffic calming humps (6.0%), improved crossings 1.9% to 3.0%), improved lighting (3.9%), clearance of dog fouling (2% to 13.2%), and planting of new bulbs (0%). **Analysis** *Count data*: Percentage changes were calculated for difference between baseline and follow-up 1, and baseline and follow-up 2. *Survey*: Continuous data analysed with independent t-test (where non-parametric, Mann Whitney U test). Categorical data were analysed using Chi squared tests. Statistical significance calculated.	Count data: pedestrian users are considered, but details of those counted who were using other forms of transport are not detailed: cannot tell what proportion of total counted were pedestrians. **Other comments** Locations: Local Authorities were selected to be part of FFW on the basis of low levels of physical activity overall, and high deprivation. Low route use at follow-up 1 attributed by authors to ongoing improvement work blocking routes. The Fitter for Walking project places emphasis on community-based approach. Power not reported. Significance: P = 0.05. Data from baseline and follow-up route user surveys were independent samples, not panel data (not recorded whether the same people completed the survey at both time points). Other outcomes: No other outcomes reported.

63 Bjornskau et al 2012

Study details	Population	Intervention/comparator	Results	Notes
Full citation Bjornskau et al., 2012 **Quality score** - **Study type** Controlled before and after study (summary paper only) **Location and setting** Norway - Oslo **Study aims** To evaluate the effect of implementing cycle lanes in both directions of a one-way street on travel behaviours, comfort, subjective safety and ease of access compared with control streets where no implementation took place. **Length of follow up** 1 year between baseline and follow-up (May-June	**Number of participants**: Not reported **Participant characteristics:** Not reported **Inclusion criteria** Cyclists using either the intervention or control streets. No other criteria given. **Exclusion criteria** Other road users (drivers, pedestrians). No other criteria given.	**Intervention:** As part of a policy to improve cycling conditions in Oslo, a counter-flow cycle lane was installed in two one-way streets (Kirkegata and Skippergata, Oslo) to allow cyclists to travel both with and against the one-way system. Signposts and "special traffic signals" (authors do not specify what these are) were added for cyclists travelling against normal traffic flow. Cycle lanes were marked with red asphalt, and advanced stop lines and cycle boxes were added. **Comparator:** Two streets where no two-way cycle lanes were implemented. Authors do not state whether these streets are one-way or two-way traffic streets. No further information on these streets is given in this summary and it is not made explicit whether these streets are one-way. **Data Collection**: Cycle traffic in intervention and control streets was counted (by City agency responsible for the measure) before and after implementation. This summary paper does not detail length of time spent doing this. Cycle volumes in different directions was counted; the number of cyclists cycling on the pavement, and numbers of cyclists cycling against red lights. Data was collected on whether motorised road	**Intervention: (I)** Introduction of cycle lanes (allowing cyclists to travel both with and against the flow of traffic) on two one-way streets **Control: (C)** Two streets with no cycle lanes **Outcomes** <u>Cycle Volume</u> Outcome data limited to percentage change – no further statistics given. Cycle counts reveal cycling volume increase by approx. 50% on both intervention streets. Cycling volumes decreased in the control streets (no figures given). Reasons for the increase in intervention streets are not stated – it could be that more people are cycling, however it is noted that "some of the increased cycle traffic may be the result of transfer of cycle traffic from neighbouring streets". <u>Cycling on Pavements</u> Cycling on pavements reduced in intervention streets (from 47% to 22% in Kirkegata [where pavements are wide] and from 23% to 5% in Skippergata). It is assumed that these percentages are shares of total cycling on the street. Pavement-cycling was unchanged between baseline and follow-up in control streets. <u>Traffic conflicts</u> (ie an event where one or more road users has to brake or swerve abruptly to avoid collision). 3 conflicts were recorded by one camera (authors state this is 0.3% of total passing cyclists). The other camera recorded 6 conflicts (authors state this is 0.6% of total passing cyclists. It is unclear whether the field of view of the cameras overlapped (both covered Skippergata) but it is assumed by the NICE team that no double counting occurred.	**Limitations identified by the author:** None reported **Limitations identified by the review team** Details are not given on how well the control streets were matched to the intervention streets, or whether any changes took place in control streets over the observation period. There is no information on whether baseline use was similar between intervention and control streets **Other comments** Study takes place in Oslo, Norway. No reason is given for video monitoring only one of the intervention streets: it may have been opportunistic as

2011, and May-June 2012 respectively. The intervention was installed on 29 August 2011, 9-10 months before the follow-up survey. **Source of funding** Not reported		users (i.e. motorbikes) increased counter-flow driving in experimental streets as a result. Two cameras, monitoring different portions of one of the intervention streets (Skippergata), were set up. More than 70 hours of footage was analysed to study traffic conflicts involving counter-flow cyclists (an event where one or more road users have to brake / swerve abruptly to avoid collision). These were manually registered, then reviewed and checked by two researchers. Interviews were conducted but do not form part of this analysis as they are qualitative. Qualitative studies outside of the UK are out of scope.	The authors state that the proportion of conflicts is lower than for many other cycling lanes in Oslo, and most were reported as being related to ongoing construction work. There can be no baseline comparison measure for this outcome. **Analysis:** Descriptive data only – this is a summary paper. Results presented in percentages.	a hotel room was required to place a video camera in. Other outcomes: No other outcomes reported in this study.

67 Clark et al 2014

Study details	Population	Intervention/ comparator	Results	Notes
Reference Clark et al 2014 **Quality score** + **Study type** Controlled before and after study (authors call this a quasi-experimental longitudinal analysis) **Location** USA – Southern Nevada **Study aims** To compare usage on trails which were altered by adding way-finding and incremental distance signage to usage on unaltered control trails over a period of one year. (Study also looks at long-term effects of a marketing campaign but this is outside of scope). **Length of follow up** Follow-up data collected between 1 and 9 months after intervention.	**Number of participants** Baseline: approx. 6,454 individuals counted Mid-intervention: approx. 9,954 individuals counted Follow-up: approx. 8,610 individuals counted. Calculated by NICE team from daily averages. **Participant characteristics** No characteristics of participants able to be collected with this data collection method. No demographic characteristics of areas given. Locations are a variety of urban and suburban areas in Southern Nevada – this diversity implies varied demographics. **Inclusion criteria** Any individual using any of the 6 intervention trails for any period of time. **Exclusion criteria** Animals using the trail, people using other trails.	**Intervention** 6 stretches of trail selected by local jurisdictions in Southern Nevada for addition of way-finding and incremental distance signage. Distance markings were embossed into trail surfaces at 0.25 mile intervals. Maps were placed on metal posts at major access points. Trails were between 3.1 miles and 8.7 miles long. One was a commuter trail, four park-like, one drainage channel. One had a bicycle bridge and some landscaping, four had landscaping, lighting, picnic shelters, residential access (two of these with current connectivity and two with planned connectivity), one had lighting only from nearby structures. **Comparator** Four trails matched as closely to the intervention trails as possible in terms of length, trail environment, amenities, and neighbourhood demographics as possible. Trails were between 0.95	**Intervention:** 6 trails with new way-finding and incremental distance signage, and marketing campaign promoting trail usage and PA. **Control:** 4 trails with no planned environmental intervention, marketing campaign promoting trail usage and physical activity. **Outcomes** <u>Mean number of trail users [standard error] at baseline, mid-intervention, and 1-9 month follow-up:</u> Intervention: baseline = 79 (10.28), mid-intervention = 141 (12.80), 1-9 month follow-up = 107 (12.63). P value for overall difference within each study group = <0.001 Control: baseline = 112 (13.51), mid-intervention = 144 (24.06), 1-9 month follow-up = 147 (18.45). P value for overall difference in three rounds = 0.039. <u>Baseline to 1-9 month follow-up change:</u> Between baseline and 1-9 month follow-up, intervention trail usage increased by 35%, and control trails by 31%, both significant increases (p = <0.01). There was no significant difference between the intervention and control groups (p = 0.3226). <u>Mid-intervention to 1-9 month follow-up change:</u> Between mid-intervention and 1-9 month follow-up, control trail use did not change significantly (p = 0.69), but intervention trails did decrease significantly (141 mean users per day to 107) (p = <0.01). The authors state that the sharp increase at mid-intervention was due to the promotional campaign which had just taken place at that point. Use then dropped for intervention trails to a level which was still an increase compared with baseline. **Analysis**	**Limitations identified by the author** Effect of interventions on *length of trip* was not identifiable by the single point infra-red lasers – multiple points could have improved this. Control trails selected non-randomly – limited by availability of similar local trails. Marketing campaign part of intervention affected all trails in the study, both intervention and control. **Limitations identified by the review team** Infra-red sensor only detects one person per 1.5 seconds (to avoid counting the same person twice). Groups could therefore be underestimated. Only one sensor per trail – other access points could be neglected, only measure one point on each trail. **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
Baseline data collected in Autumn 2011, mid-intervention data collected in Spring 2012. Interventions implemented between Spring and Summer 2012. Follow-up data in Autumn 2012. Study is one year in total. **Source of funding** Centers for Disease Control and Prevention University of Nevada Southern Nevada Health District		miles and 4.0 miles long. One was a commuter trail, two park-like, one drainage channel. One had a bicycle bridge, two had landscaping, lighting, picnic shelters, residential access, and connectivity, one had trail-specific lighting. The marketing campaign, which promoted trail use and physical activity (no other detail given), affected all trails, both control and intervention.	Data Collection: One infrared sensor installed per trail, near a trail access point on each trail. Data collected for 7 consecutive days at each data collection point: baseline (Autumn 2011), during study (Spring 2012) and at follow-up (Autumn 2012). School holidays were avoided. Audits: these were conducted for a two-hour period during each data collection point at each trail. Manual counts recorded using standardized data collection form – inter-rater reliability perfect (Kappa = 1.00). Training carried out before audits took place. Statistical Tests: The Friedman test was used for testing the difference in three rounds for the control group and the intervention group. The Wilcoxon signed rank test was then used for testing the difference of pre–post and mid–post usage for the control group and intervention groups. The Wilcoxon rank sum test, a nonparametric test, was performed to compare the control group and the signage group based on the paired daily differences.	Other outcomes: no other outcomes are reported in this study. Follow-up timeframe is wide due to description by authors of interventions implemented in "spring and summer 2012", and follow-up data as collected from "Fall 2012", hence 1-9 months. The media campaign (part of the intervention but not covered here as out of scope) took place prior to the signage intervention, perhaps explaining the large increases at mid-intervention observation point. Statistical Significance ≤ 0.05 Power not reported.

68 Department for Transport 2010

Study details	Inclusion / exclusion criteria	Population	Intervention / comparison	Method of analysis	Results	Notes
Full citation Department for Transport, 2010 **Quality score** - **Study type** Benefit-cost analysis **Aim of the study** To produce a Benefit-Cost Ratio (BCR) of the Cycling Demonstration Town programme which includes effect of not just mortality but other non-morbidity impacts (congestion, amenity, absenteeism, cycling casualties), in keeping with the analytical approach	**Inclusion criteria** Cycling Demonstration Towns (CDTs) in the UK **Exclusion criteria** Other types of cycling interventions	**Number of participants** 6 Cycling Demonstration Towns (Aylesbury, Brighton and Hove, Darlington, Derby, Exeter and Lancaster with Morecambe) **Participant characteristics** No individual level or town level characteristics reported.	**Intervention** Cycling Demonstration Towns programme, launched in 2005 by Cycling England. Invests in measures to stimulate increased levels of cycling. Interventions include physical infrastructure, promotion, and other measures. This study provides an estimate of the impact on these six towns in the first phase, ending in 2009. **Comparison** No comparison	<u>Change in number of cyclists aged 16+ in each town</u>: Percentage of respondents to surveys doing any cycling in 2006 MINUS percentage of respondents to surveys doing any cycling in 2009. Difference multiplied by adult population of the town to provide estimate of total new adult cyclists. <u>Absenteeism</u>: used assumption that physical activity programmes of ≥30mins/day, 5 days/week reduced sick absences by minimum 6% (WHO, 2003: USA). Threshold and pro-rata models used (former consistent with DfT guidance). Benefit only to those in work. <u>Decongestion</u>: incorporated lower congestion, reduced infrastructure costs, fewer road accidents, improved air quality, lower noise levels, reduced CO_2, reductions in indirect taxes. Assumed a proportion (proportion not specified) of new cycling journeys replaced car journeys. No sensitivity analysis reported. <u>Cycling casualties</u>: Average cost per cycling casualty was applied to estimate total cost of accidents (three estimates	<u>Estimate of benefits and costs over 10 year period (£m, 2007 prices and values):</u> Reduced mortality: Benefit of £45m Decongestion: Benefit of £7m Reduced absenteeism: Benefit of £1-3m Amenity: Benefit of £9m Accidents: Disbenefit of £0-£15m **Total Benefits: £47-64m** Costs: £18m **Benefit-Cost Ratio: 2.6-3.5** For every £1 spent on the CDT programme, the authors estimate that between £2.60 and £3.50 of benefits will be accrued due to reduced mortality and non-morbidity impacts. Reduced mortality accounts for between	**Limitations identified by author** Monitoring data from the CDTs was not collected with the purpose of producing a BCR. Assumptions were necessary, reducing robustness of the approach. The value of these schemes is "sensitive to assumptions which have yet to be tested" including whether increases in cycling are permanent, or reduce over time. It was not possible to value the benefits of increased cycling among children: possible underestimation of benefit It has not been possible to value reductions in morbidity from increased cycling (only mortality, and non-morbidity impacts): possible underestimation of benefit. Other schemes taking place during assessment period could have impacted outcomes, leading to overestimation of CDT scheme effect. **Limitations identified by review team** Benefits are calculated for all towns as a group. However there are likely to be differences in benefits accrued to each town which are obscured by this high level analysis.

Study details	Inclusion / exclusion criteria	Population	Intervention / comparison	Method of analysis	Results	Notes
recommended by DfT. **Location and setting** UK - Aylesbury, Brighton and Hove, Darlington, Derby, Exeter and Lancaster with Morecambe **Source of funding** Department for Transport				of changes in cycling casualties were used: webTAG, published papers on accident statistics, and police reports of cycling accidents which show a 32% increase, no change, and 12% increase in accidents respectively). Amenity benefit: used assumptions about benefit per cyclist who is using new or improved cycling infrastructure, and total cyclists (new and existing) using this infrastructure. Author highlights high levels of uncertainty. Sensitivity analyses were conducted, but not on individual outcomes – on the model as a whole.	70% and 96% of net benefits. Accidents form the next largest impact, although the range is large and it is not clear whether the programme did increase total cycling casualties. BCR is sensitive to assumptions about decay rate (these figures assume no decay) and revenue costs (these figures assume costs will be incurred for 3 years). The impact of different assumptions about decay rate was tested in a one-way sensitivity analysis (range between BCR of ~11 for 10% growth rate, to ~1.5 for 30% decay rate	**Other comments** Assumptions made by authors: benefits from CDT scheme accrue for 10 years. There is no decay in the number of cyclists over this period. Costs will be incurred in the first 3 years only. Goodman et al 2013 (included in this review) assesses CDTs in combination with Cycling Cities and Towns (CCTs) The study extends an existing cost benefit analysis so does not include full details of the method. Cope 2010 paper identified – duplicate information of this paper so excluded. Sloman et al 2009 includes interim figures developed in this study. Data not reported in Sloman extraction as would be duplicate. Other outcomes: no other outcomes reported.

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70 Dill et al 2014

Study details	Population	Intervention / comparator	Results	Notes
Reference Dill et al 2014 **Quality score** - **Study type** Controlled before and after study (authors state "longitudinal, panel design with a control group") **Location** USA – Portland, Oregon **Study aims** To evaluate changes in physical activity and active transportation in intervention groups with	**Number of participants** N = 293 Intervention = 154 Control = 139 (Participants with both pre- and post-data. 429 completed baseline data collection, making retention 68%. Retention in intervention 72%, in control 65%. Statistical significance of this difference not reported). **Participant characteristics** Authors state that intervention-group adults were slightly more likely to be employed full-time, be married, and have a four-year college degree (no significance reported). Intervention group: 63% female, 37% male. 67% reported they were in excellent or very good health; 54% were employed full-time; 64% were married, 66% had a 4-year college degree. The mean age was 43.3 years	**Intervention** Installation of bicycle boulevards. 8 streets scheduled for boulevard installation (0.9-4.2 miles long). [A bicycle boulevard is a low-volume street, often residential, that uses traffic calming and other methods to reduce speed and volume of motor vehicles]. 54,381 households were asked to participate. 335 families participated in baseline data collection (3.1% of estimated eligible population). **Comparator** No bicycle boulevard installed. 11 control streets were monitored (1.0-5.7 miles long). Control streets were similar to intervention streets in urban form and most demographic characteristics and were often parallel streets. **Data Collection**	**Intervention:** Bicycle boulevards (0.9-4.2 miles long) in 8 streets **Control:** 11 street segments with no intervention (1.0-5.7 miles long) **Outcomes** There was no correlation between being in the intervention area (as measured by participants wearing GPS and accelerometer) after boulevards were installed and either minutes of Moderate to Vigorous Physical Activity (MVPA) per day ($p = 0.33$), bicycling more than 10 minutes ($p = 0.655$), walking more than 20 minutes ($p = 0.73$), minutes of walking (if >20 minutes) ($p = 0.54$), or making a bike trip ($p = 0.69$). <u>Bicycling</u> In the intervention group 61.1% of participants made a bike trip at baseline, compared with 58.2% at 2-12 month follow-up (decrease of 2.9%). Percentage of control group participants making a bike trip also decreased between baseline and 2-12 month follow-up (55.4% to 52.9%, decrease of 2.5%) (no statistically significant difference between groups p = >0.10). *Number of* bike trips taken decreased in both groups between baseline and 2-12 month follow-up (intervention from 5.6 [SD4.9] to 4.4 [SD 4.2], control from 4.3 [SD 3.8] to 3.5 [SD 3.3]). The installation of a bicycle boulevard was statistically significantly negatively correlated with number of bike trips ($p = 0.06$). No between-group statistical significance reported. The percentage of people biking >10 minutes increased slightly between baseline and 2-12 month follow-up in the intervention group (43.9% to 45.3%) and decreased in the control group (39.7% to 31.4%) (Between group difference not statistically significant: p = >0.1). However, in the intervention group mean minutes spent bicycling (of trips >10 minutes) decreased from 103.9 (SD 73.0) to 65.9 (SD 74.7) between baseline and 2-12 month follow-up. This could indicate that, of those trips longer than 10 minutes, more were relatively short compared with baseline. >10 minutes spent biking was significantly negatively correlated with the installation of the bicycle boulevard ($p = 0.00$). <u>Walking:</u> Percentage of participants walking >20 minutes decreased between baseline and 2-12 month follow-up in both groups (intervention 83.5% to 75.6%, control 79.3% to 74.4%). Change between groups over time not statistically significant (p = >0.10). Average minutes walked (of trips >20mins) also decreased in both groups	**Limitations identified by the author** Retention was higher among the intervention group – this could be because the city chose to install bicycle boulevards in locations where residents were supportive, correlating with support. Follow-up data collection may have occurred before behaviour change has a chance to occur, due to delays in boulevard installation shortening time for embedding of behaviours. Other changes occurring could impact behaviour and have not been investigated. Detecting small effects in outcome measures with large variation (like bicycling habits, which are dependent on weather and other factors) is difficult. Projects varied in design meaning all intervention participants were not exposed to the same treatment. The behaviour of parents with children (the participant group) may be harder to change than other adults.

Study details	Population	Intervention / comparator	Results	Notes
the installation of new 'bicycle boulevards', compared with control. **Length of follow up** 2-12 months between installation of intervention and follow-up data collection. **Source of funding** School of Urban Studies and Planning, Portland State University	old: 53% were between age 35-44 at start of study. Control group: 67% female, 33% male. 65% reported they were in excellent or very good health; 49% were employed full-time; 58% were married, 61% had a 4-year college degree. The mean age was 41.0 years old: 51% were between 35-44 at start of study. **Inclusion criteria** Households where at least one child (5-17yrs) and one adult parent/guardian agreed to participate for length of study, and which were within 1000ft of either a control or an intervention street. Adults must be physically able to ride a bicycle, have access to a working bicycle, and have no intention to move in the near future. **Exclusion criteria** Households where only adults or only children agreed to participate. Individuals with no access to bicycle, or no riding ability.	**GPS and Accelerometer**: Participants wore GPS device and accelerometer units for 5 consecutive days including at least one weekend day at both time points. Days were valid when there was 10 hours of wear, and participants were included if they had 3 or more valid days at each data collection stage. **Survey**: Only participants with complete surveys at both time points were included. Surveys measured attitudes towards cycling (I like riding a bike, biking can sometimes be easier for me than driving, I prefer to bike rather than drive whenever possible) and walking (I like walking, walking can sometimes be easier for me than driving, I prefer to walk rather than drive whenever possible). It measured attitudes to relative safety of a car (Chronbach's alpha measures reliability) (1 = strongly disagree, 5 = strongly agree).	(intervention 107.2 [SD 79.1] to 89.4 [SD 66.8], control 92.0 [SD 86.9] to 75.4 [SD 66.5]). Change between groups over time not statistically significant (p = 0.54). Time effect (change over time for both groups combined) of minutes walked if >20 is not significant (p = 0.45), statistical significance for groups separately not reported. Attitudes Attitudes measured on a 1-5 scale (5 = strongly agree, 1 = strongly disagree). Positive attitudes towards bikes had significant positive correlation with making a bike trip (p = 0.00), number of bike trips (p = 0.00), biking for more than 10 minutes (p = 0.00) and minutes biked if >10 minutes (p = 0.00). No significant correlation was found with MVPA (p = 0.23). Positive attitude towards walking positively correlated with walking >20 mins (p = 0.00), minutes walked if >20 (p = 0.00) and overall MVPA (p = 0.02). Authors report that positive attitudes were generally positively correlated with engaging in those activities. Participants who felt that cars were safer were less likely to bicycle. At baseline, participants in intervention areas had slightly more positive attitudes towards bicycling (intervention = 3.84, control = 3.65, p = 0.07) and walking (intervention = 4.03, control = 3.89, p = 0.00). Control participants had stronger agreement about the safety of cars over cycling / walking (control = 2.75, intervention = 2.53, p = 0.01). No data presented for drop-outs. From a comparison of intervention group baseline survey respondents (including drop-outs) with intervention group completers of both baseline and follow-up surveys, appears that drop-outs were similar to those completing study in gender (61% female vs 63%) and employment status (56% full-time employed vs 54%) but retention was higher among adults who were in excellent or very good health (65% vs 67%), had lower BMI (average BMI 25.4 vs 25.2), were married (60% vs 64%), and were college graduates (63% vs 66%). Statistical significance not given. **Analysis** Multinomial logit model used to predict whether travel was walking/bicycling, rather than travel diaries. This is shown to correctly predict 95% of walking trips and 79% of bicycle trips. Only adults were included in the analysis.	**Limitations identified by the review team** Wide gap of "2-12 months" given by authors for time between boulevard installation and follow-up data collection prohibits drawing conclusions about impact of this timeframe on results. Control groups are near intervention streets, which could cause contamination between groups. **Other comments** Participants were not told that the study was related to installation of bicycle boulevards or any other intervention. Significance for model coefficients is p = 0.1 *SD is Standard deviation. Power not reported. Rain reported as negatively correlated with whether participants biked more than 10 min, made a bike trip, and minutes of walking in both groups Other outcomes: No other outcomes reported in this study.

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Study details	Population	Intervention/ comparator	Results	Notes
Reference Fitzhugh et al 2010 **Quality score** **+** **Study type** Controlled before and after study **Location** USA – Tennessee, Knoxville **Study aims** To investigate the impact of a new urban greenway / trail on directly observed physical activity (PA) of adults and Active Transport to School (ATS) of children in the intervention neighbourhood, compared with adults and children in neighbourhoods with no new greenway.	**Number of participants** Only median/two hour count given, no totals for either intervention or control, at either baseline or follow-up. **Participant characteristics** Characteristics of participants not collected or reported by authors – details on neighbourhoods which samples were taken from were as follows: Intervention neighbourhood: 9.3% had lower than high school education; 6.9% black, 5.6% unemployed, 50.2% female, 63.5% live in houses with mortgages (as stated by authors – unclear whether this is as opposed to mortgage paid off, or to renting, or whether occupier is owner of mortgage); median age 30.0; median household income $36,563. Control neighbourhoods (average of 2 neighbourhoods): 9.7% had lower than high school education; 5.4% black, 4.4% unemployed, 53% female, 63% live in houses with	**Intervention** Construction of 8 foot wide 2.9 mile long asphalt greenway connecting residential and commercial areas within a neighbourhood. **Comparator** Two control neighbourhoods which authors report match the intervention neighbourhood in terms of socioeconomic measures. **Data Collection** <u>PA counts:</u> Trained research assistants used pedestrian count survey methodology. Teams of 2 counted people undertaking PA on a Wednesday and a Saturday at both data collection points from 7am-9am, 11am-1pm, and 4pm-6pm in intervention and control neighbourhoods. Counts of pedestrians, cyclists, and other	**Intervention:** Construction of 8-foot-wide 2.9 mile long asphalt greenway **Control:** 2 control neighbourhoods with no intervention **Outcomes** <u>Group effects: number of individuals walking and cycling in intervention and control neighbourhoods (median and Inter-Quartile Range)</u> At 14 month follow-up, there were significantly more individuals undertaking physical activity in the intervention location than the control location (intervention 13.0 people per 2-hour data collection period [IQR 11.0, 15.0], control 1.0 [IQR 6.0, 0.0], p = 0.028). Significance remains when looking at walkers (p = 0.002) and cyclists (p = 0.036, actual numbers not supplied). <u>Time effects: change in intervention and control groups over time in number of individuals walking and cycling in 2 hour data collection period (median and Inter-Quartile Range)</u> In intervention neighbourhood, physical activity counts per 2-hour data collection period increased significantly between baseline and 14 month follow up (p = 0.000), median increase of 8 people. Control neighbourhood counts decreased significantly from baseline (p = 0.000), median decrease -1. Actual figures not supplied. <u>Group x Time: comparison of change in physical activity count</u> Increase in physical activity counts were significantly higher than in the intervention compared to control for total physical activity (from 4.5 to 13.0 in intervention; 3.0 to 1.0 in control; p = 0.001). Intervention change and control change were significantly different for both pedestrian (p = 0.001) and cyclists (p = 0.038) counts. Although direction is not given, pedestrian and cyclist counts are the two components of total physical activity, so it is likely that these differences may be interpreted as relating to greater increases in intervention than control groups. <u>Active transport to schools (ATS) group effects:</u>	**Limitations identified by the author** Outcomes by types of user was not investigated – cannot tell who was most impacted. It is possible that some greenway users are from outside neighbourhood. No distinction drawn between transport and leisure physical activity. Possible that control neighbourhoods were not identical to intervention neighbourhood. **Limitations identified by the review team** Locations chosen for physical activity in the control neighbourhood is important but not outlined. Control neighbourhood data not presented separately – could be skewed by one neighbourhood. Although not statistically significant, baseline ATS levels appear different between groups. Judgement used to define who pupils at the schools were (as opposed to teachers, parents, non-studying siblings / guardians).

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up 14-months between completion of the greenway and follow-up data collection. Baseline data collection in March 2005, 2 months before start of greenway construction. Greenway completed December 2005, follow-up data collection in March 2007. **Source of funding** Office of Research and the Southeastern Transportation Center at University of Tennessee, Knoxville.	mortgages; median age 39.5; median household income $50,612. Statistical significance of differences between control and intervention neighbourhoods not reported. **Inclusion criteria** Anyone walking, cycling, or using other transport along the new greenway, or other control locations (age criteria not stated). Any pupil leaving from or arriving at one of the three intervention schools or three control schools by a form of Active Transport to School (not defined). **Exclusion criteria** Those not travelling by active travel methods (presumably car, public transport – not defined). Those leaving or arriving at school who are not pupils.	forms of physical activity included. <u>School observation</u>: 2 to 4 research assistants placed at each of: 2 elementary and one high school in intervention neighbourhood, and 2 elementary and one middle-school from control neighbourhoods. At each location data was collected on Active Transport to School (ATS) on a Tuesday and a Thursday from 7am-9am and 230pm-4pm. Number of school-aged youths observed in ATS recorded.	At 14 month follow-up, there were more children undertaking ATS at control schools (median of 19 children per two-hour count) than intervention schools (median of 9 children per two-hour count). This difference was significant (p = 0.026). At baseline, control group also had higher ATS counts (30) than intervention (8.5). Authors state that this difference is not significant (Exact significance not reported). <u>Group x Time: comparison of change in ATS</u> Tests detected no significant difference between intervention group change, and control group change between baseline and follow up (p = 0.2061). **Analysis** Data was nonparametric. Fishers exact tests were used to find group effects (relationships between experimental and control areas at same data collection point) and time effects (relationships within the same neighbourhood over time). Wilcoxon rank test used to detect group x time effects (relationship between changes in intervention and changes in control groups over time).	**Other comments** Power not reported. Statistical significance ≤0.05. Data on control results are averaged over 2 control neighbourhoods. Authors state that pedestrian infrastructure connectivity alone does not increase active transport to schools (ATS). Authors report that no participants were exposed to any social marketing / awareness campaigns during course of study Other outcomes: no other outcomes reported in this study.

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Study details	Population	Intervention/comparator	Results	Notes
Full citation Goodman et al., 2013a **Quality score** + **Study type** Controlled before and after observational study (Authors call study a "controlled, natural experimental study) **Location** UK - multiple **Study aims** To examine whether the town-wide cycling initiatives 'cycling demonstration towns' or 'cycle cities and towns' had an effect on proportions of people cycling to work compared to matched comparison towns, unfunded towns and national comparison group.	**Number of participants**: Total n = 16,787,934 Intervention n = 1,266,337 Matched Comparison n = 969,605 Unfunded comparison n = 4,195,540 National Comparison Group n = 10,356,452 **Participant characteristics:** Participant towns were those who had applied and been accepted onto the two schemes, CDT or CCT. Intervention towns were similar to the matched comparison group in terms of population size, population density and affluence, and were also reasonably similar to the national comparison group (unfunded group not mentioned).	**Intervention:** 18 town-wide initiatives were implemented in urban areas of England outside of London. 6 "Cycling demonstration Towns (CDTs) increased annual spend / person / year to £17 between Oct 2005 and March 2011 (average spend prior to intervention not given: £1/year is the average per person per year for England). A further 12 Cycling Cities and Towns (CCTs) increased spending to £14/person/year between April 2008 and March 2011. England average is £1 / person / year. CCTs built on the experience of CDTs, and are grouped here as interventions were similar across the two programmes. Interventions varied across towns and were led by specialist cycling teams. All towns had environmental interventions (building cycle lanes, creating cycle parking) and behavioural interventions (promotional activities, cycling training). The average ratio of environmental to behavioural was 3:1 across all towns.	**Intervention:**6 Cycling Demonstration Towns (CDTs) and 12 Cycling Cities and Towns (CCTs) **Control:** Matched comparison group; unfunded comparison group; national comparison group **Outcomes** All intervention towns were combined for overall analysis when being compared with unfunded comparison group and national comparison group. <u>Cycling to work – percentage difference at 10 year follow-up compared to baseline (95% CI)</u> Intervention Towns: +0.97 (0.91, 1.03) Matched Comparison Group: +0.29 (0.23, 0.34) Unfunded Comparison: -0.05 (-0.07, -0.02) National Comparison group: -0.26 (-0.27, -0.24) In intervention towns, cyclists as a proportion of commuters increased significantly more between baseline and follow up than all three comparison groups, as seen below (effect defined as ratio of increase (with 95% CI): <u>Intervention Compared with Matched Comparison</u>: Absolute intervention effect = 0.69 (0.60, 0.77) Relative intervention effect = 1.09 (1.07, 1.11) <u>Intervention Compared with Unfunded Comparison</u>: Absolute intervention effect = 1.02 (0.95, 1.09) Relative intervention effect = 1.18 (1.17, 1.20) <u>Intervention Compared with National Comparison</u>: Absolute intervention effect = 1.23 (1.16, 1.29) Relative intervention effect = 1.26 (1.25, 1.28) **<u>Other Transport Modes</u>** In intervention towns, walking and public transport use increased (+1.71 (1.62, 1.81) and +0.32 (0.24, 0.41) respectively), and driving decreased between baseline and follow up -3.01 (-3.13, -2.88).	**Limitations identified by author:** Large effect size heterogeneity caused by some intervention towns displaying large changes whilst others showed only small, non-significant changes. A few large towns (Bristol, Brighton & Hove) drove population-level effects. Outcomes measured are very simple (usual mode of travel to work). Although a useful proxy, it may still have over- or under-estimated the overall impact of intervention on cycling. Only one post-intervention time point included, so cannot examine longer-term effects. Individual-level characteristics lacking (age, gender etc). No randomisation was possible, therefore limiting causal inferences – however randomisation would have been impossible in this context. **Limitations identified by the review team** Outcome of mode of commuting was determined in the census question "How do you usually travel to work? (Tick one box

Length of follow up 10 years between baseline and follow up (unknown month 2001 - March 2011). Interventions took place between October 2005 and March 2011. **Source of funding** National institute of Health Research post-doctoral fellowships, Centre for Diet and Activity Research funded by British heart Foundation, Economic and Social Research Council, Medical Research Council, NIHR and Wellcome Trust, under the auspices of the UK Clinical Research Collaboration	Individual-level characteristics not afforded by census-level data. **Inclusion criteria** Individuals who were captured by 2001 or 2011 census data, were aged 16-74 with a current job, and whose work address was not the same as their home address were included. **Exclusion criteria** Individuals not captured by the 2001 or 2011 census data, who did not have a current job, or who were home workers and therefore did not commute were not included in the study.	Focus was on commutes (working with workplaces and creating cycle paths); schools (all towns implemented cycling training); and general infrastructure improvements (cycle lane and cycle path improvements; advanced stop lines); cycling and stations (installing security cameras, cycle routes in stations etc). **Comparators** Matched comparison group (one per intervention town. Classed as "most similar" to town according to National Statistics 2001 Area Classification for Local Authorities). All matched comparison towns combined to form matched comparison group. Unfunded Comparison Group (largest urban region which applied for CDT or CCT grant and was unsuccessful. Controls for factors prompting application for funding) Non-London national comparison group (All non-intervention urban areas >30,000 people combined into one group)	The increase in walking and decrease in driving was significantly greater in the intervention towns than all comparison groups; changes in public transport were similar to comparison groups. <u>Heterogeneity:</u> Heterogeneity between intervention town effect sizes (I^2) was extremely high (97-99%), this was not explained by intervention category (CDT or CCT) or baseline cycling levels. However, there was evidence of larger effects in towns placing greater emphasis on workplace cycling initiatives, with this variable explaining around one third of the observed between-town heterogeneity (regression coefficient 0.75 (95% CI 0.30, 1.21, adjust R^2 41.9%). The authors concluded that the intervention appeared to increase cycling and, to a lesser extent, walking to work. This was at the expense of driving to work. Cycling increased significantly in all quintiles of deprivation (although smaller improvements were seen amongst most deprived). **Analysis** Commuters from all 18 intervention towns were combined into a single sample. This combined data was taken from self-reporting data on the 2001 and 2011 census (2011 census covered 96% of the population outside of London). An individual was defined as cycling to work if they reported that the longest part, by distance, of their usual journey to work was cycled. Prevalence was defined as the proportion of commuters who reported cycling to be their usual, main mode of travel to work. Each intervention town was compared with each control town to investigate potential differential effects between towns. Meta-regression was conducted to investigate the source of between-town heterogeneity in effect sizes. The Matched Comparison Towns were considered the best control group as they had the most similar baseline characteristics and trends over time (1981, 1991, and 2001 census data) in travel modes.	only, for the longest part, by distance, of your usual journey to work)". This could exclude people who split their journey. Prevalence of cycling and walking to work in absolute terms was more common in intervention towns at baseline – this was largely driven by Cambridge. However, authors have addressed this in the analysis by carrying out absolute and relative measures of the effect. **Other comments** No P-Values are given in the paper. High levels of precision afforded by very large sample size. No power reported. 10-year follow-up from baseline measurements was conducted a maximum of 5 and a half years after interventions began. Actual length of time between intervention and follow-up not specified. Other outcomes: Equity impacts are not extracted here in detail (summary in results section).

Goodman et al 2013b

Study details	Population	Intervention/ comparator	Results	Notes
Reference Goodman et al 2013b **Quality score** - **Study type** Uncontrolled before and after study **Location** UK – Cardiff, Kenilworth, Southampton **Study aims** To investigate how new local walking and cycling routes (Connect2 initiative) are used by adults over one-year and two-year follow-up periods, and factors associated with use. **Length of follow up** Follow-up 1 conducted 9 months after 2	**Number of participants** Baseline: **3,516** (15.6% response rate from 22,500 adults who were posted the baseline survey, randomly selected from edited electoral register). Follow-up 1: **1,849** (53% retention; 8% of original population approached) Follow-up 2: **1,510** (43% retention; 7% of original population approached) [1,235 participants took part in both follow-up 1 and follow-up 2 surveys] **Participant characteristics** Groups split into those who responded at baseline and follow-up 1 (one-year sample); and those who responded at baseline and follow-up 2 (two-year sample). There was no difference in characteristics between the samples (p>0.16). <u>One-year sample:</u> 13% were 18-34years (214); 35-49 is 21% (379), 50-64 is 33% (607), 65-89 is 33% (616). White is 97% (1771), non-White is 3% (64). 16% (301) had one or more children under 16. 39% (715) had tertiary education or equivalent, 34% (622) had secondary school education, 27% (500) had	**Intervention** Three Connect2 interventions selected due to their implementation timetable, likelihood of measurable population impact, and heterogeneity of overall mix of sites. Cardiff: a traffic-free bridge built over Cardiff Bay Kenilworth: a traffic-free bridge was built over a busy trunk road Southampton: an informal riverside footpath was turned into a boardwalk. **Data Collection:** At all 3 data collection points, participants were sent postal surveys including	**Intervention:** Three Connect2 interventions (Cardiff, Kenilworth and Southampton) including traffic free bridges and new riverside boardwalks. **Control:** No control **Outcomes** <u>Awareness and Use of Intervention (Binary data)</u> At follow-up 1, 32% reported using their nearest intervention and a further 32% were aware of it. At follow-up 2, 38% had used and a further 35% had heard of their nearest intervention. Pearson correlation between reported use at follow-up 1 and follow-up 2 is 0.62, meaning there is a positive correlation. Statistical significance not reported <u>How intervention routes are used</u> [Note: results below are reported as percentage of total sample (and then, in brackets, percentage of people who actually used the trail).] Walking: At follow-up 1, 29% of the total sample (92% of those who had actually used the intervention routes) had used the intervention routes for any kind of walking, rising to 35% at follow-up 2 (91%). The most common category of walking (see “intervention” section for categories) was walking for recreation, at 27% (84%) at follow-up 1, and 32% (85%) at follow-up 2. Walking for education, and walking for business were least popular: <1% at both follow-up 1 and 2 for both categories. Cycling: At follow-up 1, 13% (39%) of respondents had used the intervention area for any form of cycling, rising to 16% (43%) at follow-up 2. The most popular form of cycling was recreational, with 12% (37%) using it for this purpose at follow-up 1, and 15% (39%) at follow-up 2. Education and business were again the least popular: <1% at both follow-up 1 and 2 for both categories. For both cycling and walking, social / leisure, shopping, and to work featured in descending order of popularity, all much lower than recreational.	Linked to Sahlqvist et al 2015, Goodman et al 2014 **Limitations identified by the author** Low response rate introduces selection bias. It was not possible to blind participants to their intervention status, although measures taken to limit exposure to hypotheses of study. Only ever-use of the intervention was assessed, not frequency of use. Education, work, and business categories might have been more strongly represented in trip frequency. **Limitations identified by the review team** No control areas without interventions were used. Data collected was self-reported, and past-week walking and cycling required recall of past 7 days. This could therefore introduce recall bias or social desirability bias. Possible self-selection bias. **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
interventions running. Follow-up 2 conducted 21 months after first 2 interventions and 7 months after third intervention running (i.e. 12 months after follow-up 1). <u>Baseline</u>: April 2010 <u>Follow-up 1</u>: April 2011 <u>Follow-up 2</u>: April 2012 **Source of funding** iConsortium (funded by the Engineering and Physical Sciences Research Council); Medical Research Council; Centre for Diet and Activity Research; British Heart Foundation; Economic and Social Research Council; NIHR and Wellcome Trust (under auspices of UK Clinical Research Collaboration).	none or other. 34% (584) lived in a household earning >£40,000, 34% (577) ≤£20,000. 51% (939) were working, 3% (48) students, 38% (710) retired. 87% (1599) owned a car, 55% (948) owned a bike. 25% (441) had a long-term illness or disability that limited daily activities. <u>Two-year sample:</u> 18-34 years is 10% (144); 35-49 is 20% (300), 50-64 is 35% (532), 65-89 is 35% (530). White is 97% (1460), non-White is 3% (45). 16% (234) had one or more children under 16. 39% (590) had tertiary education or equivalent, 33% (490) had secondary school education, 28% (425) had none or other. 32% (451) lived in a household earning >£40,000, 35% (488) ≤£20,000. 49% (740) were working, 2% (25) students, 40% (609) retired. 86% (1290) owned a car, 55% (768) owned a bike. 26% (374) had a long-term illness or disability that limited daily activities. **Inclusion criteria** Adults living within 5km road network distance of any of the 3 core projects. **Exclusion criteria** Adults living further away than 5km network distance.	a seven-day recall instrument and a short-form of the International Physical Activity Questionnaire (IPAQ). At follow up, participants were also asked whether they had a) heard of and b) used their closest intervention. If they had used, they were asked whether they had walked or cycled, and for what purpose (commuting, travel for education, travel for business, shopping, travel for leisure activities, and recreation / fitness). **Comparator** No comparator	Of participants in both follow-up 1 and 2, correlation between use at the two time points was between 0.35 (cycling for business) and 0.76 (cycling for education) in all categories. <u>Predictors of use of intervention for any purpose (Risk Ratio [RR], Confidence Interval)</u> *Proximity*: those living closest to their intervention site were most likely to use it (Those living <1km away compared to those ≥4km away: follow-up 1 RR = 3.62 [2.27, 5.80]; follow-up 2 RR = 3.38 [2.35, 4.87]). *Reported time spent walking / cycling at baseline*: Those reporting more time were more likely to use the intervention, with a dose response relationship. When compared with people who reported no time walking/cycling at baseline, those with 1-149 minutes in the past week had a RR at follow-up 1 of 1.41 (1.08, 1.85) and at follow-up 2 of 1.47 (1.10, 1.96). Those with 150-299 minutes had a RR of 1.41 (1.10, 1.81) at follow-up 1 and 1.52 (1.16, 1.99) at follow-up 2. Those with 300-449 had an RR of 2.08 (1.63, 2.66) at follow-up 1 and 1.83 (1.41, 2.38) at follow-up 2. Those with ≥450 minutes had an RR of 1.93 (1.47, 2.53) at follow-up 1, and 2.09 (1.55, 2.81) at follow-up 2. All multivariable RR. [At baseline, 83% of participants reported doing any walking in the past week, compared with 16% reporting doing any cycling]. Use was also predicted, to a lesser extent, by being retired (as opposed to working); bicycle ownership; self-reported excellent health (at follow-up 1). **Analysis** To examine predictors of a) awareness and b) use, Poisson regression with robust standard errors was used. Analyses adjusted for age, sex and study site initially. Multivariable analyses were then carried out. Missing data assumed random. Robust standard errors were used clustered by geographical area (average population 1500) to allow for potential correlations between participants living in the same neighbourhood.	Other outcomes: no other outcomes reported in this study. Sample vs population: Sample contained lower proportion of young adults than the general population (7% vs. 26%). Sample was also somewhat healthier, better-educated and less likely to have children. Otherwise largely representative. All findings unchanged in a sensitivity analysis restricted to those who provided data at both time points. Authors note that predictors of use of the interventions appear to favour those with good health, pre-existing exercise habits, and with use of an adult bicycle. 2 interventions implemented by July 2010; third intervention implemented September 2011. Power not reported. Statistical significance ≤0.05.

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Study details	Population	Intervention/ comparator	Results	Notes
Reference Goodman et al 2014 **Quality score** - **Study type** Uncontrolled before and after study **Location** UK – Cardiff, Kenilworth, Southampton **Study aims** To investigate the extent to which proximity to the Connect2 intervention predicts changes in the activity levels of those living nearer the intervention, versus those living further away. **Length of follow up** Follow-up 1 conducted 9 months	**Number of participants** Baseline: **3,516** (15.6% response rate from 22,500 adults who were posted the baseline survey, randomly selected from edited electoral register). Follow-up 1: **1,796** (51% retention; 8% of original population approached) Follow-up 2: **1,465** (42% retention; 7% of original population approached). **Participant characteristics** Groups are split into those who responded at baseline and follow-up 1 (one-year sample); and those who responded at baseline and follow-up 2 (two-year sample). There was no difference in characteristics between the samples (p>0.16). *One-year sample*: 13% were 18-34years (214); 35-49 is 21% (379), 50-64 is 33% (607), 65-89 is 33% (616). White is 96.4% (1771), non-White is 3.6% (64). 16% (301) had one or more children under 16. 39% (715) had tertiary education or equivalent, 34% (622) had secondary school education, 27% (500) had none or other. 34% (584) lived in a household earning >£40,000, 34% (577) ≤£20,000. 51% (939) were working, 3% (48) students, 38% (710) retired. 87% (1599) owned a car, 55.6% (948) owned a bike. 25% (441) had a long-	**Intervention** Three Connect2 interventions selected due to their implementation timetable, likelihood of measurable population impact, and heterogeneity of overall mix of sites. Cardiff: a traffic-free bridge built over Cardiff Bay Kenilworth: a traffic-free bridge was built over a busy trunk road Southampton: an informal riverside footpath was turned into a boardwalk. **Data Collection:** At all 3 data collection points, participants were sent postal surveys including	**Intervention:** Three Connect2 interventions (Cardiff, Kenilworth and Southampton) including traffic free bridges and new riverside boardwalks. **Control:** No control **Outcomes** <u>Whole sample change in Physical Activity (PA) (from baseline to follow-up 1 and 2)</u> Walking and Cycling: (assumed that these 2 activities are combined for these figures.) Mean minutes per week increased by 4 minutes between baseline and follow-up 1, and 0 minutes between baseline and follow-up 2. Authors describe this as relatively stable (no absolute numbers provided). Other moderate to vigorous intensity physical activity (MVPA) declined (-16 mins/week between baseline and follow-up 1; -24 mins/week between baseline and follow-up 2). <u>Proximity and PA</u> *1 year follow-up:* No evidence of proximity predicting changes in activity levels for any activity outcome. Sensitivity analysis removes Kenilworth (the latest completing intervention) and results are unchanged. Total walking and cycling*: +4.6 min/wk per km closer [CI -4.2, 13.4, *p* not reported, but CI demonstrates no statistical significance) Total physical activity*: 0.9 min/wk per km closer [CI -6.8, 8.5, *p* not reported, but CI demonstrates no statistical significance) *2 year follow-up*: Parameter estimates and 95% confidence interval (CI) for change in minutes/week, per kilometre closer to intervention (i.e. individual 1km away will have the following increases in activity compared with someone 2km away, and double the below compared with someone 3km away): Total walking and cycling*: +15.3 min/wk per km closer [CI 6.5, 24.2, *p* = <0.001])	Linked to Sahlqvist et al 2015, Goodman et al 2013b **Limitations identified by the author** Low response rate introduces selection bias. Participants not blinded, although measures taken to limit exposure to hypotheses of study. Only ever-use of the intervention was assessed, not frequency of use. Education, work, and business categories might have been more strongly represented in trip frequency. **Limitations identified by the review team** No control areas without interventions were used. Data collected was self-reported, and past-week walking and cycling required recall of past 7 days. This could therefore introduce recall bias or social desirability bias. Due to above issues, participants likely to not be representative of the population. **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
after 2 interventions running. Follow-up 2 conducted 21 months after first 2 interventions and 7 months after third intervention running (i.e. 12 months after follow-up 1). Baseline: April 2010 Follow-up 1: April 2011 Follow-up 2: April 2012 **Source of funding** iConsortium (funded by the Engineering and Physical Sciences Research Council); Medical Research Council; Centre for Diet and Activity Research; British Heart Foundation; Economic and Social Research Council; NIHR and Wellcome Trust (under auspices of UK Clinical Research Collaboration).	term illness or disability that limited daily activities. *Two-year sample:* 18-34 years is 10% (144); 35-49 is 20% (300), 50-64 is 35.5% (532), 65-89 is 35% (530). White is 97% (1460), non-White is 3% (45). 16% (234) had one or more children under 16. 39.5% (590) had tertiary education or equivalent, 33% (490) had secondary school education, 28% (425) had none or other. 32% (451) lived in a household earning >£40,000, 34.3% (488) ≤£20,000. 49% (740) were working, 2% (25) students, 40% (609) retired. 86% (1290) owned a car, 55% (768) owned a bike. 26% (374) had a long-term illness or disability that limited daily activities. **Inclusion criteria** Adults living within 5km road network distance of any of the 3 core projects. **Exclusion criteria** Adults living further away than 5km network distance. Those with what the authors considered to be an unreliable physical activity data (change of ≥900 mins/week).	a seven-day recall instrument and a short-form of the International Physical Activity Questionnaire (IPAQ). At follow up, participants were also asked whether they had a) heard of and b) used their closest intervention. If they had used, they were asked whether they had walked or cycled, and for what purpose (commuting, travel for education, travel for business, shopping, travel for social / leisure activities, and recreation / fitness). **Comparator** No comparator	Total walking and cycling**: +9.2 min/wk per km closer [CI 0.6, 17.9, *p* not reported, but CI demonstrates statistical significance]) Total physical activity*: 12.5 [CI 1.9, 23.1, *p* not reported, but CI demonstrates statistical significance]) Total physical activity**: 10.5 [CI 1.8, 19.2, *p* not reported, but CI demonstrates statistical significance]) *After adjusting for demographic, socioeconomic, and health characteristics, and walking and cycling time at baseline. ** Same as above, also excluding 65 outliers (those whose change score was ≥600 min/wk). Authors note that there were no significant changes at year 2 in forms of MVPA outside of walking and cycling (adjusted effect is 0.1min/wk, CI -6.2, 6.5), showing no evidence that gains in walking and cycling are offset by reductions in other forms of activity. Benefits are greater for those who use the intervention compared with those who don't: adjusted effect = 30.0 min/wk; CI = 3.5, 55.5 among Connect2 users vs 7.4 min/wk; CI = –5.3, 20.1 among nonusers for total walking and cycling. Authors assert that this demonstrates causality. **Analysis** Proximity measured to be the distance from (weighted population centroid of) participant's home postal code, to nearest access point of Connect2 project. Primary outcome (past-week walking and cycling) was the sum of total time walking or cycling for transport (7-day recall tool) and total time walking or cycling for recreation (modified International Physical Activity Questionnaire [IPAQ]). Secondary outcome: (total past-week physical activity) is 'past week walking and cycling' plus time spent in other MVPA.	Other outcomes: no other outcomes reported in this study. Sample vs population: Sample contained lower proportion of young adults than the general population (7% vs. 26%). Sample was also somewhat healthier, better-educated and less likely to have children. Otherwise largely representative. All findings unchanged in a sensitivity analysis restricted to those who provided data at both time points. Authors note that predictors of use of the interventions appear to favour those with good health, pre-existing exercise habits, and with use of an adult bicycle. 2 interventions were implemented by July 2010. The third intervention was implemented September 2011. Proximity to the intervention was associated with pre-intervention activity levels, retention, or any individual or household characteristic (all *p*'s reported as >0.05) Power not reported. Statistical significance ≤0.05.

77 Gustat et al 2012

Study details	Population	Intervention/ comparator	Results	Notes
Reference Gustat et al 2012 **Quality score** - **Study type** Controlled before and after study **Location** USA – New Orleans **Study aims** To evaluate the effect of the installation of a path and playground on community-wide physical activity (PA) in an intervention neighbourhood compared with control neighbourhoods. **Length of follow up**	**Number of participants** Baseline: 499 interviews (224 in intervention, 275 in control. Intervention 62.6%, intervention 65.5% response rate: overall 64.1%). Follow-up: 692 interviews (336 in intervention, 356 in control. Response rate 76.9%). **Participant characteristics** Mean age and ethnicity not significantly different between sample groups. No other significance information given. Authors state that intervention and control neighbourhoods were similar in terms of home ownership, education level, annual income, percentage of African American residents, built environment (including housing and business type). Demographic figures not given for these assertions. Intervention area 1 (I1), path area: 85.7% African American, 54.7% female, 61.2% employed, 82.9% high school graduate, mean age 41.6, percentage of population with annual income ≥$20,000 is 36%. Intervention area 2 (I2), playground area: 91.7% African American, 63.9% female, 50.9% employed, 76.2% high	**Intervention** Installation of an 8 foot wide path 6 blocks long. The path is on a grassy, tree-filled median of a wide neighbourhood boulevard (in the centre of the road). The path connects a park in another neighbourhood to a commercial area. Intervention neighbourhood split into 2 groups (I1 and I2) – I1 was area of path, I2 was area of playground. I2 is included in the analysis as the authors measure outcomes related to the path for this area as well, and both I1 and I2 are in the same neighbourhood. **Comparator** Two neighbourhoods (one 1.5 miles and the other 5.4 miles from the intervention neighbourhood). No active physical activity interventions taking place in these neighbourhoods. **Data Collection** <u>Survey</u>: Households were randomly sampled to select participants. 12 contact attempts were made. Interviewer administered door-	**Intervention:** Installation of a wide 6-block-long path in a neighbourhood **Control:** 2 neighbourhoods with no interventions **Outcomes** <u>Percentage of people reporting trail use at baseline and 10-month follow-up (self-reported survey):</u> Walking trail use increased slightly but non-significantly (from 21.9% to 29.6%). [To note, unclear from reported data whether this is I1 and I2 respondents combined]. <u>Percentage of people reporting walking (transportation and leisure) at baseline and 10-month follow-up (self-reported survey):</u> Transportation: Increases were seen in I1 (29.3% to 34.8%), I2 (24.8% to 36.9%), C1 (31.3% to 40.5%) and C2 (19.8% to 31.1%). Leisure: Increases were seen in I1 (60.0% to 65.3%), C1 (61.3% to 70.4%) and C2 (57.7% to 68.9%). I2 decreased (63.3% to 61.5%). There was no significant difference in the changes over time between groups (group by time effect; p value not reported). <u>Percentage of people doing moderate and vigorous physical activity (MVPA) (direct observations):</u> Neighbourhood by time interaction was significant: there were significant differences between the changes over time in the four groups (p = <0.001, direction not specified). Intervention area: A significant increase in the proportion of people engaged in moderate and vigorous activity was noted in I1 between baseline (36.7%) and follow-up (41.0%) (p = <0.001). No significant change in I2.	**Limitations identified by the author** Self-reported measures are often over-estimated, particularly for exercise (relevant to survey data collection). Controlling confounding variables difficult in natural experiments – other factors may be responsible for observed effects. Data was collected (via observations) across whole of neighbourhood, rather than just around the intervention area (due to baseline data collection prior to deciding on intervention). This could weaken observed effect. **Limitations identified by the review team** Definitions of vigorous PA (VPA) used in direct observations are not consistent with those used in other papers – the requirement for VPA seems lower. Surveys undertaken by interviewers at participants home. Time of day not noted, but if during daytime, possible that unemployed and women are overrepresented in the sample. Unclear whether baseline outcome measures are similar – some appear not to be i.e. walking for transportation at baseline varies between 19.88% (control) and 29.3% (intervention). **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
Approx. 10 months between implementation of the intervention and follow-up data collection. Baseline data collection in Autumn 2005, implementation in November 2006, follow-up data collection in Autumn 2007. **Source of funding** Prevention Research Center at Tulane University School of Public Health and Tropical Medicine Centers for Disease Control and Prevention Cooperative Agreement.	school graduate, mean age 47, percentage of population with annual income ≥$20,000 is 46.7%. Control area 1 (C1): 96.7% African American, 65.3% female, 49.7% employed, 80.4% high school graduate, mean age 43.5, percentage of population with annual income ≥$20,000 is 33.6%. Control area 2 (C2): 100% African American, 60.4% female, 60.6% employed, 88.3% high school graduate, mean age 45.5, percentage of population with annual income ≥$20,000 is 46.2%. **Inclusion criteria** Neighbourhoods included on the basis of being urban, low-income and African American. English speaking adults aged 18-70, who had lived in the neighbourhood for at least 3 months. **Exclusion criteria** No English-speaking ability, had not lived in the neighbourhood for at least 3 months, or outside age range.	to-door surveys collected information at baseline and follow-up on demographic characteristics including health, self-reported PA, perceptions of community social and physical environment. Self-reported PA included walking for leisure, walking for transportation, and other activities i.e. bicycling / jogging. <u>Direct Observation</u>: Observers collected data at baseline and follow-up between 4pm and 6pm on every Thursday, Saturday, and Sunday for 6 weeks in each neighbourhood. System for Observing Play and Leisure Activity in Youth (SOPLAY) was adapted and used. Observers drove through neighbourhood (reportedly in a systematic manner) counting anyone in sedentary, moderate (walking) or vigorous (anything more than walking including lifting, pushing, jogging, dancing) PA. Direct observation was not limited to the new path, but all streets observed during the data collection.	Control areas: A significant decrease was seen in C1 ($p = <0.001$, no figures provided). No significant change in C2. <u>Percentage of people doing vigorous PA (direct observations)</u>: Neighbourhood by time interaction was significant: there were significant differences between the changes over time in the four groups ($p = <0.001$, direction not specified), Intervention area: I1 underwent a significant increase in vigorous PA between baseline and 10-month follow-up (10.5% to 12.7%; $p = <0.001$). I2, C1 and C2 did not undergo significant changes: all decreased slightly but non-significantly. <u>Reported location of exercise (survey):</u> Self-reported activity increased for residents in both intervention areas on streets, for everyone in parks, and for those in I1 on a walking trail. However, only the change in park use was significant (no figures supplied) Authors state that after installation of the walking path, proportion of people observed who were active in that area increased (both for MVPA and vigorous PA). Authors report that participation in any other activity than walking was low in survey data – so was not reported. **Analysis** Pearson χ^2 statistics were used to explore the bivariate relationships, and logistic regression to explore the effect of the intervention. Group, time, and group by time effects were calculated.	Other outcomes: no other outcomes reported in this study. I1 is intervention path area; I2 is intervention playground area. I1 and I2 are in same neighbourhood. C1 is control neighbourhood 1; C2 is control neighbourhood 2. Baseline survey taken approx. 1 year after Hurricane Katrina. A community-based participatory research approach taken: participant neighbourhoods involved in selecting control neighbourhoods and interventions. Interventions are a path and playground. The playground intervention is outside of scope and so not described, however as both interventions take place in the same neighbourhood (different areas of this neighbourhood), the playground may have affected some outcomes. Its introduction. Power not reported. Statistical significance ≤0.05.

78 Hendricks et al 2009

Study details	Population	Intervention/ comparator	Results	Notes
Reference Hendricks et al 2009 **Quality score** - **Study type** Uncontrolled before and after study **Location** USA - Michigan **Study aims** To assess number of adults actively commuting before and after installation of bike lanes, rail trails, bike racks and bike carriers. **Length of follow up** 1 year between baseline and follow-up surveys. Intervention implementation dates not given **Source of funding** Active Living by Design (a program of the Robert Wood Johnson Foundation), the Ruth	**Number of participants** Baseline: n = 1.028 Follow-up: n = 1,853 **Participant characteristics** No participant characteristics given. The city of Jackson, where the intervention takes place, has high rates of overweight and obesity (62% of adults). Population is 48% male and 52% female. Median age is 31.3. 15.2% of families in Jackson live below the poverty level. **Inclusion criteria** Adults using active transportation in any of the observation locations between observation times (walking, cycling, rollerblading etc). **Exclusion criteria** Those not of working age using the observed trails / roads / points during observation time.	**Intervention** A variety of interventions to increase active commuting, including: Installation of 6.5 miles of bike lanes on 13 urban roads in Jackson; a 10-mile extension of the current rail trail linking Jackson with another small village; new bike racks installed in downtown area; bike carriers installed on all city transit buses. **Comparator** No comparator **Data Collection:** Volunteers were deployed to observe 10 intersections throughout Jackson in August 2005 (baseline) and August 2006 (follow-up). Intersections chosen by authors to represent a wide variety of streets (residential / commercial) including streets which were due to receive an intervention between baseline and follow-up. Observations took place on the same days of the week and times of day (7-9.30am, 11-2pm, 4.30-6.30pm) at both baseline and follow-up. Which days of the week were observation days, and how	**Intervention:** Improvement of cycle infrastructure for active commuting **Control:** No control **Outcomes** Number of active commuters observed over the observation period: At baseline, 1,028 active commuters were recorded. This increased to 1,853 at follow-up, an increase of 63%. Mode split of active commuters observed over the observation period: Of those observed at follow-up, 67% were walking, 30% were biking, and 3% were using skateboard / rollerblades / another form of active transport. Cycling habits: Of the 558 cyclists recorded at follow-up, 69% used the pavement for part of their travel. Authors report that this figure was lower on streets where there were bike lanes – no figures reported to support this statement). Only 14% of cyclists observed at follow-up were wearing helmets. Baseline figures for these outcomes are not reported by the authors – it is unclear whether they were collected. **Analysis** Descriptive statistics only – no statistical significance or confidence intervals are given. There are no splits between types of user (gender etc) or use at different times of day / different days of week.	**Limitations identified by the author** Observational studies can be influenced year to year by "summer road construction projects" (authors state), by volunteer error, and weather patterns. **Limitations identified by the review team** It would not have been possible for volunteers to identify who was actively commuting and who was undertaking physical activity at the same time but not for commuting purposes. Likely to have overestimated numbers commuting, but consistently at both time points. Little data given about baseline levels of active commuting / other behaviours, so few comparisons can be made. Volunteers used to observe – there is no mention of training, so it is possible that the counts are unreliable. Unclear how long observation periods are for. They are also conducted in August, which is likely to have fewer weather-related barriers to active commuting than other times of year - results could be overestimated (but both time points use August data) **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
Mott Foundation, Jackson County Community Foundation, Community Energy Projects (Michigan Department of Energy), Speckhard Knight Foundation, Consumer's Energy Foundation, Michigan State Medical Society Foundation, Michigan Nutrition Network, and Fitness Council of Jackson members and sponsors.		many observation days took place at each time point is not reported.		Other outcomes: The study includes many other aspects to increase physical activity (PA) including Safe Routes to School measures (looks at behavioural interventions only so outside of scope of guideline) and other workplace initiatives which are in early stages so authors were not able to present any data. Only this intervention was relevant and with appropriate data. Power not reported.

80 Hunter et al 2009

Study details	Population	Intervention/ comparator	Results	Notes
Reference Hunter et al 2009 **Quality score** - **Study type** Uncontrolled before and after study **Location** USA – St Petersburg, Florida **Study aims** To investigate the effect of installing bicycle lanes along two roads with previously low levels of bicycling, on the amount of bicycle riding **Length of follow up** Time between intervention and follow-up data collection unclear: Maximum of 5 or 11 months (depending on intervention street)	**Number of participants** Bicycles at baseline (including counter-flow cycling): 8,257 Bicycles at follow-up (including counter-flow cycling): 13,238 Numbers without counter-flow cycling are not explicitly given, the below are calculated by NICE team based on data provided in paper: Baseline: 6,171 Follow-up: 10,066 Individuals cannot be calculated as multiple trips could have been undertaken by the same participant. **Participant characteristics** No details given about participants in any part of the paper **Inclusion criteria**	**Intervention** Installation of on-street bicycle lanes along two streets (31st Street and 37^{th} Street). 31^{st} Street: carries about 4,000 vehicles over a 24 hour day. Variable lanes – roughly half 4 lanes, half 2 lanes. 6.2 mile stretch 37^{th} street: carries about 1,800 vehicles over a 24 hour day. This stretch was 2 lanes both before and after intervention. 4.6 mile stretch. **Comparator** No comparator **Data collection:** Portable road tube counters with vehicle classification software were used to gather data. This is a device which uses pneumatic tube axle sensors to record each axle of a passing vehicle, categorising them by type. <u>31^{st} street:</u> Baseline data was collected in Winter 2005, Spring 2006 and Autumn 2006. Follow-up data was collected in Summer 2007, Spring 2008 and Autumn 2008.	**Intervention:** Introduction of on-street bike lanes along 2 portions of existing roads **Control:** No control **Outcomes** <u>Count data: Difference between baseline and follow-up (5-11 months)</u> Overall, there was a 17% increase in number of bicycles counted per day after installation of the bike lanes (averages: baseline = 9.06, follow-up = 10.49). This includes the outlier detailed below. This is statistically significant (p = <0.0001). The change in number of bicycles counted in weekdays was statistically significant at the 0.05 level (p = 0.0001). The change observed over weekend days was not significant (p value not given). 31^{st} street (maximum 11 months follow up): between baseline and follow-up, average numbers of bicyclists per day decreased from 10.43 to 10.22 (change was not statistically significant p = 0.438). This includes one count location which was an **outlier** (baseline: 31.06 to follow-up: 7.89). Reasons for this are unknown. Excluding this particular location, 31^{st} street saw an increase between baseline and follow up of 11% (9.32 to 10.36) – significance is not reported for this change. 37^{th} street (maximum 5 months follow up): between baseline and follow-up, average numbers of bicyclists per day increased by 42%, from 7.59 to 10.74 (change was statistically significant, p = <0.0001). Study authors suggest that other factors such as characteristics of the road may have affected bicycle use. 37^{th} street, the site with greatest increase of bicycles counted, is reported as being largely residential and quiet. 31st street is described as commercial and as a "citywide collector" that moves traffic to arterial roads. Authors speculate that 37^{th} street may be viewed as safer – however this is not assessed as part of this study. <u>Counter-Flow cycling:</u> Counter-flow cycling was removed from most of the analysis, but were included in latter parts to see whether their inclusion altered the	**Limitations identified by the author** Analysis does not account for other factors which could have impacted on bicycle frequency, such as trends in population and demography, or transport mode change due to increase in price of gasoline in 2008. **Limitations identified by the review team** Data was only collected in Summer at follow-up, rather than baseline. It is feasible that more people cycle during summer, inflating follow-up numbers. During baseline data collection, counter tubes could only cover about one quarter of the traffic lane. Therefore if a cyclist was further into the lane than this, they would be missed (at follow-up, the whole of the bike lane was covered). No participant characteristics collated, therefore differences between before and after

Study details	Population	Intervention/ comparator	Results	Notes
Source of funding Florida Department of Transportation	Any bicycles cycling with the flow of traffic past pre-determined observation points on one of the two selected street sections. **Exclusion criteria** Pedestrians, motor vehicles. Counter-flow bicycles were removed from most of the analysis.	<u>37th street:</u> Baseline data was collected in Winter 2005, Autumn 2006 and Spring 2007. Follow-up data was collected in Autumn 2007, Summer 2008 and Winter 2008. Counts were taken for a week at each data collection timepoint (3 timepoints at baseline for each street, and 3 at follow-up for each street) by MetroCount 5600 (objective counting device). Days were 24 hours. Bicycles were detected by wheelbase, and restricted to equal to or less than 22mph. 31st street had 10 count locations in each direction, 37th street had 9 in each direction (38 total). Each location was near an intersection, and at each location 2 counters were used.	outcomes. When including all bicycles (both with- and counter-flow), outcomes do not appear to change dramatically (no significance reported for this analysis). 31st street sees a slight increase of 0.5% (from 14.32 at baseline to 14.39 bicycles per day at follow-up) and 37th street sees an increase of 35% (9.78 at baseline to 13.20 bicycles per day at follow-up), similar to analysis excluding counter-flow cycling. For 31st Street overall, 27% rode wrong way before bike lanes and 29% after. For 37th Street overall, 22% rode wrong way before bike lanes and 19% after. <u>Speed</u>: Cycling speed averaged over all baseline measured days (11.82 mph) was compared with speed averaged over all follow-up measured days (11.82 mph). Counter-flow bicycles were excluded. When conducting a log-linear model for average speeds, the ratio of average speed at follow-up to average speed at baseline was 1.009, implying a 0.9% increase. It is unclear why this is not apparent in the averaged totals presented above – perhaps due to authors rounding. This increase is not statistically significant (p = 0.14). **Analysis** Bicycles travelling against the flow of traffic (the wrong way) were removed from the general analysis, and only included in latter stages (see above). A camera study was taken at 2 locations (more details not given) and results were in agreement with findings from tube counters about numbers. Negative binomial regression models were used to estimate statistical significance.	groups, or between cyclists on 31st and 37th street cannot be investigated. Lack of clarity around length of time between intervention and follow up mean data may have been collected very soon after lanes opened, before behaviour had a chance to change. **Other comments** Statistical significance p = 0.05 Power not reported. Other outcomes: No other outcomes reported in this study.

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82 Krizek et al 2009

Study details	Population	Intervention/ comparator	Results	Notes
Reference Krizek et al 2009 **Quality score** - **Study type** Controlled before and after study **Location** USA, Minneapolis, Minnesota **Study aims** To determine the effect of constructing bicycle facilities, including on-street and off-street bicycle paths and bridges, on journey to work bicycle mode share (share of communing journeys made by bicycle)	**Number of participants** Baseline (1990): unclear. Figures appear to have been calculated from "sample means". Follow-up (2000): 212,963 **Participant characteristics** Statistical significance of differences between areas is not reported. Buffer Zones 1 and 2 (see intervention areas for definition): 43% have income <$15,000 or >$45,000, 72% have peak age for probability of cycling (18-44). Area outside of buffer zones (further from intervention area): 37% have income <$15,000 or >$45,000, 69% have peak age. Suburban Traffic Analysis Zones (TAZs; see data collection section for details). 45% have income <$15,000 or >$45,000, 62% are in peak age group.	**Intervention** 7 interventions conducted between 1990 and 2000 (dates for each not given). 2 towns are represented: Minneapolis and St Pauls. 4 intervention sites are in St Paul, 3 (including a University site) are in Minneapolis. Interventions are 'striping' of on-street bicycle lanes at 2 locations; creation of separate off-street bicycle paths and trails at 5 locations, connecting particularly employment and residential sites, rather than facilities around lakes for example. Separately, 2 new and 2 improved bridges crossing the Mississippi river are considered. **Comparator** Traffic Analysis Zones with central points greater than 1.6km away from an intervention site. **Data Collection:** Pre-set Traffic Analysis Zones (TAZ) are areas of land defined by government – typically 100-400 metres across. These are used to define areas for analysis in these studies.	**Intervention:** All areas close to any of the 7 interventions (see Data Collection for definition of 'close'). Interventions are on-street and off-street bicycle paths, and improvements to existing bridges and creation of new bridges for cycling. **Control:** Areas further from any of the 7 interventions. **Outcomes** <u>Grouped Interventions vs Control: bicycle mode share change 1990 – 2000 (SD)</u> Buffer 1: Bicycle mode share increased from 1.563% of all journeys (baseline) to 1.775% (follow-up), a significant result (authors report that change is greater than 2 standard deviations (SDs) of the baseline proportion). Buffer 2: Bicycle mode share increased from 1.023% to 1.491% (2 SDs). Traffic analysis zones (TAZs) outside the buffer zones (control) also increased from 0.510 to 0.627% (2 SDs). <u>St Pauls and Minneapolis (the two intervention towns): bicycle mode share change 1990 – 2000 (SD)</u> St Paul saw a greater increase in bicycle mode share between baseline and follow-up in Buffer 1 (0.559% to 0.797% of all journeys, 2 SDs) than in Buffer 2 (0.493% to 0.408%, 0 SDs). St Paul's control area outside buffers saw an increase of 0.476% to 0.566%, 1 SD). Minneapolis on the other hand saw a greater increase in Buffer 2 (1.309% to 2.081%, 2 SDs) than Buffer 1 (2.423% to 2.557%, 1 SD) between baseline and follow-up. Minneapolis' control area outside buffers saw an increase of 0.530% to 0.554%, 1 SD. When analysed by individual intervention sites (n = 7), all increased significantly when combining Buffer 1 and 2 (2 SDs) with the exception of the University of Minnesota (3.515% to 3.280%, 0 SDs). However, the University had the highest level at baseline. Greater proportional increases were seen in St Paul's intervention areas, compared with Minneapolis' intervention areas, as shares were lower initially.	Linked study: Poindexter et al 2007 **Limitations identified by the author** Facilities might be the effect, rather than the cause, of high bicycle use because people lobbied for the construction of such facilities. Minneapolis intervention areas already had higher bicycle mode share at baseline. Individuals included in traffic analysis zones (TAZs) in which make up the buffer zone for a particular intervention may in reality be prohibited from using it due to infrequent entry points on to the trail or other reasons. **Limitations identified by the review team** Number of participants in 1990 are not reported, and figures are not explained other than as "the number that would be expected based on the sample mean". Characteristics at baseline (outcome and demographic) are not fully outlined, or compared between groups for significant differences. Follow-up time is not clear, as dates of intervention implementation are

Study details	Population	Intervention/ comparator	Results	Notes
between 1990 and 2000. **Length of follow up** 10 years between baseline (1990) and follow-up (2000). Interventions enacted in 1990s, but no exact dates or years given. **Source of funding** Active Communities Transportation Research Group, University of Colorado.	**Inclusion criteria** Individuals included in the Census Transportation Planning Package data (see "Data Collection"), who commute to a place of work. **Exclusion criteria** None given. Implied that those who do not commute are excluded, and those outside of the geographical area under study.	**Intervention areas:** **Buffer 1:** this analysis group consisted of TAZs with a central point within 1.6km of any intervention site (commuters N = 170,000) **Buffer 2:** Consists of an extension of the buffer at either end of the trail for 0.8km, a method which the authors state "assumes that a facility might have more influence near its ends". (Commuters N = 50,000). It is assumed that the total combined for buffer 1 and buffer 2 is 220,000. **Control areas:** TAZs outside of the areas above were used as control (commuters N = 100,000). Census Transportation Planning Package (CTPP) provided data for both 1990 and 2000. It reports mode choice at TAZ level. Method used to collect this information is not reported. Intervention sites use data that place commuters by their household residence.	Bridges: bicycle mode share change baseline (1990) to follow-up (2000) (SD) Trips crossing the river by bicycle increased significantly (3.021% to 4.604% of all journeys crossing the river, 2SDs). This was in a context of generally increasing bicycle mode share: trips which both originated and terminated east of the river also increased (1.982% to 2.775%, 2SDs), as did those originating and terminating west of the river, although to a lesser extent (2.228% to 2.585%, 1 SD). **Analysis** Changes in bicycle commute share are reported, and significance is determined by calculating the number of standard deviations by which the observed number of bicycle commuters in 2000 exceeds the number that would be expected based on the sample mean in 1990. This is reported as 2, 1, 0, -2 or -2 (2 is at least 2, 1 is at least 1, 0 is less than 1.)	not given. It is possible that behaviour has not had time to solidify. **Other comments** Other outcomes: This extraction is linked to Poindexter et al 2007, which also reports on this same data with the same results. Poindexter also includes an analysis of adverse events which is included in the Poindexter data extraction. This intervention has a high commuter-focus Smaller minor improvements (i.e. short lane stripings) were not included in analysis. Minnesota University is included in this study. Universities may not be representative of cycling habits of general population (authors report that they tend to have higher cycling levels). 1.96 SDs is generally accepted to signify statistical significance. No P-values reported in this paper. Power not reported.

85 Parker et al 2011

Study details	Population	Intervention/ comparator	Results	Notes
Reference Parker et al 2011 **Quality score** - **Study type** Uncontrolled before and after study **Location** USA - New Orleans **Study aims** To examine the impact of 'striping' a new bike lane on the number of people observed cycling, and the demographic composition of cyclists. **Length of follow up** 6 months between 'striping' of the new bike lane and follow-up data collection.	**Number of participants** Approx. total cycling trips (calculated by review team as daily averages totalled multiplied by the number of days observed): Baseline: 1,205 Follow-up: 2,638 Individuals cannot be calculated as multiple trips could have been undertaken by the same participant. **Participant characteristics** The intervention site is between 2 neighbourhoods in New Orleans that are socio-demographically different. The proportion of African-American residents is 87% above and 18% below St. Claude Avenue, with 45% below the poverty line above St. Claude and 19% below. There are an average of 1.0 cars per household above St. Claude and 1.3 cars below. No participant information (gender, age etc) is given for cyclists observed at baseline. **Inclusion criteria**	**Intervention** 3.1 miles of dedicated on-road bike lane (clearly striped) installed on both sides of the road in New Orleans. Striping is not described in the paper, but a photograph included illustrates demarcation of the boundaries of the bike lane in white paint, arrows in the direction of travel, and a painted logo of a bicycle to signify the lane is for cyclists only. The bike lane is 5 foot wide and is in between the travel lane and the parking lane. Bike lane is on an "urban principal arterial street". The intervention street has a speed limit of 35mph. Daily traffic is reported as 23,216 vehicles in 2008. It is also a truck route. The area around the bike lane is a mix of schools, businesses, a police station, and residential streets. **Comparator** No comparator **Data Collection:** Pairs of trained observers used specifically designed tally forms to count cyclists at baseline and 6-month follow-up, at one point on the intervention street. At baseline, counts	**Intervention:** 3.1 miles of new and striped on-road bike lane on both sides of a road in New Orleans **Control:** No control **Outcomes** <u>Change in number of cyclists, between baseline and 6-month follow-up (average number per day [Standard Deviation])</u> There was a statistically significant increase in number of cyclists between baseline and 6-month follow-up: 90.9 (±21.7) to 142.5 (±). p=<0.001. <u>Demographic changes between baseline and 6-month follow-up (average number per day)</u> There was a 133% increase in the average daily number of women riders observed in the street (12.6 versus 29.4; p=<0.001) and a 44% increase in the average number of male riders observed (77 versus 111.2; p=<0.001). Whether the difference between change in women and change in men is statistically significant is not reported. There were very few children observed at both times (actual numbers of children at each timepoint not provided). <u>Cycling habits change between baseline and 6-month follow-up (average number per day)</u> The proportion of cyclists riding with traffic increased (73.3% to 81.8%; p=<0.001). The proportion of cyclists riding on the sidewalk did not significantly change after the intervention (24.6% to 24.4%, p=0.90). **Analysis** To test the hypothesis that the number of cyclists would increase between baseline and 6-month follow-up, negative binomial regression was used. Unit of analysis was 'a day'.	**Limitations identified by the author** No comparison street is included to address potential displacement from other streets without lanes. Rising costs of car ownership and gas prices could contribute to decisions to cycle rather than drive – these factors were not assessed. Increases observed could simply be due to increases in the population in the area as people return after the hurricanes of 2005. **Limitations identified by the review team** 1 year between baseline data collection and follow-up data collection could be long enough for other factors to influence the increase in cyclists on the intervention street. The use of tally forms rather than mechanical counts could introduce random or systematic error.

Study details	Population	Intervention/ comparator	Results	Notes
Baseline data collected November 2007, intervention implemented in Spring 2008, and follow-up data collected in November 2008. **Source of funding** Centers for Disease Control and Prevention, Prevention Research Centers Program.	All cyclists using the new bike lane (at follow-up), or the same stretch of road at baseline. **Exclusion criteria** Cyclists on other roads. Pedestrians or users of other transport modes on the intervention street.	were taken for 10 days: 8 weekdays and 2 weekend days. At 6-month follow-up, counts were taken for 14 days: 10 weekdays and 4 weekend days. Counts took place between 8am and 5pm (9 hours). Observers collected data on the number of men, women, adults and children riding a bicycle with traffic, against traffic, and on sidewalks. Counts were totalled for each hour and day, and means and standard deviations were calculated.	To test the hypotheses that a) the proportion of people riding *with* traffic rather than against it would increase and b) that the proportion of people riding on the street instead of on the sidewalk would increase, binary logistic regression was used. Unit of analysis was individual cyclists.	Only one point of the 3.1 mile long lane was observed, which could be either a busier or a quieter point on the road. More points could be observed to assess changes along the lane. **Other comments** Significance is *P* = 0.05 Power not reported Other outcomes: No other outcomes reported in this study.

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87 Parker et al 2013

Study details	Population	Intervention/ comparator	Results	Notes
Reference Parker et al 2013 **Quality score** - **Study type** Controlled before and after study **Location** USA - New Orleans **Study aims** To examine the impact of striping a new bike lane on the number of people observed cycling and to determine if more people chose to ride with the flow of traffic and on the street, rather than the sidewalk, when compared with streets with no bike lane, and compared with the same location prior to bike lane striping. **Length of follow up** 3 months between striping of the new bike	**Number of participants** Approx. total trips (calculated by review team as daily averages totalled multiplied by the number of days observed)): Baseline: 625 Follow-up: 1,100 Individuals cannot be calculated as multiple trips could have been undertaken by the same participant. **Participant characteristics** Intervention and control sites are located between two contrasting neighbourhoods. Residents living in one of these neighbourhoods were 58 % African American, 33 % below the poverty line, and 35 % without access to a car. Residents in the other neighbourhood were 28 % African American, 26 % below the poverty line, and 18 % without access to a car. Intervention street at baseline, average number of cyclists per day: 48.9 white cyclists, 22.8 black cyclists. 3.6 youth cyclists, 74.9 adult cyclists.	**Intervention** 1 mile of dedicated on-road bike lane installed and clearly striped on both sides of the road in New Orleans. The paper offers no definition of striping, but a definition taken from a previous paper by the same authors shows images of striping as demarcation of the boundaries of the bike lane in white paint, arrows in the direction of travel, and a painted logo of a bicycle to signify the lane is for cyclists only. The bike lane is 5 foot wide and is in between the traffic lane and the parking lane. Bike lane is on an "urban principal arterial street". The intervention street has a speed limit of 35mph and has a streetcar running in the median (60-foot gap between traffic lanes). Daily traffic is reported as 23,900 vehicles in 2008. The area around the bike lane is low density	**Intervention:** One mile of new and striped on-road bike lane on both sides of a road in New Orleans **Control:** 2 roads adjacent to intervention road, with no bike lanes **Outcomes** Follow-up data collected 3 months after bike lane striping was completed <u>Between groups: Cyclists at baseline (average number per day [Standard Deviation])</u> In the intervention street at baseline, there were 79.2 (±30.5) bicycles per day on average, compared with an average of 54.4 (±24.1) on the control streets. This difference was statistically significant (*Z*=43.58, *p*=<0.000). <u>Change in number of cyclists, between baseline and 3-month follow-up (average number per day [Standard Deviation])</u> When figures for all 3 streets were combined, there was a statistically significant increase in number of cyclists overall between baseline and 3-month follow-up: 62.5 (±28.8) to 110 (±109). *Z*=8.97, *p*=<0.000. In the intervention street, there was a statistically significant increase from 79.2 (±30.5) at baseline, to 257.1 (±50.9) at 3-month follow-up (Z=10.79, *p*<0.000) On the control streets, daily average of bicycles decreased from 54.4 (±24.1) to 36.4 (±16.1) (Z=-10.79, *p*<0.000). This suggests there may have been displacement of some of the cyclists using the control streets to the intervention street. <u>Change in number of cyclists, intervention v. control (average number per day [Standard Deviation])</u> Average numbers of cyclists per day increased by 177.9 in the intervention street, and decreased by 18 in the 2 control streets combined. This was statistically significant (*Z*=24.27, *p*=<0.000).	**Limitations identified by the author** A novelty effect could have inflated results, as follow-up took place only 3 months after intervention introduction. This study took place in a neighbourhood where car ownership was low and walkable destinations are high – other neighbourhoods may not see such significant increases in ridership. No data on trip purpose was collected to ascertain any change. **Limitations identified by the review team** 1 year between baseline data collection and follow-up data collection could be long enough for other factors to influence the increase in cyclists on the intervention street (intervention was completed 9 months into this 1-year period, i.e. 3 months before follow-up data collection)

Study details	Population	Intervention/ comparator	Results	Notes
lane and follow-up data collection. Baseline data collected September 2009, intervention implemented in June 2010, and follow-up data collected in September 2010. **Source of funding** Robert Wood Johnson Active Living Research Rapid Response Program, Prevention Research Centers Program of the Centers for Disease Control and Prevention, ASPH/CDC Environmental Health Scholarship, HRSA MCHB Maternal and Child Health Epidemiology Doctoral Training Program.	Control streets at baseline, average number of cyclists per day: 32.7 white cyclists, 16.6 black cyclists. 1.6 youth cyclists, 52.4 adult cyclists. No percentages can be calculated as "other" categories were present for race and age, but numbers were not presented in the report. Statistical significance of differences was not reported for any of these data. **Inclusion criteria** All cyclists using the new bike lane, or a pre-defined stretch of standard road on the control streets. **Exclusion criteria** Cyclists on other roads. Pedestrians or users of other transport modes on the intervention / control streets.	residential and commercial (public and private schools, churches and businesses along the corridor). A park is at one end. **Comparator** Two adjacent streets without bike lanes. Similarity of control streets to intervention street not discussed. They are adjacent and so geographically very close.	Sidewalk riding: Proportion of riders using the sidewalk instead of the street did not change from baseline to follow-up in the intervention street (baseline 93 %, follow-up 93 %; Z=−0.24, p=0.81). However, there was a significant decrease in the proportion of people observed riding in the street on the side streets after the lane was installed on S. Carrollton (baseline 99.5 %, follow-up 97.8 %; Z=−4.03, p<0.000). Counter-flow riding: At follow-up, the proportion of riders traveling with traffic increased in the intervention street (baseline 92.8 %, 3-month follow-up 95.6%; Z=2.93, p<0.003). Over the same time, the proportion of people traveling with traffic decreased in control streets (baseline 96.6 %, follow-up 93.5 %; Z=−3.05, p=0.002). This is not explained by the authors. **Analysis** <u>Data Collection:</u> Pairs of trained observers used standardised tally forms to record cyclists at baseline and 3-month follow-up for 10 days at each point. Of these 10 days, 6 were weekdays and 4 were weekend days. Counts took place between 7am and 6pm (11 hours). Observers were only certified for data collection when their agreement within pairs was >80% about characteristics of cyclists (on location of cyclist [street / sidewalk / neutral ground], gender, age group, and race). To test the hypothesis that more people would be observed cycling on the intervention street after the intervention, negative binomial regression was used, unit of analysis was day and outcome was number of people observed cycling. To test the hypothesis that people would be more likely to ride *with* traffic, and in the bike lane (as opposed to on the pavement), binary logistic regression was used, unit of analysis was individual cyclists and the outcome was binary.	It appears that tallies were taken rather than counts using objective tools – this could introduce bias if counters were aware of intervention and control status, which is likely: however, human error may be more likely **Other comments** Significance is *P* = 0.05 Power not reported Other outcomes: No other outcomes reported in this study.

88 Poindexter et al 2007

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Poindexter et al 2007

Quality score

-

Study type
Controlled before and after study

Location
USA, Minneapolis, Minnesota

Study aims
To investigate the effect of building a bicycle facility (an off-street bicycle ‘expressway’ with on-off ramps) on the number of bicycle crashes in the area (safety analysis). [Lined to study by Krizek determining the effect of bicycle facilities on commuting journeys].

Length of follow up
Safety analysis: Baseline data 1998-2000, intervention implemented in 2000, follow-up data collected 2001-2002.

Source of funding
Midwest Regional University Transportation Center.</td>
<td>Number of participants
Participant numbers not given [also see Krizek 2009]

Participant characteristics

No characteristics reported for safety analysis.

For linked paper by Krizek 2009 statistical significance of differences between areas is not reported.

Inclusion criteria

Cyclists who have undergone an accident which resulted in either bodily injury or $1,000 in property damage

Exclusion criteria
Those cycling outside of the defined area, without accidents, or having accidents which were not reported / caused no bodily injury and less than $1,000 property damage.</td>
<td>Intervention
Midtown Greenway phase-1 (opened in 2000). The Greenway is an off-street bicycle facility. Traffic free, with pedestrian lanes separated from cycling lanes. Part of larger network of 73 miles of continuous off-street cycle facilities.

Comparator
None

Data Collection:
A zone of 2.5km around the intervention Greenway was measured. Baseline was 3 years prior to Greenway construction. Number of accidents at baseline was compared with number of accidents after construction.</td>
<td>Intervention: a new Greenway for cyclists.
Control: none.

Outcomes
At baseline, there were 78.33 (SD 8.33) crashes/year within the 2.5km area around the intervention site. At 1-2 year follow-up, after the bicycle greenway was opened, this reduced to 50 crashes/year (no standard deviation reported). Authors report that this is a significant difference, but no p-value or SD given. When buffer area is stratified by distance from intervention greenway (0.5km categories), this decrease is only significant in 0.0km-0.5km and 0.5km-1.0km categories:

<table>
<tr><th>Buffer area</th><th>Crashes per year at baseline</th><th>Crashes per year at 1-2 year follow-up</th><th>Significance</th></tr>
<tr><td>0.0-0.5</td><td>26.67</td><td>12</td><td>Significant</td></tr>
<tr><td>0.5-1.0</td><td>17</td><td>15</td><td>Significant</td></tr>
<tr><td>1.0-1.5</td><td>15.67</td><td>8.5</td><td>Not significant</td></tr>
<tr><td>1.5-2.0</td><td>13</td><td>8.5</td><td>Not significant</td></tr>
<tr><td>2.0-2.5</td><td>6</td><td>6</td><td>Not significant</td></tr>
</table>

Analysis
Significance determined by Standard Deviations (SDs). If no significant difference, the Greenway should have numbers of accidents within 1 SD of baseline.</td>
<td>Linked study: Krizek et al 2009

Limitations identified by the author
None

Limitations identified by the review team
Data on cycling accidents only record those which either resulted in bodily injury or $1,000 in property damage: likely to involve a car to meet these requirements. Therefore cycle-cycle accidents may be under represented and therefore even if they increased between baseline and follow-up, this may not be identified.

Other comments
These results are closely linked to Krizek et al 2009, which reports full results on the count intervention. This paper also included some but not all of the results reported by Krizek et al 2009 and are therefore not extracted here.

1.96 SDs is generally accepted to signify statistical significance. No P-values reported in this paper.

Power not reported

Other outcomes: no other outcomes reported in this study, with the exception of those found in the Krizek data extraction.</td>
</tr>
</table>

89 **Rissel et al 2015**

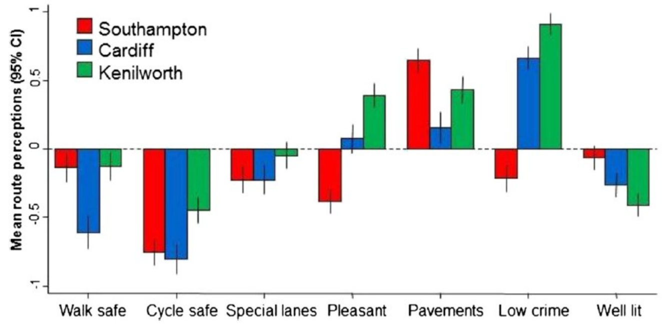
Study details	Population	Intervention/ comparator	Results	Notes
Reference Rissel et al 2015 **Quality score** - **Study type** Controlled before and after study (authors call this a longitudinal, quasi-experimental design) **Location** Australia - Sydney **Study aims** To assess the short term impact of new cycling infrastructure on awareness of and use of the new infrastructure,	**Number of participants** Survey: N = 846 (baseline) N = 512 (follow-up) (control = 272, intervention = 240) Response rate 60.5% Counts (for both count locations in Sydney combined: one at the northern end and one half way along intervention route) (cyclist frequency, not individuals): 1,013 (baseline) 1,396 (follow-up) **Participant characteristics** Intervention and control demographic information not reported separately, and any differences between groups not reported. *Baseline characteristics for intervention and control combined (N = 846):* 17.6% 18-24, 25.3% 25-34, 25.7% 35-44, 31.4% 45-55. 41.9% Male, 58.1% female. 30.4% had	**Intervention** The intervention was a 2.4km long new bicycle path built by the City of Sydney as part of its expanding bicycle network. The path is bi-directional and separated from motor-vehicles. It appears (not explicitly stated) that the path is alongside / parallel to a vehicle road. Participants lived no more than 2.5km from the intervention site. **Comparator** Neighbourhoods a similar distance from the central business district and with similar demographic profile to the intervention area, where there were no plans to modify infrastructure. **Data collection:** Survey: At baseline, participants were recruited through an online consumer panel / cold calling / social media / electronic mailing lists / intercept events. An online questionnaire was sent to participants along with an online 7 day travel diary (results not included in this study). One year later, participants were sent the follow-up questionnaire which included questions to examine awareness of and use of new bicycle path. The questionnaire assessed the following: • Travel behaviour: Participants were asked whether they had access to a bike (binary response); their cycling	**Intervention:** 2.4km new bicycle path **Control:** similar neighbourhoods with no intervention **Outcomes** Bike Counts at 4 months follow up (intervention site only) Number of bikes counted through City of Sydney bike counts increased by 23% (812 cyclists at baseline, and 1001 cyclists at 4-month follow-up) and 97% (201 cyclists at baseline, and 395 cyclists at 4-month follow-up) at the two bike count sites located on the intervention route. The change in rates of cycling between baseline and 4-month follow-up across the whole of the City of Sydney was a 3% increase. No significance reported for these figures. Use of Bicycle Path at 4 months follow up: comparison between control and intervention groups at 4-month follow-up (Adjusted Odds Ratio [Confidence Interval], P-Value) Intervention groups showed statistically significantly higher awareness of the new cycle path than control group at 4-month follow up (60% aware compared with 19% aware, 5.99 [3.87–9.27], p = <0.001). Intervention group were also significantly more likely to use the new cycle path (23.8% compared with 7.0%, AOR = 3.58 [2.01–6.40], p = 0.001. This is assumed to be percentage of participants who have used the cycle path at all). Intervention group significantly more likely to respond that they are "likely or very likely" to use the new cycle path in the future (35.8% compared with control 15.8%, 2.77 [1.76–4.37], p = <0.001). However, there was no significant change over time of proportion of people reporting that they had cycled in the past week (intervention baseline = 29.2%, follow-up = 25.8%. Control baseline = 22.4%, follow-up = 23.2%. (P value is 0.2; unclear whether this is difference between change scores intervention vs control, or difference in follow-up score [intervention vs control] alone), meaning the cycle route could be funnelling existing riders to the new cycle path (baseline here includes only those who also completed a follow-up survey i.e. control = 272, intervention = 240)	**Limitations identified by the author** Count data was of all cyclists through the intersection, not only those cycling along new bicycle path. Authors state that the sample (unclear whether survey, count, or both) may not be representative of inner Sydney population as too many young people recruited. Loss to follow up reduces power of analysis. Neighbourhood perception questions not validated. **Limitations identified by the review team** Demographic composition changed significantly between baseline and 4-month follow up in the following ways: significantly more earned $80k (AUS) or over (*p* = 0.03) and were aged 44-55 (*p* = <0.001) at follow-up. This could confound, although awareness, use and future intention to use were adjusted for age, sex, education and income.

Study details	Population	Intervention/ comparator	Results	Notes
and explore changes in cycling behaviour. **Length of follow up** 4 months between intervention implementation and follow-up data collection. Baseline data was collected online in Sept/Oct 2013. Intervention was implemented in June 2014, follow-up data was collected in Sept-Oct 2014. **Source of funding** Australian Research Council Linkage Grant	less than tertiary education, 69.6% had tertiary education or higher. 37.3% earned less than $80k (AUS), 62.7% earned $80k (AUS) or more. **Inclusion criteria** Geographical constraints (Intervention: residential postcode within 2.5km of the nearest point of the bicycle path in Sydney. Control: within control neighbourhoods in Sydney), aged 18-55 years, had ridden a bicycle before, no current disability preventing them from cycling; sufficient English to participate. **Exclusion criteria** Outside of geographical or age limits, inability to ride a bicycle, those with a disability, or with insufficient English to participate.	frequency (seven frequency categories); usual travel to work/study (public transport, motor vehicle, bicycle, walking, no travel). • Demographic information: Sex, age, education level, annual household income. All dichotomised to increase statistical power. At follow-up, the following section was added: • Neighbourhood perceptions: participants answered questions on feeling connected to neighbours, perceived pleasantness of neighbourhood, perceptions of how many people walked or cycled in the neighbourhood, all compared with 12 months ago. <u>Counts:</u> Counts were undertaken by City of Sydney in October 2013 and October 2014, outside of the process / control of this study. Two count locations happened to be on intervention route (one at the northern end, one half way along), and so the data they recorded were used. Any cyclist moving in any direction was counted. Counts taken for 3 hours in morning and afternoons (6am-9am, 4pm-7pm) at each location. Number of days not specified – implied that counts taken on one day only. Day not specified.	<u>Neighbourhood Perceptions (Adjusted Odds Ratio [Confidence Interval], P-Value)</u> Participants in the intervention area were significantly more likely to agree/strongly agree that compared to 12 months ago there were more people walking (54 % Vs 38 % AOR = 2.04, [1.37–3.03] p = <0.001) and more people cycling (75 % Vs 59 %) (AOR = 2.48[1.62–3.79], p = <0.001) in their local area, compared with participants in the control area. There was no significant difference in participants reporting that they felt more connected to their neighbours. <u>Bicycle path user characteristics</u> Compared with low intensity recreational riders, bicycle path users (from both control and intervention sites combined) were 4.38 times as likely to be a high intensity recreational rider (95 % CI 1.53–12.59, statistically significant), 2.42 times as likely to be a low intensity transport rider (95 % CI 1.17–5.04, statistically significant). They were not significantly more likely to be a high intensity transport rider (AOR 2.4, 95 % CI 0.9-6.44). Compared with those who ride their bike less than weekly, bicycle path users were 7.5 times as likely to ride their bike at least weekly (95 % CI 3.93–14.31, statistically significant). As distance from the bicycle path decreased (500 m increments), likelihood of using the bicycle path significantly increased (AOR = 1.24, 95 % CI 1.13–1.37). **Analysis** Characteristics of baseline and follow-up samples compared using Chi Square tests. McNemar and ANOVA tests used to compare sample characteristics of follow-up group for >2 categories. Changes in cycling behaviour over time tested using mixed-effects logistic regression. Awareness, neighbourhood perceptions, and demographic characteristics differences between control and intervention groups examined with logistic regression analyses. This was adjusted for age, sex, education and income.	Follow-up responders were significantly less likely (than baseline of 846 participants) to report cycling frequently, or to bicycle to work – this could be a change in behaviour, or mean those that dropped out were significantly different. Questions about neighbourhood perceptions may suffer from self-reporting bias or recall bias – instead of asking at baseline and comparing with follow-up, participants are asked to compare 1 year ago with present day themselves. They are also somewhat leading questions, which could skew results towards positive. However, the comparator somewhat controls for this. Dropout (whether they were significantly different from those that were retained, and whether dropout was skewed between intervention and control) is not reported. **Other comments** No power reported Significance is *p* = 0.05. Other outcomes: no other outcomes reported in this study.

90 Sahlqvist et al 2015

Study details	Population	Research parameters	Results	Notes
Full citation Sahlqvist et al., 2015 **Quality score** + **Study type** Mixed method study: survey data and qualitative interviews (linked to Goodman et al 2013b and Goodman et al 2014,both also extracted). **Location and setting** UK 3 Connect2 towns (Cardiff, Kenilworth, Southampton)	**Number of participants** Survey: Baseline 3,516. Follow-up 1 (*1 year after baseline):* 1,849 Follow-up 2 *(2 years after baseline)*: 1,510 Interviews: 17 **Participant characteristics** Survey: 54% of respondents were women, 13% were aged 18–34 years, 21% were aged 35–49 years, 33% were aged 50–64 years and 33% were aged 65 years or over. No detail of interview participant characteristics. This is the extent	**Intervention** Connect2 towns intervention details: The Cardiff project consists of a 140m traffic-free pedestrian and cycle bridge, which completes a 5km circular link connecting railway stations and suburbs to the city centre. It also includes feeder routes to and from the bridge to facilitate access and use. The Kenilworth project included the upgrade and creation of approximately 10 km of dedicated walking and cycling paths and a new bridge crossing a busy dual carriageway The Southampton project comprises a raised walkway built on top of a wave wall. It provides a north–south connection through the city and is intended to connect local people to the river and sea. **Data collection** <u>Interviews:</u> Semi-structured interviews conducted prior to the intervention. Authors state that this is to avoid risk of bias or post-hoc rationalisation due to participants knowing outcome of intervention. Most interviews were conducted face-to-face, the remaining were carried out by telephone (number of each method not given).	**Key themes** **Stage 1 (quantitative descriptive statistics from survey)** <u>Awareness</u> Cardiff: 2011 86%, 2012 91% Kenilworth: 2011 57%, 2012 71% Southampton: 2011 47%, 2012 55% <u>Use</u> Cardiff: 2011 48%, 2012 52% Kenilworth: 2011 28%, 2012 37% Southampton: 2011 19%, 2012 22% The most common type of use (both within walking and within cycling) at all locations is recreation (higher than social/leisure, shopping, work and education combined). **Stage 2a (qualitative interviews)** <u>Expected use and impact of the schemes</u> All three sites expected some impact on both recreational and utility walking and cycling. In Cardiff, emphasis was on commuting: "*people [will] commute into the Bay and Cardiff [City Centre]" Cardiff1* Kenilworth participants saw their intervention as largely recreational: "*it goes across some very beautiful countryside… some interesting sort of leisure walks or bicycle rides" Kenilworth6.* General utility journeys (shopping) expected less. Southampton expected use for both recreational and transport users, as the site linked with existing infrastructure: *"as it's part of the national cycle route… it will fit in with that" Southampton1.* Generally, authors state that emphasis was placed on cycling rather than walking, with cyclists more in need of safe routes. <u>Perceived need for the schemes</u>	Linked to Goodman et al 2013b, Goodman et al 2014 **Limitations identified by author** Authors did not mention any limitations **Limitations identified by review team** The number of interviewers for data collection is not clear – it is clear that there were at least two interviewers, this may result in inconsistencies in how questions were asked influencing the responses given. Potential Interviewer bias. Due to resurveying of the same residents awareness of the connect2 will definitely increase – this is not accounted

Aim of the study To examine differences in awareness of the local 'Connect2' intervention and the ways in which use of the intervention changes between three study sites using quantitative survey data, and to explain differences by integrating qualitative interview data from key informants. **Source of funding** One of the researchers were funded by Medical Research Council, Centre for Diet and Activity Research and National Institute of	of detail published in this paper; further detail reported in Goodman et al 2013b and Goodman et al 2014 (extracted separately). **Inclusion criteria** Core Survey participants: Adults living within the 5km by road of the planned Connect2 infrastructure Interviews: Purposive sampling was carried out: authors state that participants were key informants from relevant local and national stakeholder organisations (representatives of Connect2 steering groups, local authorities, cycling groups, building contractors, and Sustrans)	Topic guide contained open-ended questions about the background of the local Connect2 project; which groups within the local population (type of groups alluded to not specified) were expected to use the infrastructure; for what types of journeys; and to and from what destinations. Local interviews conducted by at least 2 researchers – exact number not clear Audio recordings were made and interviews transcribed verbatim. <u>Surveys</u>: Awareness (yes/no) and use (yes/no) assessed. Perceptions of local neighbourhood (defined as 10-15 minute walk around home) assessed using 13 items adapted from the ALPHA European Environmental Questionnaire (test-retest reliability reported as acceptable). All items 5-point Likert scale. **Method of analysis** <u>Structure of Analysis:</u> Authors split analysis into stages and report that they followed a "sequential and a parallel approach". <u>Stage 1</u>: Identifying differences in awareness of and use of the interventions between sites (obtained from quantitative data). <u>Stage 2a</u>: Assessing how schemes might influence walking and cycling (obtained from qualitative interview data)	Cardiff: current routes were considered unsafe: "*None of these routes are user friendly roads for pedestrians and cyclists" Cardiff1.* And the bridge would provide a more direct route into the centre – need relatively high. Kenilworth: An existing route was recognised to be of high standard and direct, although hilly and unpleasant. The new route would be good for young children, mothers, and older adults: *"as a weekend leisure route and as an introduction to cycling it is going to be very, very important" Kenilworth5.* The university's (not specified) travel plan changes reduced car parking spaces and removed free parking were expected to increase demand for walking and cycling. Southampton: Boardwalk added to existing routes (one through industrial estate, one a secluded informal path, both considered unsafe). "*It's only 400m long but it goes to many places" Southampton2.* <u>Visibility of the Schemes</u> Visibility recognised as important: "*there are some schemes that will be so visible that people will very quickly get it into their mental map and that's a phrase that's bandied around here" National1.* Recognition that residents may "*see, know, understand, get used to it" Natonal1* very quickly, or more gradually. <u>Scale of environmental change</u> Participants viewed coherence of routes as necessary for behaviour change. Cardiff participants in particular raised concerns about quality of feeder routes. Kenilworth's routes lacked continuity to High Street and large areas of the town. In Southampton the scheme was viewed by some participants as of insufficient size to create behaviour change. <u>Design features of schemes</u> Design was perceived to be important for increasing accessibility (i.e. width of the Cardiff bridge) and safety (i.e. lighting – Cardiff was lit, Kenilworth was not, passing through agricultural land); and reducing antisocial behaviour (an aim in Southampton). **Stage 2b (quantitative change in perceptions of route and neighbourhood from survey)** The chart below illustrates perceptions at baseline. It shows that at baseline safety for cyclists had the most negative perception, and presence of pavements was most positive. Southampton received negative results in the most categories.	for or mentioned by the authors **Other comments** The three sites were selected because they were accessible, had measurable population impact and provided some heterogeneity. No power reported. Other outcomes: No other outcomes / themes were reported in this study.

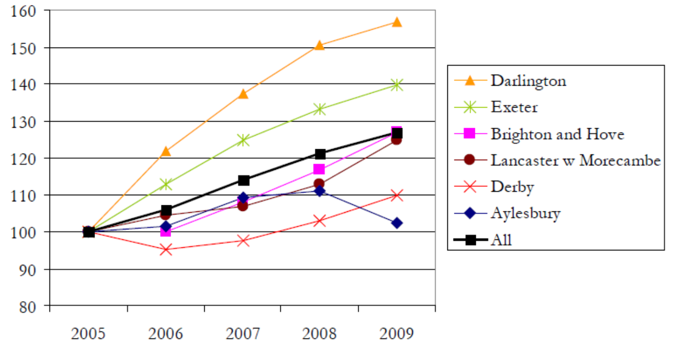
Health Research	**Exclusion criteria** Survey: those living >5km away from nearest entry point to an intervention. Children.	Stage 2b: Using data on route and neighbourhood perceptions to assess change over time (obtained from Likert questions in quantitative survey). Stage 1 was analysed first. Authors then analysed stages 2a and 2b in parallel, using these latter two to interpret findings from Stage 1 and explain unexpected outcomes. Qualitative Analysis (2a): Led by one researcher with peer-checking by other researchers. Familiarisation with transcripts was followed by examination and coding of data. Codes were put together into categories. Categories challenged by searching for contradictions. Iterative process through discussions with research team. Quantitative Analysis (1, 2b): Awareness and use data summarised using simple descriptive statistics. Route perceptions summarised by site and mean changes baseline to follow-up 1, and baseline and follow-up 2. Neighbourhood perceptions calculated for each perception item (6), for each of three sites, for participants living within 2km of infrastructure. Perception items are: safety for walking, safety for cycling, presence of special lanes, pleasantness, presence of pavements, having low crime, and being well lit.	 At follow up, one and two years post-baseline: Cardiff: statistically significant improvements were made between 2010 and 2011 in all perception item categories (CI on chart showing change scores do not include 0), and sustained between 2010 and 2012. Kenilworth and Southampton: results are less clear. In Southampton, small but statistically significant improvements in perceptions of cycle safety, special lanes, pleasantness and being well lit were seen between 2010 and 2012 (2011 results were smaller). Presence of pavements increased non-significantly, and walk safety and perceptions of low crime decreased non-significantly. In Kenilworth, statistically significant improvements were seen for special lanes and perceptions of pleasantness between 2010 and 2012. All other items also increased but were not statistically significant. Interpretation by authors: Use of the intervention routes were dominated by recreational users, which was not expected in all locations. Authors believe that the dominance of recreational use is a result of lack of continuous, dedicated walking or cycling routes. The interventions are all partial routes, requiring most commuters to navigate “hostile” routes as well. Survey respondents less likely to report using schemes for cycling than walking. Not surprising based on higher baseline levels of walking, but may mean that feeder route quality impacts cycling more than walking. Visibility of the Cardiff scheme may have contributed to its higher use. Lighting and perceptions of safety were lower in Southampton and Kenilworth, and could be linked to use, and to perceptions of crime. In Cardiff, car journeys described as difficult and congested, increasing need for the intervention. Less need in Southampton and Kenilworth may have contributed to lower use.	

91 Sinnett and Powell 2012

Study details	Inclusion/ exclusion criteria	Population	Intervention/comparison	Method of analysis	Results	Notes
Full citation Sinnett and Powell 2012 **Quality score** - **Study type** Cost benefit analysis **Aim of the study** To assess the costs and benefits associated with the Fitter for Walking (FFW) project in five locations, to determine the cost-benefit ratio. **Location and setting** UK Specifically deprived communities with low levels of walking.	**Inclusion criteria** Towns which have implemented Fitter for Walking programmes in the UK. No inclusion criteria provided for the two survey methods. No detail on how or why the five towns (out of the 12 taking part in FFW) were chosen, with the exception of authors commenting that these less affluent areas represent a challenge to improving walking	**Number of participants** Pedestrian count survey (five locations combined): baseline 3,083. 12-month follow-up: 2,456. 14-month follow-up: 732. 16-month follow-up: 1,845. 20-month follow-up: 964. Route User Survey (five locations combined): Baseline 191. 12 month follow-up 189.	**Intervention/comparison** Improvements to routes implemented in five Fitter For Walking (FFW) towns (Marks Gate, London; Byker Link, Newcastle; Taylor Street, Blackburn; Weddell Wynd, Wolverhampton; Cliff Hulls, Rotherham). FFW is a project delivered by Living Streets in partnership with local areas, which aims to increase short-distance walking through three areas: 1) infrastructural changes; 2) community activities; 3) promotional activity. *London*: improved crossings, dropped kerbs, resurfacing, improved signage *Newcastle:* Removal of smoking shelter blocking route, display board at the start of route, new signage. *Blackburn:* new lighting, bollards to discourage traffic, removal of graffiti.	Value of statistical life (VSL) for UK is £1.25m. (VSL is the amount of money a society is willing to spend to save a life – source is Rutter 2006). Benefits were calculated over a time period of ten years (authors state this is 'default'). Authors fed data into WHO HEAT tool to estimate benefit cost ratio. Discount rate for future resource savings is 3.5%.	**Total Costs:** Costs include coordination costs, behavioural and environmental costs: London: £104,481 Newcastle: £8,806 Blackburn: £ 13,832 Wolverhampton: £6,917 Rotherham: £40,431 Range is large with London costs particularly high. Journey distance, journey duration, and pedestrian count: Average distance of journeys taken (journeys were not between 2 fixed points) decreased in all locations except Newcastle and Wolverhampton, and journey duration decreased in all locations except Wolverhampton. At 12 months, pedestrian count decreased in all locations except Newcastle (London: 856 to 736; Newcastle 129 to 147; Blackburn: 621 to 367; Wolverhampton: 280 to 134; Rotherham: 1197 to 1072). Pedestrian count increased in all 5 locations when using later follow-up data (authors report the final follow-up scores for each location which is either 20, 16, or 14 months) (London: 856 to 964; Newcastle 129 to 205; Blackburn: 621 to 732; Wolverhampton: 280 to 378; Rotherham: 1197 to 1262). Cost-benefit using 12-month pedestrian counts (using either journey duration [JDu] or journey distance [JDi]: Negative figures indicate a negative cost benefit ratio, i.e. costs exceed benefits. Although figures improve at	Study linked to Adams and Cavill 2015 **Limitations identified by author** Baseline surveys took place after implementation of some interventions at Blackburn, Wolverhampton and London, according to authors. HEAT may therefore show a trajectory of change rather than before-and-after. HEAT does not calculate morbidity benefits (i.e. blood pressure, stroke), or social benefits (sense of community, social capital) only mortality benefits. These BCRs may be conservative estimates. Lack of consistency in later follow-up timeframes (14, 16, or 20 months). This could lead to bias as result of seasons. **Other comments** Perspective not specified.

Source of funding FFW managed by Living Streets, funded by the Big Lottery Fund's Wellbeing Programme. Centre for Sustainable Planning and Environments, Faculty of Environment and Technology Department of health and Applied Social Sciences, Faculty of health and Life Sciences, University of the West of England, Bristol.	**Exclusion criteria** Towns not involved in the Fitter for Walking programme.	18 month follow-up 43. 20 month follow-up (20-month data not used in study – unclear why, perhaps because only from one location). **Participant characteristics** None given.	*Wolverhampton:* footway maintenance, litter bin installation, clearing of vegetation. *Rotherham:* dropped kerb, path improvement, green space. No comparison group. **Data Collection** Pedestrian count survey: Baseline, 12-month and either 14-, 16- or 20-month follow-up. Used to estimate population size (those who could reasonably be expected to benefit from intervention), which was used in HEAT model (see "other comments" for detail). Route User Survey: Baseline and 12-month follow-up. Measured frequency of trips (trips per week); total journey duration per week (mins); approximate journey distance per week (km). Change in walking levels (duration or distance) used in HEAT model. No information on how surveys were administered, how many participants in route user survey etc.	Sensitivity analysis used different parameters (25% of change between baseline and follow-up attributed to FFW; 2 years rather than 1 year required to achieve sustained maximum change in walking level; benefits estimated over 5 rather than 10 years). Costs: include a coordinator, local authority staff time, resource costs for soft interventions, capital costs, costs of staff time to deliver capital works.	later data collection points (14-, 16- and 20-month), London ratios remain negative, as do ratios using journey duration in Newcastle, and journey distance in Rotherham. Benefit-cost ratios (BCRs) were: London: JDu -9.9:1 JDi -6.9:1 Newcastle: JDu -10.9:1 JDi -0.04:1 Blackburn: JDu -25.8:1 JDi -25.4:1 Wolverhampton: JDu -30.4:1 JDi -31.9:1 Rotherham: JDu 0.1:1 JDi -7.3:1 Total Benefits using 12-month pedestrian count data (current value accumulated over 10 years, £000): London: JDu -1000 JDi -717 Newcastle: JDu -96 JDi 0 Blackburn: JDu -357 JDi -351 Wolverhampton: JDu -210 JDi -221 Rotherham: JDu 4 JDi -295 Cost-benefit using 14-, 16-, or 20-month pedestrian counts (using either journey duration [JDu] or journey distance [JDi]: London: JDu -9.6:1 JDi -6.6:1 Newcastle: JDu -0.4:1 JDi 9.6:1 Blackburn: JDu 2.2:1 JDi 0.9:1 Wolverhampton: JDu 46:1 JDi 34:1 Rotherham: JDu 3.7:1 JDi –4.1:1 Total Benefits using 14-, 16-, or 20-month pedestrian count data (current value accumulated over 10 years, £000): London: JDu -998 JDi -687 Newcastle: JDu -4 JDi 84 Blackburn: JDu 30 JDi 13 Wolverhampton: JDu 318 JDi 235 Rotherham: JDu 147 JDi -167	All locations also had behavioural interventions: these are out of scope for this guideline so not evaluated. Interventions at each location appear to have more environmental than behavioural elements. Health Economic Assessment Tool (HEAT) released by WHO in 2011 – estimates reduced mortality / life years saved connected with change in levels of walking and estimated resource savings. Only suitable for 20-74 years old. It was assumed that 50% of the changes in walking seen between baseline and follow-up were attributable to FFW project. Follow-up period uncertain: Route user survey 12 - 18 months, pedestrian count 14 - 20 months, varies by location. Authors conclude that each location (with the exception of London) has a BCR of between 0.9 and 46.0:1 for at least one measure (journey duration or journey distance). Other outcomes: No other outcomes reported in this study.

92 Sloman et al 2009

Study details	Population	Intervention/ comparator	Results	Notes
Reference Sloman et al 2009 **Quality score** - **Study type** Controlled before and after study **Location** UK - (Aylesbury, Brighton & Hove, Darlington, Derby, Exeter and Lancaster with Morecambe **Study aims** To investigate the change in population prevalence of cycling before and after Cycling Demonstration Towns (CDT) were implemented, and whether this had	**Number of participants** Survey 1: Baseline survey: 6,000 Survey 2: Follow-up survey: 3,000 Surveys 3-4: no information given. **Participant characteristics** Not given **Inclusion criteria** Individuals resident in Cycling Demonstration Towns (Aylesbury, Brighton & Hove, Darlington, Derby, Exeter and Lancaster with Morecambe), or in the six matched towns used in the APS	**Intervention** Cycling Demonstration Towns programme in 6 towns. Each town received funding of £500,000 Per year from October 2005. Matched by local authorities. This is roughly £10/head of population/year. Interventions were varied and included school travel planning; cycle facilities at schools, pedestrian bridge (Aylesbury). Further detail not included in the paper. **Comparator** Six matched towns used in the APS survey where CDT programme was not implemented. Actual towns not reported. **Data Sources** The impact of being a CDT was followed up with four different surveys. Only one (Survey 1) provided a control. • Survey 1: Sport England Active People survey (APS) enable comparison between cycling activity and physical activity between intervention towns and control towns. Control towns were the most closely matched using National Statistics 2001 Area Classification	**Intervention:** 6 Cycle Demonstration Towns **Control:** Six matched towns used in Survey 1 where CDT program was not implemented **Outcomes** <u>Prevalence of cycling baseline to follow-up</u> **Survey 1** showed a 28% increase in adults cycling at least 30 minutes per month in CDTs (11.8% in 2006 to 15.1% in 2008; 3.3%-point difference). Matched towns increased by approx. 1%-point over the same time (estimated by NICE team from an image in the paper – actual figures not published by authors). Proportion of adult CDT residents who cycled regularly (≥30 minutes ≥12 times per month) increased from 2.6% in 2006 to 3.5% in 2008, an increase of 0.9%-points or 37%. Matched towns decreased by approx. 0.7%-point (estimated by NICE team from image in the paper). **Survey 2:** Data from **automatic cycle counters** (Survey 2) shows that cycling levels (6 town average) increased by 27% between baseline and 1-3 year follow-up in the CDT towns, ranging from +6% to +29%. Data from **manual counts** show an average annual percentage increase (6 town average) of 4% in the CDT towns. **Survey 3**: found that the proportion of adult residents of the CDTs doing any cycling in a typical week in the previous year rose from 24.3% in 2006 to 27.7% in 2009, an increase of approximately 3.4%-points or 14%. They also reported that the number of inactive people decreased by 10% in CDT towns between 2006 (26.2%) to 2009 (23.6%), a decrease of 2.6%-points.  Year-on-year growth of cycling levels (in %) of each CDT reported above. Actual numbers not given for individual towns. This shows an overall increase, with large variation between towns both in scale of improvement and in pattern over years.	**Limitations identified by the author** All CDTs implemented wider initiatives to increase cycling levels beyond what was funded. Therefore changes may not be entirely due to CDT programme. Manual and automatic counts sometimes showed different results (Exeter and Lancaster) showed increase in automatic and decline in manual. Patchy growth, or problematic data collection? APS' definition of frequent cycling as ≥30 mins excludes shorter trips. Levels of change likely to be underestimated. Independent samples (rather than panel data) means it cannot be stated that CDTs resulted in a fall in proportion of inactive respondents due to them taking up cycling. There was variation on some measures between towns: automatic counts showed increases in cycling

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
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<td>benefits to health when compared with towns where the programme was not implemented. Interim results.

Length of follow up
Intervention began in October 2005. Follow-up data collected between within months of start date, to 4 years after start date.

CDT Baseline survey taken in March 2006. Follow-up survey taken in March 2009.

Source of funding
Department for Transport</td>
<td>survey (matched towns not given). Focus is on 16+ (only interventions with children are behavioural at schools and therefore excluded).

Exclusion criteria
Individuals in any other geographical area. Individuals under 16.</td>
<td>• Survey 2: Sustrans Research and Monitoring Unit collaborated with local authorities to determine plans for monitoring and counting. Automatic cycle counters were used, generally sited in traffic-free locations. These calculated unweighted mean percentage change relative to 2005 baseline using data collected between Jan 2006-March 2009. Manual Counts: Manual counts, taken quarterly in each town centre, calculated unweighted mean percentage per year. They included cyclists on roads and paths/tracks (Sustrans)
• Survey 3: Cavill Associates managed 2 surveys carried out in March 2006 and March 2009. Quota sampling led to telephone interviews with 1,500 individuals aged 16+ in each town. Data on occasional cyclists and inactive people (ICM Unlimited)
• Survey 4: National Travel Survey data (NTS): from medium-sized urban areas (those with populations of between 25,000 and 250,000 people, corresponding with the range in population of the CDTs). Data based on travel diaries.</td>
<td>Survey 4: Authors report that CDT trends differ from underlying trends in cycling levels nationwide (levels not specified) which show stable levels or even slight decline.

<u>Total Physical Activity</u>
Survey 3: The proportion of adult respondents classed as inactive (using validated measure – EPIC, self-reported 4-level index) fell from 26.2% in 2006 to 23.6% in 2009, a fall of 2.6%-points or 10%. Authors report that the proportion of people of all ages in medium urban areas who cycled ‘less than once a year’ or ‘never’ was stable at 68 or 67% in each year between 2005 and 2008.

<u>Demographic Information: Change in CDTs between baseline (2005/6) and follow-up (2007/8) (CDT Towns only, no matched group)</u>
Survey 3: Age: CDTs - Propensity to cycle at baseline in 2006 generally decreased with age, from 36% amongst 16-24 year olds to 5% amongst those aged over 75. Authors state that at follow-up, the largest changes in behaviour appear to have come from people in the ‘middle’ and ‘older’ age groups (a bar chart of percentage reporting cycling in a typical week, by age for the years 2006 and 2009 shows greatest increases between 35 and 74 years old – actual figures not given so not extracted here).
Gender: The proportion of male respondents doing any cycling in a typical week in the previous year increased from 31% to 35% between baseline and 2009; amongst female respondents, the increase was from 18% to 21%.
Sociodemographic: Respondents in higher social classes were generally more likely to have cycled in the last year, but increases were seen across all “social grades”, as demonstrated in the paper by a bar chart. No actual figures given.
Adults with children: Adults living in households with children were more likely to have cycled in the last year (31% compared with 21%). Authors state that this may be due to generally younger profile of adults in households with children.

<u>Adverse events: Personal cycling injury incidents (information only available for four towns.</u>
Lancaster is the only statistically significant result, reported by authors (P-Values not given).
<table>
<tr><th></th><th><u>2003-2005</u></th><th><u>2006-2008</u></th></tr>
<tr><td><u>Aylesbury</u></td><td><u>49</u></td><td><u>56</u></td></tr>
<tr><td><u>Darlington</u></td><td><u>87</u></td><td><u>96</u></td></tr>
<tr><td><u>Derby</u></td><td><u>282</u></td><td><u>306</u></td></tr>
<tr><td><u>Lancaster</u></td><td><u>173</u></td><td><u>129</u></td></tr>
</table></td>
<td>ranging from 2.4% to 57%; manual counts showed between -5% and +13% increase (see graph, left). This means conclusions cannot be drawn on towns individually.

Limitations identified by the review team
Many varying surveys mean varying methods with varying levels of bias, error, and validity. Although complex, this may lead to increased reliability of the results through triangulation.

Other comments
Some information on ‘Bike It’ schemes for children – almost exclusively behavioural so excluded. Department for Transport 2010 extraction contains more up-to-date version of the interim cost-benefit analysis presented in this paper – interim analysis not extracted.
Power not reported.

Other outcomes: change in cycling in other European cities.</td>
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</table>

93 West and Shores 2011

Study details	Population	Intervention/ comparator	Results	Notes
Reference West and Shores 2011 **Quality score** - **Study type** Controlled before and after study **Location** USA - along a river in a "midsized Southeastern US city". No further location information given. **Study aims** To determine whether development of a new greenway has the potential to increase activity levels of existing, proximate residents (living within 0.5miles) compared	**Number of participants** Distance residents live from intervention: Intervention (≤0.5miles): 95 Control (0.51-1.0 miles): 74 (participants who completed both baseline and follow-up surveys). Baseline survey sent to 1,168. 368 (31.5%) returned baseline survey. Of 368, 169 (45.8%, or 14.5% of initial send-out) returned follow-up survey. **Participant characteristics** Statistical significance between intervention and control groups not reported. Intervention: 48.9% male, 51.1% female. 85.7% Caucasian, 9.9% African American, 4.4% Hispanic/non-white. 14.3% 30 and under, 41.8% 31-50, 32.9% 51-70, 11.0% over 70. 13.8% had annual household income of <$15,000 per year, 20.7% had >$100,000. Control: 45.9% male, 54.1% female. 95.8% Caucasian, 1.4% African American, 2.8%	**Intervention** Extension of an existing greenway by 5 miles, along a river. Authors report that greenways are "open-space corridors reserved for recreational use or environmental preservation that connect urban centres". **Comparator:** No comparator **Data collection:** Postal surveys sent to households randomly selected from comprehensive list, with postage paid return. Reminder postcards and second full mail out. Questions included sociodemographic characteristics and frequency of measures of physical activity (PA): number of days in the past 7 that the respondent had achieved ≥30 minutes	**Intervention:** Individuals living within 0.5 miles of 5 mile extension of an existing greenway **Control:** Individuals living 0.51-1.0 miles away from 5 mile extension of an existing greenway. **Outcomes** <u>Baseline and 11-month follow-up change in walking, mean (standard deviation)</u> Intervention: Mean number of the past 7 days that the respondent had achieved ≥30 minutes of walking was 3.0 (2.47) at baseline and 3.48 (2.39) at follow-up. Control: Mean number of the past 7 days that the respondent had achieved ≥30 minutes of walking was 2.48 (2.25) at baseline and 3.10 (2.27) at follow-up. *Significance*: all participants combined, change between baseline and follow-up: P = 0.003 (significant) Group x time effect (significance of difference between change score for intervention and change score for control): 0.363 (not significant). <u>Baseline and 11-month follow-up change in moderate PA, mean (standard deviation)</u> Intervention: Mean number of days undertaking moderate PA was 1.76 (1.99) at baseline and 2.39 (1.93) at follow up. Control: Mean number of days undertaking moderate PA was 1.63 (1.81) at baseline and 2.11 (1.91) at follow up. *Significance:* all participants combined, change between baseline and follow-up: P = 0.000 (significant) Group x time effect (significance of difference between change score for intervention and change score for control): 0.476 (not significant). <u>Baseline and 11-month follow-up change in vigorous PA, mean (standard deviation)</u> Intervention: Mean number of days undertaking vigorous PA was 1.41 (1.69) at baseline and 1.87 (1.71) at follow up.	**Limitations identified by the author** The groups may not be different enough in distance to observe an effect. Additional environmental variables may have mediated greenway participation (i.e. design, aesthetics) and were not measured here. Straight-line distance may not be the best measure of distance to use, and may not correlate with ease of access. Definitions of moderate and vigorous PA as described for participants in the survey may have been problematic or have been interpreted differently by different participants. Potential responder bias – the results may be biased if the participants who were more likely to increase their physical activity over the previous year were more likely to respond to the follow up survey **Limitations identified by the review team** Control group may not be considered a true control, as the "control" group still receives the intervention, and members of each group could theoretically live next door to each other. Low response rate could indicate selection bias. The authors did not report on suitable sample size and power of the study.

Study details	Population	Intervention/ comparator	Results	Notes
with those living 0.51-1.0 miles away. **Length of follow up** Authors report 11 months between intervention implementation and follow-up data collection. (Baseline Dec 2007, implementation began reportedly immediately after. Follow-up survey in 2008.) **Source of funding** Department of Health, Leisure and Exercise Science, Appalachian State University, NC. Department of Recreation and leisure Studies, East Carolina University, NC.	Hispanic/non-white. 5.6% 30 and under, 49.0% 31-50, 35.6% 51-70, 9.8% over 70. 14.9% had annual household income of <\$15,000 per year, 13.4% had >\$100,000. **Inclusion criteria** Property owners who owned a single-family dwelling unit valued at more than \$5000 and located ≤1.0 miles from the greenway in a straight line. **Exclusion criteria** Presumed by NICE team to be people renting, or whose owned home was valued at less than \$5000, or who lived further from greenway than 1.0 miles.	of walking, ≥30 minutes of moderate PA, and ≥20 minutes of vigorous PA.	Control: Mean number of days undertaking vigorous PA was 1.25 (1.79) at baseline and 1.71 (1.78) at follow up. *Significance:* all participants combined, change between baseline and follow-up: P = 0.000 (significant) Group x time effect (significance of difference between change score for intervention and change score for control): 0.962 (not significant). <u>Time effects: both arms combined, significance of change between baseline and 11-month follow-up:</u> Change was statistically significant for all outcomes (see above). <u>Group x time effect: difference between change scores for intervention and control groups</u> Differences in change scores between groups were not significant for any outcomes (see above). This indicates that the nearer participants did not increase their activity (in any of the three outcome measures) significantly more than the further group of participants. **Analysis** Paired *t* tests conducted to determine time effects (whether respondents PA levels increased following greenway development). Repeated measures analyses of variance (RM-ANOVAs) were conducted to determine group x time effects (whether respondents living ≤0.5miles from greenway were significantly more likely than those living 0.51-1.0 miles away to report increased PA behaviours following development of greenway).	The authors do provide definitions of moderate/vigorous activity however, the examples provided e.g. dancing and hunting are not activities that would be carried out along the greenway, they do not explain the link between their intervention (extension of the greenway) and increase in activities carried out away from the greenway. **Other comments** Non-respondent bias was checked with 50 phone interviews with non-responders. This group had significantly different household incomes, length at residence, and interest in being active at a greenway compared with those living ≤0.5miles from intervention and who completed both surveys (direction of effect not specified). There were no differences between responders and non-responders with regard to park visitation / physical activity in past 7 days. Other outcomes: no other outcomes reported in this study. Significance: p ≤ 0.05. Power not reported.

94 West and Shores, 2015

Study details	Population	Intervention/ comparator	Results	Notes
Reference West and Shores 2015 **Quality score** + **Study type** Controlled before and after study **Location** USA – North Carolina (city name not given) **Study aims** To determine whether development of a new greenway has the potential to increase walking, moderate activity and vigorous activity of residents living within 1.0 miles, compared with a control neighbourhood	**Number of participants** Intervention: 118 Controls: 85 Baseline survey sent to 1,300 randomly selected individuals. 524 (40.3%) returned baseline survey. Of 524, 44 had moved house by follow-up. Of remaining 480, 207 (43.1%, or 16.5% of initial send-out) returned follow-up survey. **Participant characteristics** Statistical significance of differences between intervention and control groups not reported. Intervention: 58.4% male, 41.6% female. 88.8% Caucasian, 11.0% racial/ethnic minority. 1.5% 30 and under, 43.7% 31-50, 45.6% 51-70, 8.5% over 70. 1.6% had annual household income of <$15,000 per year, 6.4% had >$100,000. 20% are obese (BMI >30kg/m^2). Control: 57.6% male, 42.4% female. 92.3% Caucasian, 7.6% racial/ethnic minority. 3.1% 30 and under, 27.4% 31-50, 50.8% 51-70, 18.2% over 70. 3.4%	**Intervention** Extension of an existing greenway by 1.93 miles. Previous work by the same authors define a greenway as "open-space corridors reserved for recreational use or environmental preservation that connect urban centres". **Comparator** A neighbourhood with (authors report) a similar sociodemographic composition, located 2 to 3 miles from the greenway. No intervention. **Data Collection** Full list of included participants within 1 mile of greenway (N = 1.964) and in control neighbourhood obtained. Authors report that participants were randomly	**Intervention:** 1.93 mile extension of existing greenway **Control:** Similar neighbourhood with no intervention **Outcomes** <u>Baseline and 1-year follow-up change in walking, mean (standard deviation)</u> Intervention: Mean number of the past 7 days that the respondent had achieved ≥30 minutes of walking was 2.57 (2.17) at baseline and 2.91 (2.21) at follow-up. Control: Mean number of the past 7 days that the respondent had achieved ≥30 minutes of walking was 2.71 (2.09) at baseline and 2.88 (2.28) at follow-up. For statistical significance of change, see group x time effect below. <u>Baseline and 1-year follow-up change in moderate PA, mean (standard deviation)</u> Intervention: Mean number of days undertaking moderate PA was 1.68 (1.91) at baseline and 1.60 (1.96) at follow up. Control: Mean number of days undertaking moderate PA was 1.94 (2.07) at baseline and 1.76 (2.19) at follow up. For statistical significance of change, see group x time effect below. <u>Baseline and 1-year follow-up change in vigorous PA, mean (standard deviation)</u> Intervention: Mean number of days undertaking vigorous PA was 1.42 (1.79) at baseline and 1.40 (1.86) at follow up. Control: Mean number of days undertaking vigorous PA was 1.86 (2.21) at baseline and 1.51 (2.32) at follow up. For statistical significance of change, see group x time effect below. <u>Group x time effect: difference between change scores for near and far groups</u> Differences in change scores between groups were not significant for walking (p = 0.998), moderate activity (p = 0.998) or vigorous activity (p = 0.982). This indicates that the intervention group did not increase their	**Limitations identified by the author** Small sample size may limit power to detect an effect. Collecting data during winter (December) may have shown lower physical activity than yearly average, but temperatures were similarly cold in both years. The length of time needed for a greenway to affect behaviour is unknown: timeframes may have been too small. Length of greenway may have been too short to have a significant difference. Self-reported data lacks reliability. **Limitations identified by the review team** There is no information on what respondents were told about the study, or whether they were aware of the research question. Including those who lived within 1-mile of the greenway by both straight-line and walking distances may reduce observed effect by including individuals for

Study details	Population	Intervention/ comparator	Results	Notes
between 2-3 miles away. **Length of follow up** Authors report “a little less than 1 year” between intervention implementation and follow-up data collection. (Baseline Nov 2009, implementation began reportedly immediately after. Follow-up survey in 2011.) **Source of funding** Appalachian State University, North Carolina. East Carolina University, North Carolina.	had annual household income of <$15,000 per year, 11.9% had >$100,000. 13.6% are obese. **Inclusion criteria** Intervention: Property owners who owned a single-family dwelling unit valued at more than $5000 and located ≤1.0 miles distance from greenway, either by straight-line distance or by walking distance. Control: Assumed that the same criteria (with exception of distance) were applied, but this is not explicit. **Exclusion criteria** Presumed by NICE team to be people renting, or whose owned home was valued at less than $5000, or who lived further from greenway than 1.0 miles (intervention) or not in the control neighbourhood (control).	selected (800 for intervention, 500 for control) to receive postal survey. Reminder postcards and second full mail out. Questions included sociodemographic characteristics and frequency of measures of physical activity (PA): number of days in the past 7 that the respondent had achieved ≥30 minutes of walking, ≥30 minutes of moderate PA (MPA), and ≥20 minutes of vigorous PA (VPA).	activity (in any of the three outcome measures) significantly more than the control group. <u>Relationship between proximity to the greenway and physical activity behaviour:</u> Travel distance to the greenway was not predictive of walking, moderate or vigorous PA after the greenway was opened. Only previous physical activity was related to activity after the greenway’s construction. Walking before development was predictive of walking post development (β = 0.59, t = 8.14, P < .00). Moderate activity before greenway development was strongly associated with moderate activity post development (β = 0.55, t = 9.60, P < .00). Vigorous activity before the greenway was built was the only significant predictor of greenway physical activity after the green-way was developed (β = 0.67, t = 10.42, P <.00). **Analysis** GIS was used for all calculations of distance from greenway, and a trained GIS analyst conducted these tests. Repeated measures analyses of variance (RM-ANOVAs) were conducted to determine group x time effects (whether the intervention group was significantly more likely than the control group to report increased walking, moderate PA or vigorous PA following development of greenway). 3 ordinary least squares regressions were carried out to examine the relationship of residential proximity to the greenway (by travel distance, not Euclidian) on physical activity behaviour. This was analysed first by simple linear regression, and then controlling for sociodemographic characteristics (age, gender, income category, and BMI status).	whom there is no direct route to the greenway, or who must travel much further than 1 mile to reach it. **Other comments** There is unlikely to be a situation in which someone is more than 1mile from the greenway by straight-line distance, but less by walking distance. Therefore using walking distance may be redundant. Panel data (where the same group of individuals take part in both baseline and follow-up data collection) cannot be guaranteed, but authors state that they encourage individuals who completed baseline data to also complete follow-up, possibly slightly reducing differences in outcomes due to individuals varying. Other outcomes: no other outcomes reported in this study. Statistical significance ≤0.05. Power not reported.

Review 3

Neighbourhood

Christian et al 2013

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Christian et al 2013

Quality score
+

Study type
Controlled before and after study

Location
Australia - Perth

Study aims
To examine whether people moving into a housing development designed according to Livable Neighbourhoods Guidelines (LNGs) engage in more walking after the</td>
<td>Number of participants
1,047 respondents completed all three surveys
(total responses:
Baseline: 1,813
1-year: 1,467
3-year: 1,230)

Participant characteristics
There were no significant differences between groups.

Intervention (livable developments, n=299): 62.9% female; mean age 42.2; 79.9% married or de facto, 9.4% single; 27.1% had bachelor degree or higher; 71.2% had children at home.

Control (conventional neighbourhoods n=528): 59.7% female; mean age 41.9; 85.4% married or de facto, 6.8% single; 20.8% bachelor's degree or higher; 74.4% had children at home.</td>
<td>Intervention
The intervention group were individuals moving into RESIDE neighbourhoods which met with the Livable Neighbourhoods Guidelines (LNGs) as classified by the Western Australian Department of Planning (n = 18)

LNGs incorporate 4 design elements: 1) community design (mixed use planning, mixed lot sizes), 2) movement network (interconnected street networks, public transport access etc.), 3) public parklands (balance between small and large parks), 4) lot layouts (to maximise surveillance of streets / parks, increase density around activity hubs).

Comparator
The comparator arm was RESIDE neighbourhoods classified as conventional (n = 44); not complying with any of the guidelines.

Conventional neighbourhoods matched to livable</td>
<td>Intervention: New neighbourhoods meeting livable neighbourhood guidelines (LNG)s
Control: new neighbourhoods not meeting LNGs

Outcomes
<u>Changes in walking behaviour by development type (mean minutes per week [standard deviation]):</u>
There is no significant difference between intervention and control group mean minutes of walking at baseline, 1- year follow-up, or 3- year follow-up. There is no significant difference between the changes (baseline to 1- year follow-up, 1- year follow-up to 3-year follow-up, baseline to 3- year follow-up) observed in intervention versus control developments. This is true of recreational walking, transport walking, and all walking totalled.

<table>
<tr><th>Transport walking</th><th>Livable (mean difference, mins [SE])</th><th>Conventional (mean difference, mins, [SE])</th><th>P value of change score</th></tr>
<tr><td>Baseline to 1-year</td><td>-10.8 (2.8)</td><td>-7.0 (2.1)</td><td>0.285</td></tr>
<tr><td>1-year to 3-year</td><td>9.1 (3.8)</td><td>7.0 (2.8)</td><td>0.643</td></tr>
<tr><td>Baseline to 3-year</td><td>-0.4 (4.0)</td><td>-0.9 (3.0)</td><td>0.92</td></tr>
</table>

<table>
<tr><th>Recreational walking</th><th>Livable (mean difference, mins, [SE])</th><th>Conventional (mean difference, mins, [SE])</th><th>P value of change score</th></tr>
<tr><td>Baseline to 1-year</td><td>16.6 (5.7)</td><td>18.1 (4.2)</td><td>0.828</td></tr>
<tr><td>1-year to 3-year</td><td>9.3 (8.8)</td><td>-2.3 (6.2)</td><td>0.279</td></tr>
<tr><td>Baseline to 3-year</td><td>26.3 (8.8)</td><td>12.6 (6.2)</td><td>0.21</td></tr>
</table>

<u>Transportation walking absolute figures:</u>
Intervention baseline = 25.2 (3.2), 1-year follow-up = 15.2 (2.9), 3-year follow-up = 25.6 (4.1)
Control baseline = 28.1 (2.4), 1-year follow-up = 19.6 (2.2), 3-year follow-up = 25.7 (3.1).</td>
<td>Linked study: Knuiman et al 2014

Limitations identified by the author
New neighbourhoods (those being lived in in 1-and 3-year follow-up had generally lower connectivity and amenities than baseline neighbourhoods, creating a dip in observed transport walking.

Authors state that many features of livable neighbourhoods had not been implemented during study period, accounting for lower results.

Self-reported physical activity measures can introduce bias.

Limitations identified by the review team</td>
</tr>
</table>

Study details	Population	Intervention/ comparator	Results	Notes
move, than those who move to neighbourhoods not meeting LNGs. **Length of follow up** Surveys at baseline, 1, and 3 years after baseline. **Source of funding** Western Australian Health Promotion Foundation Australian Research Council Australian National Health and Medical Research Council	A hybrid group (partly meeting Livable neighbourhood Guidelines) was described but not included in the analysis. **Inclusion criteria** Participants must be part of the RESIDential Environments Project (RESIDE), a longitudinal experiment of people moving into new development neighbourhoods. The Residential Environments (RESIDE) study includes participants with English language proficiency, age of 18 years or older, intention to relocate (to one of 73 particular, pre-defined newly built neighbourhoods) by December 2005. Participants must be willing to complete surveys 3 times over 3 years. **Exclusion criteria** Individuals with no English proficiency, children, no intention to relocate to one of the neighbourhoods, and	neighbourhoods by matching stage of development, block value, and proximity to ocean. **Data Collection:** Objective environment measures taken using geographic information systems. These measures included connectivity, residential density and land mix. Also number of services, shops, open spaces and public transport stops within 1600 metres of participants home. Perception measures were collected with the Neighbourhood Environment and Walking Scale questionnaire (NEWS). Perceptions of availability of services, connectivity, traffic safety, and aesthetics were collected. The Neighbourhood Physical Activity Questionnaire (NPAQ) was used to measure frequency of transport and recreational walking participants engaged in within their neighbourhood (neighbourhood defined as within a 15-minute walk from their home) over an average week.	<u>Recreation walking absolute figures</u>: Intervention baseline = 65.9 (5.7), 1-year follow-up = 85.4 (6.2) 3-year follow-up = 95.1 (9.1) Control baseline = 77.3 (4.2), 1-year follow-up = 91.4 (4.7), 3-year follow-up = 86.2 (6.5). <u>Perceived environment (intervention v control at 1- and 3-year follow-up):</u> Significantly more intervention individuals compared with control individuals reported a score of ≥3.5 on a Likert scale* for access to mixed use services (1-year follow-up 29.8% vs 21.6%; 3-year follow-up 41.5% vs 25.8%); safety for walking (1-year follow-up 40.3% % vs 21.1%; 3-year follow-up 35.6% vs 17.3%); neighbourhood aesthetics (1-year follow-up 70.2%% vs 62.5%; 3-year follow-up not significant). Significantly more intervention individuals compared with control individuals agreed that there were footpaths present on both sides of most roads in their neighbourhoods (1-year follow-up 30.5% % vs 9.9%; 3-year follow-up 32.2% vs 8.4%). Intervention individuals reported significantly more destinations within a 20 minute walk from home compared with control individuals (1-year follow-up no significant difference; 3-year follow-up 8.1 destinations vs 6.5 destinations). None of these factors were significantly different at baseline. There were no significant changes between intervention and control perceptions of street connectivity, not many cul-de-sacs being present, traffic safety, traffic slowing devices being present, crime safety. <u>Perceived environment (intervention v control at 1- and 3-year follow-up):</u> Intervention participants neighbourhoods had significantly more street connectivity, residential density, and land use mix than did neighbourhoods of those living in conventional developments (1-and 3-year follow up all P < .001). At 3-year follow-up they also had greater land use mix designed to encourage recreational walking (i.e., more public open space; P < .001). *Likert Scale: strongly disagree, disagree, neither agree nor disagree, agree, strongly agree. 3.5 is half way between neither agree nor disagree and agree. **Analysis** Chi squared analysis used to examine univariate association between development type and categorical variables (sociodemographic factors, self-selection factors, access to destinations, public transportation). *F*-test from a general linear model used to examine univariate associations between development type and continuous variables (age, transportation and recreational walking, perceptions of environment etc).	No response rate given. No information given on what participants are told about the study **Other comments** Other outcomes: More detail given in study about neighbourhood environment perception – deemed not relevant. Panel data used (i.e. participants who responded at all three time points). No significant differences in outcome measures between panel data and total responses (no attrition bias). Another paper on the same study (Knuiman 2014, included) states that 99% of participants moved into new homes between baseline and follow-up 1.

Study details	Population	Intervention/ comparator	Results	Notes
	who are not willing to participate.		General linear models examined association between types of development and mean weekly minutes of neighbourhood walking, and change in walking. Models adjusted for baseline age, gender, education level, marital status, children at home, baseline minutes of walking, self-selection factors.	Power not reported. Statistical significance ≤0.05.

100 Coulson et al 2011

Study details	Population	Research parameters	Results	Notes
Full citation Coulson et al 2011 **Quality score** + **Study type** Qualitative case study **Location and setting** UK, deprived inner-city neighbourhood in Bristol **Aim of the study** To investigate the experiences of residents of a deprived neighbourhood before, during, and after construction of a home zone development and a cycle-walkway to improve the neighbourhood,	**Number of participants** 5 focus groups. 36 participants FG1: n=10 FG2: n=4 FG3: n=10 FG4: n=7 FG5: n=5 **Participant characteristics** Participants of focus groups not described. "The Dings" (the intervention area) is described as a neighbourhood with a high proportion of socially rented homes (47% vs UK average of 12.9%), a high proportion of non-white ethnicities (23.6% vs UK average of 9.1%), and composed of single-person households (64.1% vs UK average 30.1%). Age information not given.	**Data collection** Focus group invitations were hand-delivered to all houses in the intervention neighbourhood, and postal and verbal reminders (at community meetings) were also given. Focus groups (n=5) lasted 45-90 minutes and were conducted in the local social club. A semi-structured topic guide (informed by literature search) structured the focus groups. Emphasis was put on quality of life. Guide underwent some adaptation throughout process, informed by interim results. Visual aids (photographs of intervention) were used as prompts. Sessions were audio-recorded, transcribed, and the transcriptions posted in an accessible area for participants to feed back on.	**Key themes** <u>Space</u> Home Zone (HZ): Participants recognised the potential for the HZ to improve their personal space: "*yes it will change the environment… make it more pleasant*" (F, FG1), and this view persisted in spite of disruption during building: "*I reckon it was well worth-it. When you come of your house now, you look at it and you think 'Gosh, this is lovely, isn't it*?'" (F, FG5). However, space for parking is still a concern: authors state that parking is a more important issue to participants than fear of accidents: "I *don't want to leave my car where it's out of sigh*t" (F, FG1), *"The parking's worse now… You can't park outside your houses any more*" (F, FG5). Cycle-walkway: less ownership was felt over this intervention, partially due to lower levels of consultation: "*We didn't have the same sort of process (as with) the home zone*" (F, FG3 or 4). <u>Community Interactions</u> Most participants appeared to consider there to have been existing and strong community spirit in the area: "*I think we have a good community. We've won 'best neighbourhood watch of the year' in the past*" (M, FG1). This may have been renewed or strengthened slightly through the process of the intervention, as a community approach was taken – the community association was strongly involved, and interacted with councillors etc. "*We've all pulled together haven't we*" (M, FG4). "*They let us have our say*" (F, FG4). However, there is no evidence that the home zone itself had helped to build bridges. <u>Personal and road safety</u> Home Zone: Personal safety was a concern at the start of the process, with street furniture received with concern: "*You'll get a congregation of youths sitting (on the benches)… we won't get the neighbours*" (F, FG 3). Over time, some improvement was seen, but this was also linked to action taken by the council in other areas: "*I don't really think the home zone (has stopped the kids from coming down here.)… I just think we had the ASBOs [Antisocial Behaviour Order] come out… and when the summer ended, they don't want to hang around the streets*" (F, FG3 or 4).	Linked study: Trayers et al 2006 **Limitations identified by author** Focus group approach risks excluding certain populations. Male, non-white-British and younger adults were under-represented. Views are likely to be those of confident, community-conscious residents rather than isolated individuals, such as the reported "problem families" (social housing). Participants may have been suffering from burn-out towards the end of the process, having been subjects of interest for multiple parties. Effects of home zone and cycle path difficult to disentangle as timeframes overlapped.

with particular focus on quality of life and physical activity. **Source of funding** British Heart Foundation	**Inclusion criteria** Adult residents of the neighbourhood receiving the intervention **Exclusion criteria** Infers that children are excluded (from the data collected for this particular study. The study shows a focus group schedule including school children but does not state whether the findings for these are published separately). **Intervention** The intervention comprised a home zone or "living street", aiming to improve environmental aesthetics, give greater priority to non-motorised road-users and slow traffic, largely by breaking up motorists' sight-lines and introducing shared space, such as pavement-free surfaces (reported by authors). Construction was	Focus groups were undertaken in: **1) 03/2004** (before any works) **2) 03/2005** (cycle walkway near completion, homezone underway) **3) 09/2005** **4) 04/2006** **5) 05/2006** [To note that at focus groups 3, 4 and 5 above cycle ways werecomplete and home zones mostly complete] **Method of analysis** Analysis was thematic. A framework approach was used to classify data according to both pre-figured themes and emergent categories. Transcript excerpts were coded and inductive rebuilding was carried out using a long table approach. Emphasis was given to attitudes, incidents, opinions, and recollections relating to experiences. Similarities and difference were compared within and between groups. No feedback from posted	Road safety remained a concern because, although some traffic calming measures had been introduced resulting in "*that little feeling that you're less likely to get run over because it's a home zone"* (M, FG 4). One particular road was neglected. This road was used as a shortcut to avoid traffic, and had no speed restriction signage resulting in negative feeling: '*There's no speed restrictions so they feel they're entitled to whoosh up… a good start would be 'please slow down' or '15mph advisory speed limit'… (The) bureaucracy to get these signs through!*'' (M, FG4). Cycle Walkway: Safety was a large concern here, with participants fearing the removal of protection offered by overgrown land: "*It'll be a quick escape route… for anybody up to no good*" (F, FG1). Some had proactive attitudes towards claiming the path: "We want to make the track an asset to the area. That means nipping any problems in the bud… supervision, lighting…" (M, FG1). After installation, most considered lighting adequate, but people were still afraid as the path was isolated: "*They got trees overgrowing and people hide in the trees"* (older F, FG5). Authors report that most looked forward to a time when more users would make the route feel busier. <u>Health and Physical Activity</u> Home Zone: Adult participants generally saw their levels of physical activity as unchanged since implementation of the home zone and cycle paths: "*Nah, still the same amount of walking, isn't it?... Health-wise,… I don't think that it's made (any difference)… not to me"* (F, FG5). This had exceptions: one participant reported taking on the upkeep of the new planters, but this appears isolated. However, participants did report increased activity in children: "you see 'em playing football more in the street now" (F, FG4). However, there is general ill-feeling about this, with participants expressing opinion that children should use the park rather than the home zone: "*you never got kids playing in the street… now they've got all this going for 'em, why aren't they using (the park)*" (F, FG5). Damage to cars as well as noise is cited as reasoning. Cycle Walkway: Local usage of the route is reported by the authors as seeming marginally higher than expected. Participants reported using it to get children to nursery and to walk dogs. However, litter was still problematic: "(*It's still) a dumping ground… Oh, it's lovely to have (it), don't get me wrong… but there's no dog bins there*" (F, FG 4). The route is also seen as a route to nowhere, as it did not fully connect through to the station or city centre: *"I think with the better connections and more people around… it's gonna develop"* (F, FG5).	Timeframes may not have been long enough to view long-term change, which may take a long time to become concrete. **Limitations identified by review team** Reminders at community meetings may only have reached engaged (or positively engaged) residents. Double checking of themes / transcriptions by other researchers not mentioned so may not have been done – lowers reliability. Relationship between researcher and participants not explicitly addressed, may be important in this setting and could have resulted in social desirability bias. **Other comments** Other outcomes: no other outcomes were reported in this study.

	finished by September 2006. Additionally, a disused railway bed converted into National Cycle Network extension.	transcripts meant that confirming accuracy of interpretations was reported to be difficult.	<u>"Unresolved Issues"</u> There were perceived to be other factors requiring resolution before the intervention would result in a noticeable change. Participants mentioned a lack of public transport services: "You cannot get out of the district, unless you go by taxi. You got no chance" (F, FG5). A lack of services, particularly local food stores, was noted. When asked what interventions they believed would contribute to increasing local people's physical activity levels, 26 voted for access to a free or affordable gym / classes; 21 votes for less crime / anti-social behaviour and feeling safer, and 17 votes for active maintenance of the home zone i.e. group window-cleaning, gardening sessions and street-sweeping.	Participants offered a £5 gift voucher

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Study details	Population	Intervention/ comparator	Results	Notes
Reference Dunton et al 2012 **Quality score** + **Study type** Controlled before and after study **Location** USA - California **Study aims** To ascertain the impact of a recent move to a Smart Growth (SG) neighbourhood on children's physical activity context (where they physically exercise) compared with children from control neighbourhoods	**Number of participants** N = 94 (120 completed at baseline; 102 at follow-up: some respondents excluded for not completing at least 1 survey in each wave). Intervention = 46 Control = 48 **Participant characteristics** There were no significant differences in baseline characteristics between groups. All children aged 9 – 13 Intervention: 50% male, 50% female. 21.7% with household income <$45,000. 23.9% with household income >$100,000. 32.6% Hispanic, 21.7% White, 10.9% biracial/Mixed. Control: 54.2% male, 45.8% female. 29.2% with household income <$45,000. 20.8% with household income >$100,000. 31.3% Hispanic, 31.3% White, 18.9% Biracial/Mixed. **Inclusion criteria**	**Intervention** Children living in Smart Growth (SG) neighbourhoods. SG neighbourhoods use principles to inform their construction: compact building design, walkable neighbourhoods with plenty of open space (e.g. parks, wetlands, natural spaces), sense of place and identity, mixed uses (e.g. combining residential and commercial use). The intervention neighbourhood is designed so that school, public and private recreational facilities are within 5-15 min walking distance from any residence. Neighbourhood was still under development at the time of publication. No further intervention information given. **Comparator** Children living in one of the six nearby low-to-medium density suburban municipalities also in California, whose parents had considered buying or	**Intervention:** One Smart Growth neighbourhood **Control:** Six other low-to-medium density suburban municipalities. **Outcomes** All control children were combined into one group, regardless of which municipality they were from. On average, children responded to 78% of Ecological Momentary Assessment (EMA) survey prompts. <u>Time spent in physical contexts (both time points combined)</u> Intervention group spent marginally more time outdoors (54% vs. 52%), less time at home (indoors) (29% vs. 36%). No significance data reported. <u>Change in quantity of physical activity over time</u> Minutes of daily moderate to vigorous physical activity (MVPA) increased more in intervention group (from 32.75 min/day at baseline to 42.78 min/day at follow-up) than the control group (from 34.23 min/day at baseline to 38.40 min/day at follow-up). The change was not significant (Adj.Wald F=0.44, p=0.51). <u>Group x Time: Difference between change over time in control and change over time in intervention group.</u> The proportion of physical activity bouts reported in outdoor locations with no traffic increased among intervention children between baseline (55%) and follow-up (66%), and decreased in the control group (78% at baseline and 49% at follow-up). The reason for change in control group figures is not known. (Adj. Wald F 4.51, *p* = 0.036*). There is a significant difference between the change between control and intervention group in terms of the overall physical setting of physical activity (Adj. Wald F 3.43, *p* = 0.067*) <u>There was no difference between intervention and control changes over time in the following (Group x time effect):</u> Overall social setting (friends only vs other) Adj. Wald F 1.17, *p* = 0.283 Distance (more than a few blocks away from home or a few blocks away from home vs. at home) Adj. Wald F 1.49, p = 0.230 Travel mode (walking or bicycling vs motorised transit) Adj. Wald F 0.46, *p* = 0.633	**Limitations identified by the author** Intervals between prompts could have meant some physical bouts were missed Children may not have responded to prompts whilst taking part in physical activity. Overrepresentation of weekend days in data collection windows could skew data Participants may change behaviour as a result of being monitored. However, similar expected impact on intervention and control groups. Activities taking place at school not captured. Intervention neighbourhood not complete at time of study – missing mixed land use and public transport facilities. **Limitations identified by the review team** Control neighbourhoods incorporated six municipalities which may have had different

Study details	Population	Intervention/ comparator	Results	Notes
Length of follow up Follow-up data collected between 6 and 12 months after baseline data collection. Baseline data collected in two two-month periods in 2009. Follow-up data in late 2009 or first half of 2010. **Source of funding** Active Living Research Rapid-Response Grant National Cancer Institute Grant	Children participating in the larger 4-year intervention trial (Healthy PLACES) Children living in Chino, California, or within a 30-minute drive of Chino. Children enrolled to study in 4th – 8th grade (UK year 5 to 9, 8-9yrs to 13-14yrs old) Annual household income <$165,000 Ability to complete questionnaires in English **Exclusion criteria** Children living more than a 30 minute drive away from Chino. Children in 9th grade or above (15 years old and over), or 3rd grade or below (up to and including 7 years old). Children whose parents earned >$165,000 Children whose English abilities prevented them from filling in the questionnaire.	renting a home in the SG community under examination (the Reserve). **Data collection** For both groups, four days of data were collected through text message surveys sent to participants' phones (Friday 4pm – Monday 8.30pm). Participants completed surveys on their phones at the time, and data was sent back to researchers. Surveys asking about current activity and context were sent 20 times over 4 days (3-7 random prompts during preprogrammed intervals each day). No surveys were sent during school hours. Surveys took 2-3 minutes to complete. Children were instructed to ignore prompts during incompatible activities ("sleeping, bathing"). Accelerometers were worn by all children from Friday morning to Monday evening to validate activity survey questions.	*Vegetation (a lot of trees and plants vs. no/some trees and plants(*Adj. Wald F 0.02, *p* = 0.884 *Safety (very safe vs. unsafe/somewhat unsafe)* Adj. Wald F <0.01, *p* = 0.967 Effect sizes not reported. The social setting of children's physical activity did not change over time alone (combining both groups) for any of the above factors. **Analysis** Survey: Ecological Momentary Assessments were used to measure current activity and in what social and physical context it was taking place. Data was collected through mobile phone electronic surveys (phones were given by research team, and phone calling and internet capabilities were disabled). Accelerometer data: strings of 0 activity for 60 minutes or more were counted as non-wear and removed. Valid days were defined as having at least 10 hours of accelerometer wear. Analysis: All analyses were adjusted for sex, age, and annual household income. The Wald F test was conducted to test for significance between groups, between time points (baseline and follow-up) and "group x time" (differences in changes between groups over time). Change in physical activity over time: a multilevel linear regression model tested whether children in SG community had a larger six-month increase in daily MVPA than control group. MVPA defined using age-specific thresholds generated from the Freedson prediction equation (≥4 Metabolic Equivalents [METS]).	characteristics – these are not split down due to small sample size. **Other comments** Other outcomes: No other outcomes were reported for this study. At the time of the study the intervention neighbourhood was still under construction: 1,956 out of 12,231 homes were complete. Children had already lived in intervention neighbourhood for a median of 15 months at baseline. Children were compensated up to $40 for taking part - $20 plus $1 for each completed survey entry. Power not reported. *Statistical significance appears to be ≤0.1 (not explicitly stated)

104 Knuiman et al 2014

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Knuiman et al 2014

Quality score
+

Study type
Uncontrolled longitudinal study

Location
Australia - Perth

Study aims
To examine neighbourhood walkability and destination accessibility in relation to walking for transportation (transport walking) within a neighbourhood over 7 years.

Length of follow up
Surveys at baseline and 1, 3 and 7 years after baseline.

99% of participants moved into new homes between baseline and follow-up 1.</td>
<td>Number of participants
Baseline: 1,813
1-year: 1,467
3-year: 1,230
7-year: 565 (31.2% of baseline).
Response rates not given.

Participant characteristics
Baseline (n = 1,703):
Female 59.8%.
Mean age 39.9 (standard deviation 11.8). 81.6% married or living with partner.
Highest level of education secondary school for 39.4%, trade school / apprenticeship / certificate 37.4%, Bachelors degree or higher 23.2%.
17.4% not in workforce. 25.7% have annual household income of ≤50,000 AUSD, 26.0% ≥90,000AUSD.</td>
<td>Intervention
Natural experiment. Study records changes over time of:
<u>Neighbourhood Environment measures</u>:
Objective measures such as: i) neighbourhood walkability measures (street connectivity, residential density, land-use mix); ii) types of services, iii) types of convenience stores, iv) numbers of public open space destinations, v) bus stops and vi) train stops.
Perception measures such as: i) Number of various services, shops, and open spaces to which participants perceived that they had access within the neighbourhood, ii) access to a bus stop, iii) access to a train station.

<u>Outcome measures</u>:
frequency of participants engaging in transport-related walking in their neighbourhood (neighbourhood defined as within a 15-minute walk from their home) over an average week.</td>
<td>Intervention: Association between environment and frequency of transport walking over time.
Control: No control

Outcomes
<u>Percentage of participants making transport walking trips</u>:
At baseline, 37% of participants did some neighbourhood transport walking, with the rates changing to 28% after 1 year, 29% after 3 years, and 36% after 7 years (no standard deviation; significance of change not reported).

<u>Number of transport walking trips made per week:</u>
At baseline, the mean trips per week was 1.4. This decreased to 1.1 trips at year 1 and 3, and authors report increased to baseline level at 7 years (no standard deviation; significance of change not reported).

Relationship between built environment and transport walking:
<u>Associations of neighbourhood walkability and objective environment measures (obtained from geographic information systems):</u>
<table>
<tr><th>Measure</th><th>Odds Ratio (OR)</th><th>95% Confidence Interval (CI)</th></tr>
<tr><td>Connectivity z score</td><td>1.09</td><td>1.03, 1.15*</td></tr>
<tr><td>Residential density z score</td><td>1.02</td><td>0.92, 1.14</td></tr>
<tr><td>Land-use mix z score</td><td>1.21</td><td>1.12, 1.30*</td></tr>
<tr><td>15-29 bus stops within 1600metres (compared with 0-14)</td><td>1.63</td><td>1.34, 1.98*</td></tr>
<tr><td>≥30 bus stops within 1600metres (compared with 0-14)</td><td>1.75</td><td>1.39, 2.19*</td></tr>
<tr><td>Railway station present within 1,600 metres of home</td><td>1.34</td><td>1.00, 1.81*</td></tr>
<tr><td>4-7 types of destinations present (compared with 0-3)</td><td>1.03</td><td>0.87, 1.22</td></tr>
<tr><td>8-15 types of destinations present (compared with 0-3)</td><td>1.29</td><td>1.02, 1.64*</td></tr>
</table>
* = statistically significant

<u>Associations of neighbourhood walkability and subjective environment measures (obtained from self-reported NEWS survey):</u></td>
<td>Linked study: Christian et al 2013

Limitations identified by the author
Demographic transitions such as leaving the workforce may be associated with changes in walking behaviour and are also likely to be associated with changes in built environment if the participant relocates because of the change.

High levels of drop-out (particularly between 3 and 7 year follow-up periods). Analysis showed that drop-out status was not related to outcome variable (but was related to some demographic characteristics). This is “drop out at random”, and, authors state, does not bias results.

Limitations identified by the review team
No response rate given.

No information given on what participants are told about the study.</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>**Source of funding**
Western Australian Health Promotion Foundation

Australian Research Council

Australian National Health and Medical Research Council Capacity Building Grant

National health and Medical Research Council Principal Research Fellow Award

National Health and Medical Research Council/National heart Foundation Early Career Fellowship grant</td>
<td>98.1% had access to a motor vehicle.

Inclusion criteria
The Residential Environments (RESIDE) study (of which this paper is a part) includes participants with English language proficiency, age of 18 years or older, intention to relocate (to one of 73 particular, pre-defined newly built neighbourhoods) by December 2005, and willingness to complete surveys 4 times over 7 years. Study does not state whether those moving away from the new neighbourhoods are excluded.

Exclusion criteria
Individuals with no English proficiency, children, no intention to relocate to a study neighbourhood, and who are not willing to participate.</td>
<td>Study looks at associations between changes in neighbourhood environment measures, and changes in outcome measures. Participants are those who were building homes in 73 new housing developments across Perth, Australia.

Comparator
No comparator

Data Collection:
Objective environment measures taken using geographic information systems (GIS).

Perception measures were collected with the Neighbourhood Environment and Walking Scale questionnaire (NEWS).

The Neighbourhood Physical Activity Questionnaire (NPAQ) was used to measure frequency of transport walking.</td>
<td>
<table>
<tr><th>Measure</th><th>Odds Ratio (OR)</th><th>95% Confidence Interval (CI)</th></tr>
<tr><td>Connectivity z score</td><td>1.05</td><td>0.99, 1.11</td></tr>
<tr><td>Residential density z score</td><td>1.04</td><td>0.94, 1.15</td></tr>
<tr><td>Land-use mix z score</td><td>1.16</td><td>1.08, 1.25*</td></tr>
<tr><td>Perceived access to bus stops (within 15-minute walk from home)</td><td>1.35</td><td>1.10, 1.66*</td></tr>
<tr><td>Perceived access to railway stations (within 15-minute walk from home)</td><td>1.44</td><td>1.13, 1.85*</td></tr>
<tr><td>3-6 types of destinations present (compared with 0-2)</td><td>2.07</td><td>1.76, 2.43*</td></tr>
<tr><td>7-11 types of destinations present (compared with 0-2)</td><td>2.32</td><td>1.95, 2.77*</td></tr>
</table>
* = statistically significant

The above demonstrates that:
• Objective (but not perceived) connectivity i.e. actual connectivity as measured using GIS, is weakly associated with transport walking.
• Neither perceived i.e. self-reported in NEWS questionnaire, nor objective residential density mix is associated with transport walking.
• Perceived and objective land-use mix is associated with transport walking.
• Perceived and objective access to bus stops and railway stations are associated with transport walking.
• Perceived number of types of destinations is more strongly associated with transport walking than objective measures of destinations present.

Analysis
Results were adjusted for age, sex, marital status, educational level, occupation (including whether or not the participant was in the workforce), hours of work per week, annual household income, the number of adults in the household, whether there were children who lived in the home, and whether the participant had access to a motor vehicle.
Logistic regression model used for binary outcome data (yes/no to transport walking over previous week). The model was a marginal model fitted to all available data providing population-average estimates of the association of objective factors with neighbourhood transport walking</td>
<td>Baseline data not useful due to large variation. 73 new neighbourhoods may have very different characteristics.

Not explicitly stated that those who move away are excluded – if included, makes results inaccurate.

Other comments
Other outcomes: No other outcomes were reported in this study.

Power not reported. Statistical significance ≤0.05.

NPAQ and NEWS questionnaires reliable.

The new homes were in neighbourhoods which are newly constructed and (authors report) have lower numbers of facilities than most of the neighbourhoods participants lived in at baseline data collection.</td>
</tr>
</table>

105 Trayers et al 2006

Study details	Population	Research parameters	Themes	Notes
Full citation Trayers et al 2006 **Quality score** + **Study type** Qualitative focus group study **Location and setting** UK - Bristol **Aim of the study** To explore perspective s of four groups of stakeholder s about proposed neighbourh ood improveme nts (home zone developme	**Number of participants** N = 32 **Participant characteristics** All participants were from a deprived neighbourhood in the south-west of England, in one of the 10% most deprived wards in the UK (specific place-name not given) within proposed extension of the National Cycle Network (NCN). Participant were 10 residents from neighbourhood; 10 students and tutors from a local further education	**Data collection** Local residents were recruited by letter, delivered to all 117 houses in the community. Children and students were recruited through local school and college. Planners were recruited from an open invitation to the planners working on the developments. Focus groups were conducted in the following order: local residents; primary school pupils age 9-10; college students and tutors; local authority planners. 2 authors acted as facilitators. A brief topic guide was informed by a literature review and open discussion was encouraged. Main focus of topic guide was on potential health benefits of environmental change: i.e. increased physical activity. Similar questions asked of each group, with appropriate changes for situation. Each session was audio-taped and transcribed, field notes	<u>Safety</u> For local residents, the new National Cycle Network (NCN) cycle/walkway provided a new route of entry into the neighbourhood, potentially allowing criminals or outsiders in. Students spontaneously expressed similar anxieties. *“You need a visible deterrent, cause it could be a place for antisocial behaviour, drug abuse, whatever” (college student)* *“Once this becomes a cycle track there is going to be potentially continuous traffic down there until the small hours, especially late at night in the summer, lots of kids around here go out until 2 am” (residents)* School pupils were concerned about their safety from cars and traffic on the road, welcoming changes which improve pedestrianisation. *“Also by my house there is a school, and you have to cross a very big street, and there are no islands in the middle or a zebra crossing, or a lolly pop lady, the council or somebody else should complain and somebody should do something about it” (children)* Planners recognise these themes and believe that on balance, regeneration will improve safety: *“the police said that trees cut out light, so we are trialling up-lighters (referring to lighting from the bottom up in planting areas), so there are not areas that are black spots, that people can get up to no good” (planners)* <u>Space</u> Space as territory emerged in the responses of residents, who wanted to protect space: *“Once a resident takes their car away in the morning, you can forget about finding a parking space when you come home” (resident)* School pupils saw space in terms of aesthetics, with awareness of litter and graffiti to which the new plans appealed:	Linked study: Coulson et al 2011 **Limitations identified by author** Small numbers of participants. Purposive sampling means opinions cannot be generalised to all residents of the area. Volunteers likely to have strong opinions / motivations for participating. **Limitations identified by review team** Views are specific to this deprived area. Unclear how these may differ in areas with higher socioeconomic status.

nt and extension of the National Cycle Network [NCN]) and their perceived health and physical activity benefits, and whether perceptions align. **Source of funding** Department of Exercise and Health Sciences, University of Bristol	college; 9 pupils from a primary school; 3 local authority planners overseeing the developments. Both female and male participants are quoted in each group apart from the students-and-teachers group – however this does not mean no females were present. **Inclusion criteria** Those living inside the area, and agreeing to participate. No others reported. **Exclusion criteria** Those living outside area.	were taken to supplement this. Focus groups were approximately 90 minutes long. **Method of analysis** Iterative process employed: constant comparison of themes as they emerged. This was undertaken through process of first three focus groups, so that for the fourth, themes could be put forward for discussion. The two researchers who conducted focus groups conducted initial analysis using the qual framework (familiarisation, identification of themes, indexing, charting and mapping, and interpreting). Themes were agreed independently. Further reviewers applied the framework approach as well, to establish inter-rater reliability. High level agreement was found between raters, so no formal measure was applied. Each theme was examined for contrasting viewpoints, and frequency / strength of each view was examined. A matrix of quotes to support each theme was displayed.	*"I don't like to play in my street, cause it is not safe cause I live in a dangerous area… and there is dog pooh everywhere and glass" (child)* College students, on the other hand, see space in terms of isolation, particularly isolated paths (in spite of theory about the paths providing connections). *"… if it is hidden away, out of the way, it can be scary, which is what happened in York, cause if there is a fair amount of space away from the houses, it then became quite inconvenient". [authors state that student describing route locations and an incident that was in the media last year about an attack on a students in York who was walking along a cycle path].* <u>Antisocial Behaviour</u> All groups were united in the worry that more open spaces, and quiet trails may increase what they considered antisocial behaviour mainly from youths (although some of this "antisocial behaviour" could count as physical activity). *"With the Home Zone you are encouraging use of the street for other things, but course that could mean a bunch of teenagers playing football in the street outside my house" (planner)* *"…if you open something up to cyclists, it also means a motor bike can get through so that is the problem we are constantly dealing with". (planner)* <u>Physical activity and health</u> Physical activity was seen by the researchers to be the least important theme to the participants, particularly compared with safety. Residents understood that some people might use it instead of driving, but referred to these people as "them" rather than "us". Number of entrances onto the path were also mentioned as a factor which would influence use. Children mentioned enjoying physical activities but made no link between these and the path, which the authors hypothesised may have been a result of their age. One college student appeared enthusiastic about the path as alternate travel, but tempered with concerns about safety. Planners also recognised that changes to PA were likely to be modest: *"I think it is great that you are opening it up, and the people that live in there will be able to get out to the river and walk along there, but how much are they going to use it, that is the question". (planner)* <u>Overall</u> The authors concluded that the mismatch between planners' and residents' perspective exists in relation to benefits of new Home Zone and cycle/walk way. Concerns with safety may be a feature of the deprived nature of the neighbourhood, particularly for women walking alone when car ownership is low.	No information given on characteristics (ethnicity, age, gender) of the groups, or the impact this could have on responses. **Other comments** **O**ther outcomes: no other outcomes were reported in this study. Accelerometer use by school pupils "found that the vast majority of these pupils were as active as children from more affluent areas that had been the subject of other studies". The views expressed here are in relation to the proposal, not a completed intervention. Unclear if views might change once intervention is in place.

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Study details	Population	Intervention/ comparator	Results	Notes
Reference Ward-Thompson et al 2014 **Quality score** - **Study type** Controlled before and after study **Location** UK – England, Wales and Scotland **Study aims** To assess the effect of a street improvement programme called "Liveable Neighbourhoods" on older adults physical activity and quality of life using cross-sectional, longitudinal cohort and activity surveys. **Length of follow up** 2 years **Source of funding**	**Number of participants** As described in the paper: <u>Cross-sectional survey</u> Intervention: n = 56 at baseline n = 29 at follow-up Comparison: n = 40 at baseline n = 32 at follow-up <u>Subset who took part in the longitudinal cohort</u> Intervention n = 20 Comparison n = 16 (same n for baseline and follow-up) **Participant characteristics** <u>Cross-sectional survey</u> Authors do not report any difference between intervention and comparison groups. Those providing follow-up data for the cross sectional survey tended to be female, have a higher functional capacity. No statistical comparison of the difference between baseline and follow-up characteristics is reported. Intervention group at baseline: 49% male, 51% female, mean age 75.92 (SD 7.3), mean (SD) functional capacity* 2.02 (0.76), 48% lived at home alone, 52% lived at home with others. Comparison group at baseline: 37% male, 63% female, mean age 74.11 (SD 7.35), mean (SD) functional capacity* 2.11	**Intervention** Nine sites were planned to receive the intervention**. The Do-It-Yourself (DIY) streets programme involved the sustainable transport charity 'Sustrans' partnering with local communities to use urban and landscape design to make streets safer and more attractive. Examples of improvements included inserting planters, changing parking space provision and layout, and adding features to reduce the speed and volume of traffic. No further details on intervention given in the study. **Only 7 out of the 9 streets were surveyed at follow-up due to delays in the implementation of the intervention **Comparator** Comparison streets chosen where no	**Intervention:** "Liveable Neighbourhood" streets **Comparator:** Matched comparison streets **Outcomes** <u>Cross-sectional survey</u>: Self-reported frequency of summer outdoor activities: declined in the intervention group (p = 0.02) at 2 year follow-up. No significant differences for the comparison group. No further results from the t-test are reported. <u>Longitudinal cohort survey:</u> Self-reported levels of outdoor activity in summer: did not increase significantly in either intervention or comparison groups. No further results from the t-test are reported <u>Neighbourhood perceptions</u> Cross-sectional: In the intervention group, perceptions that "most of the streets and paths in my neighbourhood are safe to walk after dark" increased significantly (p=0.04). There was a significantly negative change in perceptions relating to "good outdoor facilities, including garden and parking, at home" (p=0.02). The comparison group saw no significant change over time. Longitudinal: Responses to the statement 'it is easy for me to walk on my street' showed an increase in the intervention group, a change that was significant	**Limitations identified by the author** Loss to follow up: 29 (51.8%) in the intervention group and 32 (80%) in the comparison group provided follow-up data. Authors state that this was because 2 sites did not finish implementing the intervention and also because some participants moved streets during the 2 year follow-up. It could also be due to the burden of participation for older people. **Limitations identified by the review team** Small sample size Authors do not state how they dealt with missing follow-up data for the cross sectional survey. Some outcome data missing from results – authors have not reported physical activity data pre- and post-intervention for both groups; they have reported that a decrease happened in the intervention group but only a p value is given (no averages, no effect size). Study power: power calculation not included with regards to between-group differences pre- and post-intervention. **Other comments** Other outcomes: Outcomes also included measures of general health (EQ-5D) and quality of life (CASP-19). A subset of participants also

Study details	Population	Intervention/ comparator	Results	Notes
UK engineering and physical sciences research council	(0.91), 39.1% lived at home alone, 34.8% lived at home with others, 26.1% lived in sheltered housing alone. <u>Longitudinal cohort</u> Intervention: 36.8% male, 63.2% female, mean age 73.84 (SD 7.49), mean (SD) functional capacity* 1.9 (0.84), 39.1% lived at home alone, 55% lived at home with others, 45% lived in sheltered housing alone. Comparison: 31.3% male, 68.7% female, mean age 70.87 (SD 4.83), mean (SD) functional capacity* 1.84 (1.03), 37.5% lived at home alone, 50.0% lived at home with others, 12.5% lived in sheltered housing alone. *Functional capacity measured on a scale of 1-5 (Instrumental Activities of Daily Living scale). With higher scores associated with lower functional capacity. **Inclusion criteria** Aged 65 or older and living in either the intervention sites or chosen comparison sites **Exclusion criteria** None stated.	intervention took place. Streets were matched as closely as possible in terms of housing type, street layout and socioeconomic status as measured by the relevant index of Multiple Deprivation for the local census area.	compared with the comparison group (p=0.03). **Analysis** Relevant outcome measures to this review included: frequency of outdoor visits in a typical summer month; typical time spent outdoors in relation to utilitarian walking, recreational walking, gardening, outdoor sports, and other outdoor activities. Differences pre- and post-intervention were examined for each variable by t-test.	took part in an activity survey which involved self-report measures of activity as well as objective measures using an accelerometer. Only the baseline data is presented in the paper as the post-intervention data is yet to be analysed. Therefore, in the absence of follow-up data, the reviewers have not included these results in this table. Power not reported. Statistical significance ≤0.05.

Parks

Bohn Goldbaum et al 2013

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention / comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Full citation
Bohn-Goldbaum 2013

Quality score
-

Study type
Controlled before and after study

Location and setting
Australia - Sydney

Aim of the study
1) To determine if an urban park renovation that included playground alterations affects usage and physical activity (PA) in children within playgrounds; (2) determine whether playground alterations affects parents'</td>
<td>Number of participants
<u>Intervention (park A)</u>
Observation
All children observed using the park during research times (numbers not provided)
Survey
Follow up survey N = 140
<u>Control (park B)</u>
Observation
All children observed using the park during research times (numbers not provided)
Survey
No follow up survey carried out in control park

Participant characteristics
Not provided in detail – authors state that survey</td>
<td>Intervention (park A)
Specific changes in the park renovation included upgrading paths and adding new greenery, lighting, and facilities (e.g., park furniture). More green space was created by opening the adjacent sports field to public use, thus increasing the accessible park size from 2.2 to 4.6 hectares.

Comparator (park B)
The playground is similar to the pre-renovation playground in Park A: a fenced area with soft-fall flooring and containing multifunction apparatuses, swings and slides.

Data collection
Observation
Systematic observations of playground visitors aged 2-12 years were carried out using the System for Observing Play and Recreation in Communities.
Survey
Follow up survey with intervention park users were conducted post-upgrade, using the Sydney Parks User Interview Survey. The survey was not</td>
<td>Intervention: Park with upgraded facilities (park A)
Control: Park with unchanged facilities (park B)

Outcomes
The primary outcomes were the daily mean number of children visiting the playgrounds and the proportion of children engaging in moderate or vigorous physical activity (MVPA) based on systematic observations of children

Observation
This study observed a decline in children's moderate to vigorous physical activity (MVPA) levels post renovation; this decrease was significant in girls at the renovated playground. At baseline, fewer children performed MVPA in intervention compared to control park (P = 0.02). After the park upgrade, there was no detectable difference between parks in the number of children engaged in MVPA (interaction between park and time: P = 0.73)
<u>Mean number of children engaged in MVPA per 2-hour observation period (SD)</u>
<table>
<tr><th></th><th>Boys</th><th></th><th>Girls</th><th></th><th>Total children</th><th></th></tr>
<tr><td></td><td>Pre[a]</td><td>Post[a]</td><td>Pre[a]</td><td>Post[a,b]</td><td>Pre[a]</td><td>Post[a]</td></tr>
<tr><td>Intervention Park A</td><td>1.19 (2.09)</td><td>1.10 (1.51)</td><td>1.14 (2.37)</td><td>0.24 (0.44)</td><td>1.17 (2.21)</td><td>0.67 (1.18)</td></tr>
<tr><td>Control Park B</td><td>3.19 (4.76)</td><td>2.38 (3.79)</td><td>2.52 (3.03)</td><td>1.57 (2.04)</td><td>2.86 (3.95)</td><td>1.98 (3.03)</td></tr>
</table>
[A]A significant difference was found between parks. [b]A significant difference was found between pre and post intervention MVPA for girls in Park A.

Survey at follow up (intervention park only)
More than half of the parents visited the intervention park at least once per week. There was no significant difference in park visit frequencies between May (57.7%) and September (61.3%, p=0.47). Significantly lower proportion of survey respondents from September had visited the playground before the renovation (49.2%) than those from May (66.7%, P = 0.04)
<u>Parental park use (%(n)) from survey (intervention park only)</u></td>
<td>Limitations identified by author
The generalizability is limited because the findings relate to one intervention and one comparison park.

Changes in playground layout resulted in observation scan areas at follow up that include both play equipment and other park amenities, complicating the comparison of playground usage and PA levels.

Limitations identified by review team
No power calculations reported</td>
</tr>
</table>

Study details	Population	Intervention / comparator	Results	Notes
report of playground and (3) assess parental impressions of environmental features post intervention **Length of follow up** 2 years (baseline May 2007-May 2009) **Source of funding** The Cluster for Physical Activity and Health, Prevention Research Collaboration, School of Public Health, the University of Sydney	respondents resided in a low socio-economic area. Over 50% of intercept survey participants were mothers. At baseline, significantly more children engaged in moderate to vigorous physical activity (MVPA) in the control Park B compared to Park A **Inclusion criteria** **Follow up survey –** Intervention park users aged 16 years or older, who were accompanied by children under 13 years. Physical activity observations were made on children aged 2-12. **Exclusion criteria** Not defined (assume children aged less than 2 or aged 13 or older)	undertaken with control park users. These questions asked the number of days and hours on week days and weekend days a child engaged in PA outside of school hours. Survey Interviews were conducted by one of the authors (EB). Interviews were conducted throughout the park space, one interview per target area, rotating through all target areas for each data collection period. In the event of a refusal, another park user within the same area was approached; if no users participated in a given target area, data collection directly continued in the next target area. The authors carried out the survey at two survey points in May (n=75) and September (n=65) because two new pieces of play equipment were installed in Park A, however there were no significant differences in socio-demographic characteristics between the survey participants at the two survey points with the exception of a higher percentage of mothers in September (73.0%) than in May (53.2%, $P < 0.01$)	(see results below)	Selective reporting – the authors did not report the number of children observed in Park A post intervention. **Other comments** Authors report that survey participation in Park B was poor and inadequate for analysis, therefore results were not presented in the paper No other outcomes reported Significance level was considered at p≤0.05

Results:

	Total (n=140)	**May (n=75)**	**September (n=65)**	**Chi-square (P value)**
Playground visit frequency %(n)				
At least once per week	59.4 (79)	57.7 (41)	61.3 (38)	1.51 (0.47)
1-2 per fortnight or less	27.1 (36)	31.0 (22)	22.6 (14)	
First time	13.5 (18)	11.3 (8)	16.1 (10)	
Visited playground before renovation %(n)				
Yes	58.6 (82)	66.7 (50)	49.2 (32)	4.36 (0.04)
No	41.4 (58)	33.3 (25)	50.8 (33)	

<u>Physical activity level of children of intervention park users as a parental proxy questionnaire</u>

This study observed a decline in children's MVPA levels post intervention; this decrease was significant in girls at the renovated playground

Analysis
Data from five weekdays and two weekend days from each time period were used. Data points concerning infants were omitted. Due to large fluctuations in usage, there was some variation in the number of scans per 2-hour observation periods both within and between parks. To standardize this difference, usage means (observed persons per observation period) were calculated for playground usage for total children and by gender.

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Study details

Reference
Cohen et al 2009

Quality score

-

Study type
Controlled before and after study

Location
USA - California

Study aims
To assess the impact of park improvements on park use and physical activity

Length of follow up
3-5 years follow up (baseline data was collected between Dec 2003 and Nov 2004 and follow-up data between April 2006 and March 2008)

Population

Number of participants
Parks
Intervention parks – n= 5
Control parks – n=5

Survey
Survey respondents not divided by intervention and control park. No response rates provided

Survey at Baseline
N = 768 park users
N= 767residents
Survey at Follow-up
N= 712 park users
N= 620 residents

It is unclear whether or not the researchers resurveyed the same residents or park users at follow up

Participant characteristics
The 10 (matched) intervention and control parks were located in predominantly Latino and African-American and low-income neighbourhoods (average 31% households in poverty). The parks ranged from 3.4 to 16 acres (mean=8 acres) and served an average of 67,000 people within a 1 mile radius and

Intervention/ comparator

Intervention
5 refurbished parks. Refurbishments were:
Gyms in 4 of 5 parks. 1 park replacing existing gym, 1 refurbished gym, 1 adding an additional gym and 1 constructing new gym One underwent some field improvements in watering and landscaping. One had improvements to picnic areas, upgrades to a walking path, and enhancements to a playground area so that it had rubberized surfacing around the climbing apparatus and stationary horses.

Control
the intervention parks were matched to parks which were similar to the intervention parks but had not received any improvements

Data Collection
The System of Observing Play and Recreation in Communities was used to objectively assess baseline park use and Physical Activity

Park users were also surveyed and recruited systematically from the most and busy areas, by gender and by activity level for self-reported park use and safety.

Residents living within a 2-mile radius of the park were surveyed. More specifically, households were classified into four strata (within ¼ mile, from ¼ to

Results

Intervention: Park improvements
Control: No improvements made to the Parks

Outcomes
Overall park use (based on direct park observations)
The authors reported that park use declined in all age groups bar 'teens' from baseline to follow up (14682 individuals used the 10 parks at follow up compared to 19579 at baseline).

<u>Key outcomes based on survey respondents</u>
Perceptions of park safety from baseline to follow-up improved among intervention park users and neighbourhood residents; while it decreased for the control parks. This was a significant change; however, it was not correlated with observed park use or self-reported exercise

	Baseline		Follow up		ORs	P-values
	C	I	C	I		
First time users	0.80	0.097	0.099	0.195	1.08	**0.007**
Neighbourhood park use	0.692	0.587	0.582	0.488	1.01	0.850
Use of other parks	0.117	0.111	0.108	0.066	0.96	0.249
Perceived park safety	0.860	0.696	0.774	0.913	1.35	**<.001**
Health	0.374	0.468	0.433	0.521	0.99	0.905
Physical activity during leisure time at park	0.667	0.616	0.482	0.419	0.99	0.812

C=control, I= intervention
Improvements in intervention parks did not result in increased park use and physical activity

Analysis

Notes

Limitations identified by the author
Due to the lengthy time span between baseline and follow-up measures it is possible that factors beyond the scope of the study contributed to the decline in park use.

Observations were limited to a single week in a single season at each time period, and if changes occurred in other seasons, they would have been missed

Limitations identified by the review team
The authors did not report on the levels of physical activity despite setting this as one of the main outcomes – selective reporting bias

The study power was not calculated

Other comments
No other outcomes reported

Statistical significance was considered at P≤0.05

Study details	Population	Intervention/ comparator	Results	Notes
Source of funding Supported by the NIEHS grant (full name of grant was not provided)	210,000 people within a 2 mile radius. Significantly more Latinos and women were interviewed at follow-up than baseline (*p*<.0001 and *p*< .0001, respectively). The majority of respondents were women with on 28.1% of resident survey respondents reported to be mails. Approximately 50% of respondents had lived in the neighbourhood for more than 5 years. **Inclusion criteria** Residents living within a 2-mile radius of the intervention or control parks were surveyed **Exclusion criteria** Not defined – but assume anyone residing outside the above mentioned boundaries	½ mile, from ½ to 1 mile, and from 1 to 2 miles from each park) and sampled approximately equal numbers of households from each stratum. The same households were visited at baseline and follow-up, but unique identifying personal information was not collected from respondents. All methods were approved by the RAND IRB. The validity of the survey was not mentioned or provided	To assess whether park improvements had an effect on outcomes of interest, a propensity score analysis was conducted. This analysis included only 8 of the10 study parks because a few key questions had not been included in the initial survey given to the residents living near them. A propensity score weighted logistic regression was then run to assess whether the changes in the intervention parks were significantly different from the changes in the control parks over time. The authors did not mention any adjustments made for potential confounders.	

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<table>
<tr><th>Study details</th><th>Population</th><th>Research parameters</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Full citation

Cohen et al, 2014

Quality score
-

Study type
Controlled before and after study (Authors call ‘controlled quasi experimental post only comparison’)

Location and setting

USA – Los Angeles

Aim of the study
To assess the use of new pocket parks in low-income neighbourhoods.

Length of follow up
2 years</td>
<td>Number of participants
<u>Intervention parks</u>
Baseline (Before)
Residents survey respondents – n= 432

Follow up (After)
Residents survey respondents – n = 342

Response rates were not provided

<u>Comparison parks</u>
Baseline
park users n = 71
Follow up
Park users n= 992

It is unclear what proportion of the baseline respondents/park users were surveyed again at follow up

Participant characteristics
<u>Survey respondents</u>
The mean age for intervention park survey respondents and park users was 39 years and 35 years respectively and for</td>
<td>Intervention
Three intervention pocket parks were developed, two in previously vacant lots and the third in a former community garden site. All were small (less than ½ an acre) and defined by authors as ‘pocket parks’.

All three intervention parks had playground equipment and benches installed; one park (the largest) also had a walking path. All were fenced and enclosed by gates that could be locked.

Data collection
<u>Survey</u>
A randomly selected sample of household addresses within a quarter mile of the pocket park and another between one-quarter and one-half mile of the park were selected and field staff went door-to-door to conduct the surveys. Residents were surveyed at home before and after the parks were completed to find out the residents’ use of parks and physical activity engagement.

Authors state that they attempted to administer surveys at the same addresses at baseline and follow-up. Authors did not provide the</td>
<td>Intervention: New intervention parks
Control: 992 neighbourhood park users and 342 residents living within ½ mile of other neighbourhood park

Outcomes

<u>Self-reported use of intervention parks at baseline and follow up (from survey)</u>
<table>
<tr><th></th><th colspan="3">Intervention parks</th></tr>
<tr><th>Residents responses</th><th>Residents Baseline (n=392)</th><th>Residents Follow up (n=432)</th><th>P value</th></tr>
<tr><td>Adults visits any park more than once/week</td><td>11.1%</td><td>33.9%</td><td><0.0001</td></tr>
<tr><td>Engage in leisure time exercise</td><td>25.8%</td><td>35.7%</td><td>0.0025</td></tr>
<tr><td>Exercise in park</td><td>9.6%</td><td>14.4%</td><td>0.0395</td></tr>
<tr><td>More than ½ of leisure time is exercise</td><td>71.7%</td><td>71.1%</td><td>0.9131</td></tr>
<tr><td>Use of other parks more than once per week</td><td>10.8%</td><td>21.8%</td><td><0.0001</td></tr>
</table>
At follow up the percentage reporting visiting any park more than once per week tripled, a statistically significant change from baseline (p<0.0001)
The number proportion of people engaging in leisure time also significantly increase (p<0.0025) as well as the proportion of respondents exercising in the park (p<0.0395)

<u>Cost effectiveness</u>
At follow up -
The cost per MET expended was lowest in one of the intervention parks with the largest number of users at $0.43/MET. At the other two parks cost per MET was $0.72/MET and $2.63/MET. Overall cost effectiveness was $0.73/MET gained. The difference in cost-effectiveness is based upon the</td>
<td>Limitations identified by author
Surveys were administered throughout the comparison neighbourhood parks, not only in the playground areas, so some responses may reflect opinions of the entire set of park users, rather than those who frequent the playground area only [authors state this as limitation but did not report on the survey from comparison parks]

Limitations identified by review team
Selective reporting as the researchers did not report on the survey responses from the comparator parks

Other comments
The “pocket park” use was reported however not included as that part of the study was cross sectional</td>
</tr>
</table>

Baseline park observations were conducted between mid-July and mid-August 2006, and follow-up assessments were completed during the same season in 2008 **Source of funding** Not mentioned by the authors	comparison parks 44 years and 37 years respectively. The majority of both park users and residents participating were Latinos and female. **Inclusion criteria** Survey respondents - 18 years of age or older and resided within a half mile of the intervention park **Exclusion criteria** Not defined	proportions of those they resurveyed. They state many houses around the parks with the highest poverty rate were not accessible (i.e., gated or fenced), so in-home resident surveys were sometimes not possible. In such cases they replaced the in-home resident surveys with intercept surveys conducted at high pedestrian traffic areas (e.g., bus stops, store fronts) within a half mile of the park.	number of park users and their physical activity levels in each of the pocket parks **Analysis** The researchers estimated cost-effectiveness by 'paying off' the cost of building each park over 30 years. They also assumed that the METs expended during the week of measurement were similar to the 329 days (47 weeks) of the year when there is no precipitation in Los Angeles. They calculated the dollars spent per MET expended in the parks per year. The method interprets cost-effectiveness based upon the achieving the nationally recommended guidelines of 150 minutes of MVPA per week or 2.5 hours at 4.5 METs (11.25 METs (meant to mean METs/hour) in light of the cost of per capita health care, and the contribution of physical inactivity to health care costs (about 2.5–5%).	No power calculation Significance testing was considered at p≤0.05

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<table>
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<tr>
<td>Full citation
Cohen et al, 2015

Quality score
-
Study type
Controlled before and after study

Location and setting
USA – San Francisco

Aim of the study
To investigate the impact of park renovations on park use and park based moderate or vigorous physical activity.

Length of follow up
3 years</td>
<td>Number of participants
The authors did not define survey responders as being in control or intervention group (split by park itself).

Baseline
Survey responses - n = 922 (of which 503 were park users and 419 were local residents)

Follow up
Survey Responses -N=1043 (of which 410 were park users and 633 were local residents)

It is unclear if the some of the respondents were surveyed at baseline and follow-up

Participant characteristics
Authors did not mention whether or not there was any statistically significant differences of baseline characteristics

<u>Baseline</u>
The average age of the 922 survey respondents was 42</td>
<td>Intervention
2 parks had extensive renovations including the installation of new play equipment, landscaping and ground surfaces, addition of adult outdoor fitness equipment and a new 2,500 square foot recreation centre

2 parks were partially renovated parks continued to undergo renovations at the time of the follow-up; several areas were open and actively used, though other areas were inaccessible due to construction.

Control
2 parks that were not renovated and remained unchanged from baseline

Data collection
Observation
Park use before and after the park renovations was measured using the System for Observing Play and Recreation in Communities (SOPARC). Researchers mapped each park, dividing it into distinct target areas
Field staff systematically rotated through all target areas in each of the 6 parks 4 times each day (early morning, mid-day, afternoon and early evening) for 7 days in May 2009 (baseline) and May 2012 (follow-up). During each area rotation, park users were counted by gender, age group, and physical activity level (sedentary, walking, vigorous) and</td>
<td>Intervention: Renovation to parks
Control: No renovations
Outcomes
<u>Observed change in total park use and energy expenditure in MET-Hours</u>
The results show that there was a 250% increase in energy expended at and 230% increase in park use in the intervention parks compared to the baseline (p<0.001).
There was a statistically significant decrease in park use (48%) and Met hours expended (53%) in the control parks compared to baseline (p<0.001).
<table>
<tr><th></th><th>Intervention Parks</th><th></th><th>Control Parks</th></tr>
<tr><td>*=P<0.001</td><td>Renovations complete Beta (SE)</td><td>Under construction Beta (SE)</td><td>No renovations Beta (SE)</td></tr>
<tr><td>% change in total park use</td><td>233.1(55.9)*</td><td>30.4(21.9)</td><td>-48.6(10.3)*</td></tr>
<tr><td>% change in MET-hours expended in park</td><td>254.8 (70.1)*</td><td>28.2 (25.3)</td><td>-53.1 (11.1)*</td></tr>
<tr><td>% change in children in park</td><td>434.0 (112.7*</td><td>58.8 (33.5)*</td><td>−7.4 (23.1)</td></tr>
<tr><td>% change in teens in park</td><td>−51.1 (10.4)*</td><td>-7.3(19.7)</td><td>0.3 (24.7)</td></tr>
<tr><td>% change in adults in park</td><td>169.6 (39.9)</td><td>29.8 (19.2)</td><td>-53.7 (8.2)*</td></tr>
</table>
</td>
<td>Limitations identified by author
Small number of parks in one city and thus findings may not be generalizable to other localities.

Changes may be due to unique local characteristics of the places and the population.

Findings may not reflect activities and park use that might occur in other seasons.

Perceptions of safety improved, but it is not possible to say whether it was due to the new construction or a change in perception of crime or safety, independent of the new construction

Limitations identified by review team
The authors did not provide the distance between parks – if the parks were close in proximity it will be natural for users to prefer a renovated park with better facilities</td>
</tr>
</table>

(Baseline 7 days in May 2009 and follow-up May 2012) **Source of funding** RWJ Foundation Active Living Research, and NHLBI and NHLBI	years old for residents and 44 years for park users. 56% were male. The race /ethnicity - 9% Hispanic, 17% African American, 40% white, 15% Asian, with 17% considering themselves multi-racial or other <u>Follow-up</u> The participant characteristics where not provided **Inclusion criteria** Stated that included anyone using the park and surveyed park users and local residents (not defined, but at follow up average distance park users lived from the park, was 1 mile) it is unclear which of the parks the authors made distance reference to. **Exclusion criteria** Not defined (assume that anyone not using the park or not a local resident.	areas were coded as to whether they provided direct supervision and organized activities and whether they were vacant Because the authors could not discern if the same or different people visited the park during the different days and hours observed, the authors summarised the park use in person-hour visit**s.** *Survey* The authors did not provide any information on the questionnaire or tool used for the survey. They report interviewing 75 adult park users and 75 residents from randomly selected houses. The survey measures included questions about use of the park, frequency and location of exercise, activities engaged in at the park, perception of safety, and self-rated health. It is not clear how the authors allocated the survey respondents to the intervention or control parks	% change in seniors in park | 25.4 (18.0) | -8.8(13.1) | -10.7(15.1) The authors did not provide age cut offs for the different age groups. <u>Survey - exercise frequency and Perceptions of safety</u> Park renovations were associated with a significantly increased perception of park safety by park users (Beta estimate 1.43, p<0.01) and local residents (Beta estimate 0.42, p<0.01). Park renovations, either finished or ongoing, were not positively associated with the self-reported number of exercise sessions, but the self-reported frequency of park visits was positively associated with the number of exercise sessions(Beta estimate 0.15(0.01),p< 0.001). <u>Cost-effectiveness of the renovations</u> The cost effectiveness of the total renovation of the parks ranged substantially, from \$0.27/MET-hour to \$2.66/MET-hour for the smaller park. **Analysis** Total park use and METS expended in the park were estimated by a mixed-effect(s) model, controlling for potential confounders (these were not defined). Changes in use were estimated by comparing two measurement periods. Self-reported park use, exercise frequency, and perceptions of safety were estimated by a set of logit models.	Reported baseline measured outcomes were not reported at follow up e.g. the authors recorded % of participants observed engaging in sedentary, moderate and vigorous PA No power calculation **Other comments** Each MET-hour gained is roughly equivalent to a person engaging in MVPA for about 15 minutes. Significance testing considered at p≤0.05 No other outcomes reported

116 Gidlow et al 2010 (qualitative)

Study details	Population	Research parameters	Results	Notes
Full citation Gidlow et al 2010 **Qualitative results**– (please note the study had two aspects quantitative and qualitative) **Quality score** - **Study type** Uncontrolled before and after study **Location and setting** England - Stoke on Trent **Aim of the study** To increase effective use of a neighbourhood park in a deprived urban community **Source of funding** Natural England	**Number of participants** *Baseline* 35 adults (of which 11 were men and 24 women) and 23 young people (of which 14 were males and 9 females) *Follow up* 10 adults. (4 of which took part in baseline) **Participant characteristics** *Baseline* 4 focus groups were carried out with 35 local adults, mean age 48 years and all were white British. Mean age of the young people was 12.7 (SD 0.8) years All where white British *Follow-up* 7 people were interviewed and 3	Focus groups were used to gather data on experiences and perceptions of local green space, and to inform the location and design of the intervention. Focus groups were first undertaken with local adults and, subsequently, with local adolescents. Focus groups and interviews at baseline aimed to establish an appropriate greenspace for intervention. Focus groups at follow up aimed to understand peoples current feelings towards the park, gain feedback and identify further improvements of the intervention park **Data collection** Discussions were semi-structured using guide questions that covered themes related to current perceptions of the park, associated experiences, ideas for improvement and, if applicable, opinions of any recent activities in the park. An experienced qualitative researcher moderated discussions, which were	**Key themes** **General perceptions of green space (Adults Baseline)** Authors report - Participants' first thoughts of green spaces were positive, as places where "you can breathe", "sit and reflect", "relax" or "enjoy". In many cases, however, this led to discussion of negative aspects such as "litter", "lack of amenities". Green space was considered important by all participants. Most perceived benefits were for psychological wellbeing: "it changes your perspective... lifts your spirits"; "you could be worried to death about something and half an hour at [District Park] and it's all different". Getting out of the house was often referred to. Physical benefits noted by some participants included fitness, but were secondary to psychological benefits. Finally, knowledge that green space was there (i.e., accessible) was important: "*I'm not going to go every day or week, but if I want it then it's there and that's what I like about it*". One group focused on the benefits for children, "*you get the kids away from computer games and get them out of the house*", and discussed the role of green spaces for families: "*it's nice when you see the parents going with them actually interacting with them... getting a footy team up or whatever*". [No information from follow-up] **Use of the park (Young People Baseline)** Most of the participating young people were regular users of the intervention park. Main activities at the park were "playing football" or "*watching the lads play football until like it goes dark, and then everyone just sits on the court, finds sumin to do*" and socialising with friends. Several young people made reference to antisocial behaviour indicating that some "*cause trouble mainly*" and "*terrorise people*". [No young people were interviewed at follow-up] **Understanding the issues surrounding the intervention park – Positive aspects** *Adults* Participants had difficulties identifying positive features of the intervention park at baseline. One participants felt the park provided social benefits. Those who owned dogs thought it was convenient for dog walking. A few participants discussed the benefits of the park for children "*it's somewhere for the children to go*" and most felt that *the cage* was popular with many of the local children.	**Limitations identified by author** None identified by the authors **Limitations identified by review team** High loss to follow-up Only one researcher developed the emerging themes and coding The sample size especially at follow-up was small Context bias – both and adult participants were linked to the local school, excluding the views of those who attended school elsewhere

	attended a focus group. Mean age was 59 (SD – 9.9) and they were all white British. **Inclusion criteria** participants were resident within postcode areas within 300m of the intervention park and/or familiar with/used Intervention Park All young people participating attended the local secondary school **Exclusion criteria** Not detailed – assume anyone not attending the secondary school or not residing within 300m of park and/or not familiar with or using intervention Park	digitally recorded, with contemporaneous notes made by a trained observer. At baseline, adult participants were asked for consent to be re-contacted regarding follow-up focus groups to discuss the intervention and gauge opinion on the relative success of the project **Method of analysis** Key themes were extracted and developed by the group moderator using an inductive approach to ensure that themes were data driven; i.e. that they represent participant views	A number of follow-up participants, however, were either unaware of the changes, or did not feel that they enhanced the area: "I can't comment on whether it is nice or not round there because I haven't been round". *Young People* Participating young people felt that the positive aspects of the park at baseline were related to socialising, "the people that go down there"; locality, "it's close as well, to where we live"; football, "I like the cage... it's good"; and the youth workers who visited the park, "the youth people, we look forward to that". [No information from follow up]. **Antisocial Behaviour(Adults)** The authors report this was the most discussed issue at baseline, causing participants to avoid the park, particularly after dark and at the weekend. Participants indicated that the lack of lighting, and the dense area of trees caused poor visibility after dark. The trees were seen as providing a haven to those taking part in the problem behaviours: "*They used the area round the trees to hide and do drugs and that's why we stopped going there*". At follow-up, antisocial behaviour remained an issue, though improvement was noted. "*There was a lot of antisocial behaviour there... but I don't think it's quite as bad as it was; they have clamped down on it a bit*", but participants were still concerned about using the intervention park after dark: "*I don't go when it's dark, I'm not stupid*" **Facilities (Baseline Adults)** *Adults* At baseline, adults felt that park facilities were very limited. Existing equipment was considered dangerous due to a lack of maintenance or vandalism: *"They have tried things in the past, they have put benches and rubbish bins in the past but they were constructed out of the wrong things, things that could be set on fire".* A lack of lighting was again indicated as a problem Consistent with survey data, litter, broken glass (i.e., evidence of antisocial behaviour) and dog mess were further deterrents to parents taking their children to the park. [No information from follow up]. *Young People* Participating young people agreed on the need for lighting in the park, especially around '*the cage*': "*there are no streetlights... and the few that there are go off really early*". Some suggestions for new play equipment included swings and a climbing frame. It was felt that there was little on the park for their age group: "*there's nothing on it, it's all for babies*". [No information from follow up].	

118 Gidlow et al 2010 (quantitative)

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference

Gidlow et al 2010

Quality score

-

Study type
Uncontrolled before and after study

Location

England - Stoke on Trent

Study aims

To increase effective use of a neighbourhood park in a deprived urban community

Length of follow up</td>
<td>Number of participants
Baseline
Postal Survey
N= 89 (8.3% response rate)
<u>Direct Observations</u>
N=817 people

Follow up
<u>Postal Survey</u>
N=120 (11.2% response rate).
Note that only 16 individuals completed survey at baseline and follow up.

<u>Direct Observations</u>
N= 688 people

Participant characteristics
No significant differences in respondent characteristics between baseline and follow-up

Approximately equal gender distribution and a</td>
<td>Intervention
One intervention site where there was thinning of wooded area, raising of tree line and introduction of path and features (e.g., boulders, logs) - to increase visibility in response to safety concerns and improve general aesthetics.
Introduction of a natural play area – in response to the widely cited lack of children's play facilities, whilst retaining natural qualities of the space.

Comparator
There were 8 comparison sites where data was collected at baseline but not follow-up

Data Collection:
A postal survey was conducted pre and post-intervention to monitor changes in a range of variables related to use and perceptions of Intervention Park, with additional health, physical activity and social capital measures.
Two copies of the survey were distributed to each residential address within the inclusion criteria with instructions for all adult occupants (≥16 yr) to complete the survey with</td>
<td>Intervention: Park renovations/modifications
Control: No control
Outcomes
<u>Baseline and follow-up perceptions of the intervention park</u>
Though there were changes in perception between baseline and follow up this was not significant.

<table>
<tr><th>B - n=50
FU -n=120</th><th colspan="2">Do not visit (%,n)</th><th colspan="2">Good/very good (%, n)</th><th colspan="2">Fair (%, n)</th><th colspan="2">Poor/very poor (%, n)</th></tr>
<tr><td></td><td>B</td><td>FU</td><td>B</td><td>FU</td><td>B</td><td>FU</td><td>B</td><td>FU</td></tr>
<tr><td>Design and appearance</td><td>1.9(1)</td><td>5.8(6)</td><td>17.3(9)</td><td>25.6(31)</td><td>32.7(17)</td><td>30.6(37)</td><td>48.1(25)</td><td>38(46)</td></tr>
<tr><td>Ease of getting around</td><td>1.9(1)</td><td>5.8(6)</td><td>67.3(35)</td><td>71.9(86)</td><td>21.2(11)</td><td>18.2(22)</td><td>9.6(5)</td><td>4.1(5)</td></tr>
<tr><td>Maintenance</td><td>1.9(1)</td><td>5.8(6)</td><td>19.2(10)</td><td>33.1(40)</td><td>34.6(18)</td><td>33.1(40)</td><td>44.2(23)</td><td>28.1(34)</td></tr>
<tr><td></td><td colspan="2">Do not visit (%,n)</td><td colspan="2">Satisfied/very satisfied (%, n)</td><td colspan="2">Neither satisfied/dissatisfied (%, n)</td><td colspan="2">Dissatisfied (%, n)</td></tr>
<tr><td>Sports facilities</td><td>2(1)</td><td>5.8(6)</td><td>17(9)</td><td>13.2(16)</td><td>37(19)</td><td>43.8(53)</td><td>44(23)</td><td>37.2(45)</td></tr>
<tr><td>Facilities for children/ parents</td><td>2(1)</td><td>5.8(6)</td><td>4(2)</td><td>8.3(10)</td><td>15(8)</td><td>24.8(30)</td><td>77(40)</td><td>61.2(73)</td></tr>
<tr><td>Overall satisfaction</td><td>2(1)</td><td>5.8(6)</td><td>25(13)</td><td>21.5(26)</td><td>19(10)</td><td>31.4(38)</td><td>54(28)</td><td>41.3(50)</td></tr>
</table>
B=Baseline, FU=follow-up
<u>Sample self-reported physical activity</u>
<table>
<tr><th rowspan="2">Days of moderate PA for 30mins</th><th>Baseline (n=50)</th><th></th><th>Follow-up (n=120)</th><th></th><th>Significance</th></tr>
<tr><th>%</th><th>n</th><th>%</th><th>n</th><th></th></tr>
<tr><td>0</td><td>13.7%</td><td>7</td><td>26.1%</td><td>31</td><td>ns</td></tr>
<tr><td>1</td><td>9.8%</td><td>5</td><td>3.4%</td><td>4</td><td></td></tr>
<tr><td>2</td><td>19.6%</td><td>10</td><td>12.6%</td><td>15</td><td></td></tr>
<tr><td>3</td><td>9.8%</td><td>5</td><td>10.1%</td><td>12</td><td></td></tr>
<tr><td>4</td><td>7.8%</td><td>4</td><td>10.1%</td><td>12</td><td></td></tr>
<tr><td>5</td><td>11.8%</td><td>6</td><td>8.4%</td><td>10</td><td></td></tr>
</table>
</td>
<td>Limitations identified by the author
Low response rate

Potential bias due to low response and over-representation of older people, retirees, dog owners and better than expected health and physical activity outcomes

Lack of control limits the study in determining whether improved perceptions among local adults and reduced antisocial-behaviour is park specific

Limitations identified by the review team
Used a number of tools in data collection, all piloted on small numbers of</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>12 months (Baseline April/May 2009, Follow up June/July 2010)

Source of funding

Natural England</td>
<td>mean age of 45 (SD 17.0), all respondents classified as White British ethnicity, had resided in the area for 15.4 +/- 12.1 years. Relatively deprived area with 47% with no formal qualifications

Inclusion criteria
The intervention park was more than 2 hectares in size and, allowed Un-restricted public access.

Households within 300m walk of the intervention park

Exclusion Criteria
Households outside of defined area.</td>
<td>further copies available on request

The survey asked about – visiting the intervention park, perceptions of the park, access to services, physical activity expended, general health and household information. The survey as a whole was not validated but the questions were mostly existing and/or pre-validated from other national surveys or studies.

Direct observation-of green space use: Observation protocol based on two existing methods –SOPARC and ProGress which the researchers internally validated on small numbers. Two trained researchers collected all observation data. All people entering the park were eligible to be counted, rather than using periodic scans. Data was collected for 10 one-hour observation periods: two complete weekdays (4x1 hour on 2 days) and two one-hour periods on a weekend day. The researchers recorded the age, status (alone or group), dog (with dog), primary activity and physical intensity.</td>
<td>
<table>
<tr><td>6</td><td>3.9%</td><td>2</td><td>5.0%</td><td>6</td><td></td></tr>
<tr><td>7</td><td>23.5%</td><td>12</td><td>24.4%</td><td>29</td><td></td></tr>
<tr><td>Meet PA recommendations</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Yes</td><td>60.8%</td><td>30</td><td>62.2%</td><td>75</td><td>ns</td></tr>
<tr><td>No</td><td>39.2%</td><td>20</td><td>37.8%</td><td>45</td><td></td></tr>
</table>
The authors did not report on the actual p values for significant differences between the baseline and follow up. There was no significant differences between the number of days reported in engaging in at least 30 minutes of moderate physical activity and consequently there was no significant differences between baseline and followup in the proportion of respondents meeting the PA recommendations.

<u>Frequency and duration of use of the park baseline vesus follow-up</u>
<table>
<tr><th></th><th></th><th colspan="2">Baseline</th><th colspan="2">Follow-Up</th></tr>
<tr><th></th><th></th><th>Winter %(n)</th><th>Summer%(n)</th><th>Winter %(n)</th><th>Summer%(n)</th></tr>
<tr><td rowspan="3">Frequency of visit</td><td>seldom/never</td><td>48.1(25)</td><td>32.7(17)</td><td>37.2(45)</td><td>20.7(25)</td></tr>
<tr><td></= per wk</td><td>15.4(8)</td><td>17.3(9)</td><td>24.0(29)</td><td>30.6(37)</td></tr>
<tr><td>Most/everyday</td><td>36.5(19)</td><td>50.0(26)</td><td>38.8(47)</td><td>48.8(59)</td></tr>
<tr><td rowspan="4">Duration of weekday visit</td><td>Do not visit</td><td>40.4(21)</td><td>38.5(20)</td><td>34.7(42)</td><td>33.9(41)</td></tr>
<tr><td></= 10 min</td><td>26.9(14)</td><td>19.2(10)</td><td>32.2(39)</td><td>25.6(31)</td></tr>
<tr><td>11-30 min</td><td>25.0(13)</td><td>26.9(14)</td><td>25.6(35)</td><td>28.9(35)</td></tr>
<tr><td>>30 min</td><td>7.7(4)</td><td>15.4(8)</td><td>7.4(9)</td><td>11.6(14)</td></tr>
<tr><td rowspan="4">Duration of weekend visit</td><td>Do not visit</td><td>30.8(16)</td><td>28.8(15)</td><td>19.8(24)</td><td>21.5(26)</td></tr>
<tr><td></= 10 min</td><td>13.5(7)</td><td>11.5(6)</td><td>22.3(27)</td><td>19.8(24)</td></tr>
<tr><td>11-30 min</td><td>25.0(13)</td><td>25.0(13)</td><td>33.1(40)</td><td>28.1(34)</td></tr>
<tr><td>>30 min</td><td>30.8(16)</td><td>34.6(18)</td><td>24.8(30)</td><td>30.6(37)</td></tr>
</table>
The authors report that the majority of those who reported visiting the park did so on foot (95.5%). There was a small but significant correlation between frequency of visits in winter and physical activity (r=0.466, p=0.001) and meeting the physical activity recommendations (r=0.349, p=0.012), correlations were weaker for the frequency of visits in the summer (r=0.302, p=0.031 and r=0.197, p=0.166) respectively.

Analysis
Baseline and follow-up survey respondents were treated as independent samples for analysis and data must be interpreted with caution. Analysis methodology was not provided.
</td>
<td>participants, but not validated.

Power not reported.

Other comments
Other outcomes - Authors also recorded views on park use and facilities qualitatively and stages of change towards meeting the 5*30 minutes of physical activity a week . Also undertook park audit.

Significance testing was considered at p≤0.05</td>
</tr>
</table>

119 King et al 2015

<table>
<tr><th>Study details</th><th>Population</th><th>Research parameters</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Full citation
King et al 2015

Quality score
+

Study type
Uncontrolled before and after study

Location and setting
USA - Denver

Aim of the study
To quantify and report the use of the surrounding streets, alleys, parking lots and green space for play and leisure activities, and the changes in total energy expended within these spaces following park construction on an existing green space

Length of follow up
2 years

(Observations were carried out in June-October 2010 and June –October 2012)</td>
<td>Number of participants
Baseline (2010) -N = 2888
Follow up (2012) – N = 4525

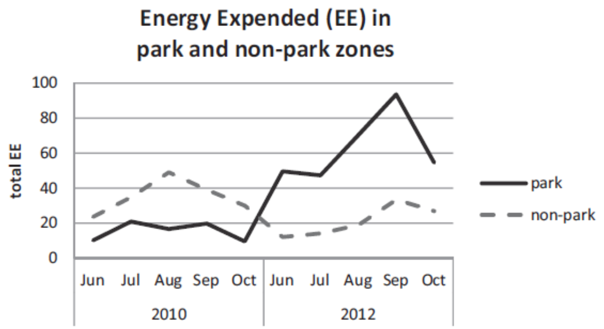
Participant characteristics
Nearly all park users and non-park users were identified as non-white (99.1% at baseline and 98.9% at follow up). The majority of the people included in the study were males, with a slight increase in proportion of females at follow up compared to baseline (53.6% males compared to 57.8% respectively).

Inclusion criteria
Not defined – appears to be everyone using the park or non-park areas which are defined as parking</td>
<td>Intervention
The new park had clearly defined recreational spaces including a multi-purpose playing field for team sports (i.e., soccer, softball); a play area with playground equipment; half courts for basketball; a shady area under a large tree with benches, a large community garden with assigned plots; and a walking path alongside the creek. The authors did not state the size of the park.

Comparator
Pre-construction of the green space.

Data collection
The System of Observing Play and Recreation in Communities (SOPARC) tool was used to document the number of people observed using the park between June–October 2010 and then again between June–October 2012. The researchers observed and recorded park use.
Data were collected within specific, predetermined activity zones to gauge how different areas within the park and the adjacent streets, alleys and parking lots were being</td>
<td>Intervention: Park construction
Control: no control

Outcomes
<u>Energy expenditure levels inside and outside of the park</u>



Pre- and post- comparisons between the non-park and park zones indicated a 38% decrease in energy expended in streets, alleys and parking lots and a 3-fold increase in energy expended within the park boundaries post-construction (P = 0.002).

<table>
<tr><th></th><th>2010 (n = 2888)</th><th>2012 (n=4525)</th><th>P value</th></tr>
<tr><td>Total park users</td><td>31.2%</td><td>72.0%</td><td>0.004</td></tr>
<tr><td>Total non-park users</td><td>68.8%</td><td>28.0%</td><td></td></tr>
<tr><td>Sedentary</td><td>38.0%</td><td>34.0%</td><td></td></tr>
<tr><td>Moderate</td><td>43.4%</td><td>40.8%</td><td>0.007</td></tr>
<tr><td>Vigorous</td><td>18.6%</td><td>25.2%</td><td>0.04</td></tr>
</table>

The researchers reported that different features attracted different sex and age groups and promoted different activity levels.</td>
<td>Limitations identified by author
A change in housing rules may influence where children are allowed to play, traffic related injuries or fatalities may counteract residential use of space and the novelty of new park features may encourage use in the interim.

The observed changes in recreational behaviour could be attributed to changes in demographic behaviour of residents.

Limitations identified by review team
No power of the study was calculated

Lack of a control park may overestimate the effect of constructing a park

Other comments
The community was greatly involved in how they wanted the</td>
</tr>
</table>

Source of funding
Kaise Permanente Colorado, Community Benefit initiatives Committee

lot, greenspace near apartments.

Exclusion criteria
Not defined

used before and after park construction.
The data collected noted day, time and temperature, coded each zone as accessible, usable, equipped, supervised and /or organised.
Activities were categorised as sedentary, moderate and vigorous and converted to energy expenditure.
Park user demographics were estimated by the data collector
Time slots were selected to include hours before school (7:30–8:30 AM), lunchtime (12:30–1:30 PM), after school (3:30–4:30 PM) and after work (6:30–7:30 PM). A total of 72 observation hours were performed over 18 days at baseline and follow-up.
Activity levels were categorized as sedentary (lying down, sitting or standing), moderate (walking at a casual pace) and vigorous (any activity that expended more energy than casual walking) as observed by the researchers.
Physical activity codes were converted to energy expenditure (kcal/kg/min).
The energy expenditure (EE) scores were calculated by multiplying the totals observed in sedentary, moderate, or vigorous activity by .051 kcal/kg/min;.096 kcal/kg/min; or .144 kcal/kg/min, respectively

Of the park users (excluding non-park zones) observed in 2012 (N = 3259) most were observed in the play area (N = 1104), on the playing field (N = 882), or in the shady sitting area (N = 439)

	2010	**2012**	**P value**
Average monthly visits in park zone	180	651	0.02
% of teens visiting park zone	11%	38%	0.007
% of adults	34%	20%	0.064
% of children	46%	38%	0.001

Adolescent (age cut offs not provided) females were under represented with only 169 compared to 920 adolescent males, very few of the adolescent females engaged in vigorous physical activity.

Activity of park users by gender, 2010 and 2012

	Females		Males	
Year	2010	2012	2010	2012
N	241	1412	648	1844
Sedentary	59%	42%	44%	26%
Moderate	41%	38%	23%	32%
Vigorous	0	20%	33%	42%

There were increases in moderate and vigorous physical activity for both males and females, however the researchers did not provide measures of variance and/or p values.

Analysis
The variables of interest were summarized by year and month and graphed over time.
Trends were explored across seasons and time and con-trolled for temperature.
The effect of the intervention (park) overtime was explored by comparing the change in slope as well as the change in the number of participants from 2010 to 2012.
T-tests or tests of medians (when appropriate) were used to compare pre-and post-construction changes in the number of observations and energy expended by demographic attributes and park or non-park zones.

transformed spaces to look like as the provided a “wish list”

Statistical significance was considered at P <0.05

No other outcomes reported

120 Patton-Lopez et al 2014

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Patton-Lopez et al 2014

Quality score
-

Study type
Uncontrolled before and after study

Location
USA, Oregon

Study aims
To evaluate outcomes of a community park redesign

Length of follow up
18 months

Pre intervention data collected August/September 2012
Post intervention data collected March 2014

Source of funding
The Robert Wood Johnson Foundation</td>
<td>Number of participants
Total observations n= 527
Children (3-11) n= 370
Adolescents n=157
The authors did not provide the number of participants before and after the intervention.

Participant characteristics
The park is located within a neighbourhood of 7,045 residents. Latinos represent approximately 10.4 percent of the population, 58.8 percent of all households report participating in the Supplemental Nutrition Assistance Program and 29.4 percent earn incomes below the federal poverty line. Several multi-family affordable housing units are located within walking distance of the park. The authors did not state level of deprivation, however imply high deprivation in their description of the area.

Inclusion criteria
Not defined by author but assume that anyone using the park play area during data collection days. The review team assume observations were of different people.

Exclusion criteria
Not defined</td>
<td>Intervention
The intervention park was multi-feature, publicly accessible park not adjacent to schools. It covers approximately two acres of land. New park features installed as a result of the project include hard surface path around play equipment, tree house, slides; monkey bars/climbing bars; natural climbing features (logs/rocks); and plastic dinosaur skeleton climber.

Comparator
None

Data Collection:
Pre-intervention observations were collected on 3 days, 42 to 56minutes per day in August/September 2012
Post-intervention observations were conducted on 3 days for 137 to 260 minutes per day March 2014 (due to the delays in park feature installations)

The parks and play spaces environmental audit tool was used to assess the presence of various features located within and around the park as well as the quality or condition of the area.
It is not clear whether this tool was validated after adaptation.
Physical activity outcomes at the park were documented with the parks and play spaces direct observation tool.
This tool was adapted from the System for Observing Play and Leisure Activity and System for Observing Play and Recreation in Communities tools by Transtria LLC to facilitate ease of data collection.
It is not clear whether this tool was validated after adaptation</td>
<td>Intervention: redesigning a park
Control: no control

Outcomes
<u>Rate of activity among youth observed in park</u>
<table>
<tr><th>Children (3-11) n=370</th><th>Pre intervention</th><th>Post Intervention</th></tr>
<tr><td>Moderate Physical Activity</td><td>53%</td><td>54%</td></tr>
<tr><td>Vigorous Physical Activity</td><td>11%</td><td>22%</td></tr>
</table>
Half of all activities observed among children (3-11years) were moderately active during both time periods
<table>
<tr><th>Adolescents* n=157</th><th>Pre intervention</th><th>Post Intervention</th></tr>
<tr><td>Moderate Physical Activity</td><td>54%</td><td>60%</td></tr>
<tr><td>Vigorous Physical Activity</td><td>11%</td><td>21.9%</td></tr>
</table>
*adolescents cut-off ages were not provided

The authors report that the results were not statistically significant – possibly due too few observations. No p values or confidence intervals provided.

Analysis
No details of analysis provided</td>
<td>Limitations identified by the author
None reported

Limitations identified by the review team
Aim of the study not clearly laid out or described

Lack of transparency: authors did not include details of data analysis

More time allocated for data collection post intervention and there was a difference in seasons during which data was collected

Number of participants not split between each arm therefore difference in numbers not known

No power calculation or measures of variance provided

Other comments
Authors did not report on adult observations despite collecting data on park use.
No other outcomes in children and adolescents were reported.</td>
</tr>
</table>

121 Quigg et al 2011

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference
Quigg et al 2011

Quality score
-

Study type
Natural experiment
Controlled before and after study

Location
Dunedin – New Zealand

Study aims
To evaluate changes in total daily physical activity for children when play grounds located in public parks within their community were upgraded.

Length of follow up
1 year (October-December 2007 and follow-up October-December 2008)
jxewhmdz
Source of funding</td>
<td>Number of participants
Baseline
N=184 children

Follow up
n=156 children (15% loss to Follow up)
Intervention 77
Control: 79

There was no statistically significant evidence that there were differences between those lost to follow-up and those who remained in the study (p>0.120)

Questionnaire respondents
Baseline =138
Follow up = 128

Participant characteristics
It was reported that there were no statistically significant differences in baseline characteristics between intervention and control group children.

<u>Control</u>
61% females, mean age 7.5+/- 1.9 years, at least 80% were of New Zealand European Origin
<u>Intervention</u></td>
<td>Intervention
At one community playground, ten new components, including play equipment, seating, additional safety surfacing, and waste facilities, were installed, and two existing components were removed. At the other community playground, two new play equipment pieces were installed, and a small modification was made to another piece of equipment

Comparator
Comparable community with no recent upgrades to their playground

Data Collection:
An accelerometer was issued to each participant to wear over 8 days. Participants were instructed and monitored by a research assistant at their school each day to increase compliance. An incentive was provided (a family swim voucher valued at US$8) to participants for correct and consistent wear when the accelerometer was collected at the completion of each phase. The follow-up data collection and data management adhered to the same protocols and procedures as the baseline</td>
<td>Intervention: changes to two community playgrounds
Control: no changes to community playgrounds

Outcomes
There authors did not report on the mean total daily physical activity as measured by the accelerometer at baseline and follow-up but used in multivariate models to identify potential predictors of physical activity.
Total daily physical activity differed depending on participant's BMI z-score and community of residence (interaction p=0.006) .The multivariate model found no evidence that participants in the intervention community had a statistically significant difference in their mean total daily physical activity (TDPA), compared to those living in the control community at follow-up.
The results show that living close to a playground (even after renovations) does not have a significant effect on total daily physical effect.

<u>Table 1</u>
<u>Potential Predictors of follow-up physical activity (mean total daily physical activity)- multivariate model</u>
<table>
<tr><th>Variables</th><th>Intervention ratio of geometric means(95% CI)</th><th>P value</th><th>Control ratio of geometric means (95% CI)</th><th>P value</th></tr>
<tr><td>Exposure to playground (community of residence) intervention compared to control</td><td>0.90 (0.69-1.16)</td><td>0.417</td><td>1.11(0.85,1.44)</td><td>0.456</td></tr>
<tr><td>BMI overall (per 1 z score unit increase)</td><td>0.96 (0.87, 1.06)</td><td>0.388</td><td></td><td></td></tr>
<tr><td>BMI (control group)</td><td></td><td></td><td>1.19(1.06,1.34)</td><td>0.005</td></tr>
<tr><td>BMI (intervention group)</td><td></td><td></td><td>0.94(0.83,1.06)</td><td>0.300</td></tr>
<tr><td>Interaction: community by BMI z score</td><td></td><td></td><td></td><td>0.006</td></tr>
<tr><td>Ethnicity (Maori/Pacific vs NZEO)</td><td>1.16 (0.97, 1.39)</td><td>0.099</td><td></td><td></td></tr>
</table></td>
<td>Limitations identified by the author
The outcome measure of total daily physical activity does not take into account differences in wear time during pre- and post-assessments, as compliance is an important issue for studies of this nature.

Wear time may have been different between communities or changed at baseline and follow up.

Distances to parks were also calculated using straight-line measurements which are not as accurate in terms of travel distance as measures based on road networks.

The precision of estimates, as reflected in the widths of confidence intervals, was a result of the relatively small sample size

Limitations identified by the review team</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Ministry of Health District Health Board Healthy Eating Healthy Action (HEHA) Evaluation Fund, the University of Otago, the Otago Healthcare Charitable Trust, the Dunedin City Council, and Sport and Recreation New Zealand.
Cancer Society of New Zealand Inc. and by the University of Otago</td>
<td>47% were females, mean age of 7.6+/- 1.6years, 77% were of New Zealand European/other origin

Inclusion criteria
Children must be aged between 5 and 10 at time of baseline assessment

Must be classed as New Zealand school year 0 to 5 inclusive

Residing 4 or more nights per week within the defined community

Exclusion criteria

Any child not meeting inclusion criteria (i.e.) younger than 5 or older than 10 years or residing less than 4 nights in the defined community.

All participants who moved away from the defined communities between assessments were excluded from the follow-up analyses</td>
<td>data collection, except for the selection of the belt with the accelerometer.

A self-administered questionnaire was developed to gather additional data about the individual child, the household, the family structure, and the responding adult.

Height and weight were measured by trained research assistants at participants' schools, and these data converted to BMI age- and sex-standardized z-scores</td>
<td>
<table>
<tr><td>NZEO girls (ref NZEO boys)</td><td></td><td></td><td>0.75(0.56,0.99)</td><td>0.039</td></tr>
<tr><td>Interaction sex & ethnicity</td><td></td><td></td><td></td><td>0.019</td></tr>
<tr><td>Participant age (per 1 year increase)</td><td>0.92(0.87, 0.97)</td><td>0.004</td><td>0.90(0.85,0.94)</td><td><0.001</td></tr>
<tr><td>Non-school day (ref school day)</td><td>0.72(0.63, 0.81)</td><td><0.001</td><td>0.72(0.63,0.82)</td><td><0.001</td></tr>
<tr><td>Usually walking to school (ref: car or mixed)</td><td>1.18 (1.01, 1.39)</td><td>0.038</td><td>1.16(1.00,1.35)</td><td>0.046</td></tr>
</table>

There was evidence of statistically significant associations in the final model between follow-up physical activity and participant baseline age, school day, usual mode of travel to school, sex, and ethnicity. Also, statistically significant interactions were found between sex and ethnicity (p=0.019)
There was no evidence of any other statistically significant predictors of physical activity levels at follow-up assessment.

Analysis
Power of study calculated – 63 participants in each group – power of 80%, to detect effect size of 0.05 SD in mean physical activity, using a 2 sided test at the 0.05 level.
Spatial variables were obtained based on the residential address of the participant and park boundary data, including the straight-line distances from the residence to the boundary of the nearest park with any playground.
Anthropomorphic data collected directly from participants at their schools enabled age- and sex-standardized BMI z-scores to be calculated. Linear mixed models were used to predict follow-up physical activity, which was log-transformed, while controlling for potential confounders (as listed in the table – sex, ethnicity, age, BMI) and baseline physical activity levels.</td>
<td>The main outcome for this study was mean total daily physical activity undertaken, but the authors did not report on the absolute figures – suggesting potential selective reporting. Baseline and follow-up actual physical activity recordings as recorded by the accelerometer were not reported

Other comments
No other outcomes were reported</td>
</tr>
</table>

122 **Roemmich et al 2014**

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference

Roemmich et al 2014

Quality score

-

Study type

Uncontrolled before and after study

Location

USA - North Dakota

Study aims

Part 1: To test whether change to a park environment – movement of park benches away from a play-ground, would increase the PA of its adult and child users

Part 2: To test whether increases in parent activity intensity with</td>
<td>Number of participants
Unclear - based on tables up to 484 observations

Participant characteristics

No details provided regarding the socioeconomic status or demography of this area

Inclusion criteria
Park visitors within the observation area (no other details provided).

Exclusion criteria

Not defined but appears to be anyone outside the observation area In addition, teenagers (age 13–18 y) were omitted from the analysis because some took on the</td>
<td>Intervention
Part 1: Moving picnic tables (seating) further away from a playground area. This was evaluated at the following time point:
Near seating (baseline, ‘A_1’) observed mid-July
Far seating (‘B’) observed early August
Reverting to near seating (A_2) observed late August 2012.

Part 2: A repeat of part 1 in the same park one year later. This was evaluated at the following time points:
Picnic tables present (‘A_1’) observed late June
Tables removed (‘B’) observed in mid -July
Reverting to tables present (A_2) observed July to early August 2013.

Comparator
The authors are comparing METs expended based on whether the seating/tables are near or far from the playground

Data Collection:
<u>Part 1</u> Observation took place at 5:30pm for 5 weekdays and 2 weekend days for each of the 3 study conditions. Observations</td>
<td>Intervention: movement of park seating and picnic tables away from a play-ground
Control: no control
Outcomes
<u>Part 1: Moving picnic tables: METS expended</u>
A_1 – seating nearer to the playground, B – seating further away from the playground, A_2 – seating nearer to the playground again

<table>
<tr><th>Condition</th><th>Adults</th><th></th><th>Children</th><th></th></tr>
<tr><td></td><td>N</td><td>Mets</td><td>N</td><td>Mets</td></tr>
<tr><td colspan="5">Part 1, summer 2012 (mean, ±standard error)</td></tr>
<tr><td>Seating near (A_1)</td><td>79</td><td>1.8±0.1</td><td>91</td><td>3.1±0.2</td></tr>
<tr><td>Seating far (B)</td><td>22</td><td>2.0±0.2</td><td>27</td><td>3.8±0.4</td></tr>
<tr><td>Seating near (A_2)</td><td>55</td><td>1.4±0.1</td><td>57</td><td>3.1±0.3</td></tr>
</table>
Children were more intensely active than adults (p=0.0001) METs intensities significantly differed by condition (p<0.05), METS Intensities were greater when seating was not accessible (B) than when seating was accessible (A1,A2) p<0.02).

<table>
<tr><th>Outcomes</th><th>Odds ratio</th><th>95% CI</th><th>P Value</th></tr>
<tr><td>Adults standing rather than sitting were greater during condition B compared to A_1</td><td>9.4</td><td>2.5-35.2</td><td><0.0001</td></tr>
<tr><td>Adults standing rather than sitting were greater during condition B compared to A_2</td><td>4.7</td><td>1.3-17.2</td><td><0.02</td></tr>
<tr><td>Adults engaging in MVPA were greater during condition B compared to A_1</td><td>4.1</td><td>1.1-15.1</td><td><0.03</td></tr>
<tr><td>Adults engaging in MVPA were greater during condition B compared to A_2</td><td>22.7</td><td>4.2-122</td><td><0.001</td></tr>
</table>
The odds of children rather than sitting was not associated with either condition (p>0.45)
ANOVA including children only demonstrated a 23% increase in activity intensity (p=0.08)

<u>Part 2: Moving picnic tables - METS expended</u>
A_1 – tables nearer to the playground, B – tables further away from the playground, A_2 – tables nearer to the playground again</td>
<td>Limitations identified by the author
None identified

Limitations identified by the review team

No power calculated for this study

No control group – effects of the intervention could be overestimated

The approach to the study was overly complex (with two separate parts) and there were multiple analyses. .

Other comments</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>reduced access to seating are associated with increased child PA intensity and whether removing seating would reduce the duration that families stay at a playground.

Length of follow up
Unclear (see intervention/comparator)

Source of funding
The USDA/Agricultural Research Service, USDA 5450-51000-049-00D.</td>
<td>role is the child while others acted as a caregiver of younger children.</td>
<td>were rescheduled when weather such as rain dictated. The observer(s) performed a rapid visual scan (so as not to change the behaviour of patrons) to determine the number of children and adults and their gender, age category and activity intensity (sitting, standing, walking/moderate, or vigorous). To minimize observer bias, intensity was scored at the moment of observation and not of the general activity. Activity level classifications were converted to MET intensities (sitting=1.25METs; standing=1.5METs; moderate= 3.0METs; vigorous=6.0METs

<u>Part 2</u>
As well as elements from study 1 – observations were every 15 minutes for 2 hours.
The duration that each family spent at the park was recorded. Observer recorded each family’s arrival time and age group of each individual and made a note of each family member so they could be assessed together.</td>
<td>
<table>
<tr><th>Condition</th><th colspan="2">Adults</th><th colspan="2">Children</th></tr>
<tr><td></td><td>N</td><td>Mets</td><td>N</td><td>Mets</td></tr>
<tr><td colspan="5">Study 2, summer 2013 (mean, ±standard error)</td></tr>
<tr><td>Seating near (A_{1})</td><td>130</td><td>1.7±0.3</td><td>115</td><td>3.6±0.2</td></tr>
<tr><td>Seating far (B)</td><td>48</td><td>2.3±0.2</td><td>69</td><td>3.6±0.2</td></tr>
<tr><td>Seating near (A_2)</td><td>49</td><td>1.6±0.1</td><td>73</td><td>3.4±0.2</td></tr>
</table>
Children were more intensely active than adults (p=0.0001)METs intensities significantly differed by condition (p<0.05),METS Intensities were greater when seating was not accessible (B) than when seating was accessible (A1,A2) p<0.01).

<table>
<tr><th>Outcomes</th><th>Odds ratio</th><th>95% CI</th><th>P Value</th></tr>
<tr><td>More adults were standing rather than sitting during condition B compared to A_1 or A_2</td><td>0.9</td><td>0.3-3.0</td><td>0.90</td></tr>
<tr><td>Adults engaging in MVPA were greater during condition B compared to A_1</td><td>4.5</td><td>2.1-9.8</td><td><0.001</td></tr>
<tr><td>Adults engaging in MVPA were greater during condition B compared to A_2</td><td>4.3</td><td>1.6-11.4</td><td><0.004</td></tr>
</table>
More (p < 0.01) children were observed during A1 than during B or A2. There was no difference in number of children observed during B and A2. More (p < 0.01) adults were observed during condition A1 than during B or A2. There was no difference (p ≥ 0.92) in the number of adults observed in conditions B and A2

<table>
<tr><td>Condition (mean±SE)</td><td>METs</td><td>Time Stayed (min)</td></tr>
<tr><td>Tables near(A1)</td><td>2.24±0.07</td><td>56.78±3.89</td></tr>
<tr><td>Tables far(B)</td><td>2.62±0.08</td><td>51.70±3.20</td></tr>
<tr><td>Tables near(A2)</td><td>2.43±0.09</td><td>48.27±3.68</td></tr>
</table>

Analysis
<u>Part 1</u>: Moderate and vigorous intensities were combined because of low frequencies. ANOVA was used to test differences in MET intensity of activity with age. A log-linear model was used to test for associations. Odd ratios were calculated to investigate associations. Chi-squared was used to determine differences in the number of children and adults visiting the playground. <u>Part 2</u>: Kaplan–Meier survival estimates were used to test for any differences in the time that families remained in the park. Activity intensity data were analysed using a hierarchical linear model with families and members within families treated as random effects.
</td>
<td>No other outcomes were reported

Significance testing was calculated at p≤0.05</td>
</tr>
</table>

123 Slater et al 2016

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>**Reference**
Slater et al 2016

Quality score
-

Study type
Controlled before and after study

Authors state the study as ‘Quasi experimental, prospective, longitudinal study design’

Location
USA - Chicago

Study aims
To examine whether involvement of community groups in playground design selection, installation and maintenance influences park use and physical activity

Length of follow up</td>
<td>**Number of participants**
Intervention: users of 47 renovated parks
Control: users of 30 parks without renovations

Exact number of users of parks in the intervention and control parks were not stated but authors reported these to be similar at baseline

Participant characteristics
The authors did not state any significant differences in the baseline characteristics between the intervention and control parks. Baseline outcome measures and neighbourhood sociodemographic measures were similar.

55% of study parks were located in predominantly black neighbourhoods. 45% of the parks offered some kind of park programs. The authors state that in general the observed parks were well maintained with varying neighbourhood crime (average annual crime =663, range 90-5, 437).

A total of 14,586 (5,612 observations at baseline, 8,974</td>
<td>**Intervention**
Renovations involved replacing old playground equipment and ground surfacing between August and November 2013. Community engagement was also carried out at intervention parks.
-47 parks located in 33 of Chicago’s 77 neighbourhoods. [No other information provided].

Comparator
30 matched control parks not yet renovated. Control parks were similar in size and park features, and located in close proximity to intervention sites to ensure that intervention and control communities had similar underlying neighbourhood characteristics. Matching was on household income and race/ethnicity.

Data Collection:
The System of Observing Play and Recreation in Communities was used to collect key outcomes – *park utilisation, number of people engaged in sedentary behaviour, number of people engaged in moderate or vigorous physical activity (MVPA).*</td>
<td>**Intervention:** Parks renovations
Control: Parks without renovations

Outcomes
The following results are controlled for park size, daily outside temperature, distance between matched parks, neighbourhood median. Model 1 included control variables only and Model 2 also examined the effects of overall neighbourhood crime count, presence of park programs and park maintenance

Park usage
<table>
<tr><th>Covariate</th><th>Model 1 (Coefficient, SE)</th><th>Model 2 (Coefficient, SE)</th></tr>
<tr><td>Group</td><td>**0.201(0.09) (p<0.05)**</td><td>0.056(0.096)</td></tr>
<tr><td>Time</td><td>0.031 (0.049)</td><td>**0.097 (0.052) (p<0.1)**</td></tr>
<tr><td>**Group + time**</td><td>**0.174 (0.062) (p<0.05)**</td><td>**0.211 (0.063) (p<0.05)**</td></tr>
<tr><td>Park maintenance scale</td><td></td><td>-0.072(0.014)(p<0.05)</td></tr>
<tr><td>Neighbourhood crime count (log)</td><td></td><td>0.359(0.104) (p<0.05)</td></tr>
<tr><td>Park has programmes</td><td></td><td>0.159(0.199)</td></tr>
</table>
The results shows there was a statistically significant increase in park utilisation over time in intervention parks compared to control parks in both model 1 and 2. The results show that the only factor significantly associated with increased park use was low neighbourhood crime count (beta=0.359, p<0.05).

Park-Based Sedentary behaviour
<table>
<tr><th>Covariate</th><th>Model 1 (Coefficient, SE)</th><th>Model 2 (Coefficient, SE)</th></tr>
<tr><td>Group</td><td>**0.409(0.119) (p<0.05)**</td><td>**0.264(0.123) (p<0.05)**</td></tr>
<tr><td>Time</td><td>**-0.194(0.068) (p<0.05)**</td><td>-0.112(0.071)</td></tr>
<tr><td>**Group + time**</td><td>0.139(0.089)</td><td>**0.173(0.089 (p<0.054)**</td></tr>
<tr><td>Park maintenance scale</td><td></td><td>-0.090(0.019)(p<0.05)</td></tr>
<tr><td>Neighbourhood crime count log</td><td></td><td>0.316(0.119) (p<0.05)</td></tr>
<tr><td>Park has programmes</td><td></td><td>0.124(0.222)</td></tr>
</table>
</td>
<td>**Limitations identified by the author**
No individual level PA measures

Not able to distinguish whether the observed increase in park use and a moderate to vigorous physical activity (MVPA) in the intervention parks are as a result of the renovations or community engagement.

Limitations identified by the review team
Power not stated

Significance testing was calculated at both p≤0.05 and p≤0.1</td>
</tr>
</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>1 year (Baseline July/October 2012 and Follow up July-October 2014)

Source of funding
Grants from UIC’s Institute for Policy and Civic Engagement and the cooperative agreement under the Health Promotion and Disease Prevention Research Centres program</td>
<td>at follow-up) people were observed across the 78 study parks

The average number of people observed visiting the study parks was 33 people, with 15 engaging in moderate or vigorous physical activity (MVPA) and 18 observed in sedentary behaviour.

Inclusion criteria
The intervention and control parks were selected due to their:
(a) The level of community support and playground maintenance plan,
(b) The age and condition of the existing playground, and (c) equitable geographic distribution of new playgrounds throughout the city (north, central, south).

Exclusion criteria
Not provided</td>
<td>The observations were carried out in the same target areas at baseline and follow up. At follow up observations was carried out 2 weekdays and 1 weekend compared to 1 weekday and 1 weekend at baseline.

Annual park-specific program data were collected pre- and post- playground renovation by the Chicago Park District. This provided data on the number and type of programs were offered (e.g. sports, summer camp); and the number of people enrolled in these programs.</td>
<td>The results show that intervention parks had significantly more people engaging in sedentary behaviour as well as a significant decrease in observed sedentary behaviour over time in the control group (beta = -0.19, p<0.05). The results also show that while provision of programmes did not influence sedentary behaviour, decreased park maintenance and increased neighbourhood crime were both associated with an increase in sedentary behaviour p<0.05.

<u>Park-Based moderate to vigorous physical activity MVPA</u>
<table>
<tr><th><u>Covariate</u></th><th>Model 1 (Coefficient, SE)</th><th>Model 2 (Coefficient, SE)</th></tr>
<tr><td>Group</td><td>0.079 (0.121)</td><td>-0.005 (0.126)</td></tr>
<tr><td>Time</td><td>0.262 (0.069) (P<0.05)</td><td>0.306 (0.071)(p<0.05)</td></tr>
<tr><td>Group + time</td><td>0.174 (0.088)(p<0.05)</td><td>0.199(0.089) (p<0.05)</td></tr>
<tr><td>Park maintenance scale</td><td></td><td>-0.028(0.019)</td></tr>
<tr><td>Neighbourhood crime count log</td><td></td><td>0.344(0.108) (p<0.05)</td></tr>
<tr><td>Park has programmes</td><td></td><td>0.151(0.201)</td></tr>
</table>
The results of Model 1 (0.17, P<0.05) and Model 2 (0.199, p<0.05) showed a significant increase in the number of people engaging in MVPA when comparing baseline with the 12 month follow-up. The results also suggest that while provision of programmes did not influence MVPA, decreased park maintenance was associated with a reduction in park based MVPA, however not statistically significant and increase in neighbourhood crime was significantly associated with a reduction in park based MVPA (p<0.05)

Analysis
Mixed effects Poisson models were used to estimate differential effects over time. Parks were used as the unit of analysis observed over time- this means any observations were allocated to either intervention parks or control parks, to allow for systematic comparison.</td>
<td>Length of data collection differed between baseline and follow up

Potential publication bias, the researcher did observe the people engaging in physical activity and could have reported findings on individual level

Other comments
No other outcomes reported</td>
</tr>
</table>

124 Tester and Baker 2009

<table>
<tr>
<td>Reference
Tester and Baker 2009

Quality score

-

Study type
Controlled before and after study

Location
USA - San Francisco

Study aims
To study the impact of a playfield renovation in two urban parks in low-income neighbourhoods

Length of follow up
1 year (Baseline May 30 to June 5 in 2006 and Follow up in 2007)

Source of funding
Team Up for Youth and from the Robert</td>
<td>Number of participants

<u>Intervention</u>
<u>Parks A</u>
Baseline observations 7 day total
– n= 5 children
- n=35 teens
- n=224 adults
- n= 0 seniors

Follow up observation 7 day total
- n=199 children
- n=94 teens
- n=1062 adults
- n=10 seniors

<u>Parks B</u>
Baseline observations 7 day total
– n= 23 children
- n= 75 teens
- n=148 adults
- n= 13 seniors

Follow up observation 7 day total
- n = 261 children
- n= 103 teens
- n = 1366 adults
- n= 203 seniors

<u>Control (Park C)</u>
Baseline observations 7 day total
- n= 15 children
- n= 74 teens
- n=390 adults</td>
<td>Intervention
2 parks (A and B) underwent significant renovations of playfields used primarily for soccer and baseball. In both parks artificial turf replaced uneven dirt fields and new fencing, landscaping, lighting and picnic benches were added. In addition, in park A, permanent soccer goals were installed and in park B, a walkway around the field was restored.

Park B was also one of five parks selected to be part of the Reconnect Initiative.
Specific program components are expanded hours of park operation (e.g. playfield lights kept on during later evening hours), professional training and skills development for park and recreational program staff

Control
Park C was selected as the control because of similar socio-economic and racial/ethnic demographics of nearby</td>
<td>Intervention: Park renovations (parks A and B)
Control: Park with no renovations (parks C)

Outcomes
Park use
In the intervention parks the results show that there was significant increase in the number of children, adults and seniors visiting the parks at baseline and at follow-up. The teens' group was the only group whose visits decreased in the intervention parks, but increased in the control park. There was a significant increase in the total number of visitors in observations on the playfield in Park A (p=0.00) and B (p=0.00), but not for the control park (p=0.36)
<u>Mean number of visitors present per observation and 7-day totals at baseline and follow-up</u>
<table>
<tr><th>Park A</th><th>Baseline (2006)</th><th>Follow-up (2007)</th><th>p value (2-tailed) males/females</th><th>7-day total (2006)</th><th>7-day total (2007)</th></tr>
<tr><td>Children</td><td>0.09</td><td>3.55</td><td>0.001/<0.001</td><td>5</td><td>199</td></tr>
<tr><td>Teens</td><td>0.64</td><td>1.67</td><td>0.813/0.008</td><td>35</td><td>94</td></tr>
<tr><td>Adults</td><td>4.07</td><td>18.95</td><td><0.001/<0.001</td><td>224</td><td>1062</td></tr>
<tr><td>Seniors</td><td>0</td><td>0.18</td><td>0.003/0.16</td><td>0</td><td>10</td></tr>
<tr><td colspan="6">Park B</td></tr>
<tr><td>Children</td><td>0.42</td><td>4.35</td><td>0.006/0.003</td><td>23</td><td>261</td></tr>
<tr><td>Teens</td><td>1.37</td><td>1.71</td><td>0.931/0.116</td><td>75</td><td>103</td></tr>
<tr><td>Adults</td><td>2.69</td><td>22.76</td><td><0.001/<0.001</td><td>148</td><td>1366</td></tr>
<tr><td>Seniors</td><td>0.4</td><td>3.38</td><td><0.001/<0.001</td><td>13</td><td>203</td></tr>
<tr><td colspan="6">Park C</td></tr>
<tr><td>Children</td><td>0.27</td><td>0.61</td><td>0.257/0.042</td><td>15</td><td>34</td></tr>
<tr><td>Teens</td><td>1.32</td><td>4.09</td><td>0.00/0.27</td><td>74</td><td>229</td></tr>
<tr><td>Adults</td><td>6.97</td><td>5.71</td><td>0.37/0.478</td><td>390</td><td>320</td></tr>
<tr><td>Seniors</td><td>0.07</td><td>0.04</td><td>0.475/-</td><td>4</td><td>2</td></tr>
</table>

Physical activity
In the two intervention parks combined, there were 1681 physically active visitors in the follow-up week, compared to a total of 360 at baseline. There were statistically significant increases among males and females who were observed at each respective PA level in the intervention parks. There majority of visitors where however sedentary. Sedentary visitors increased 5+ fold,</td>
<td>Limitations identified by the author
Length of observation each year was relatively limited

The study did not include a park that underwent program changes in the absence of playfield renovations

Observers were not blinded to the purpose of the study, it is possible they were biased towards higher levels of physical activity

Low inter-observer agreement on physical activity in the follow up period suggesting this may be due to methodological problems.

Limitations identified by the review team
No power of study reported

Other comments
No other outcomes reported

Significance testing was at p≤0.05</td>
</tr>
</table>

<table>
<tr>
<td>Wood Johnson Health and Society Scholars Program at UC San Francisco/UC Berkeley</td>
<td>- n=4 seniors

Follow up observation 7 day total

- n= 199 children
- n= 94 teens
- n=1062 adults
- n= 10 seniors

Age group cut offs were not defined

Participant characteristics
Park A and C were located in areas predominantly Latino, Park B- a mix of Latino, African-American and Asian
The median household income ranged between $43000 and $56000.

Inclusion criteria
All park users during the observation study times

Park selection criteria –
Condition, typical use, ability to increase field capacity with artificial turf, community value of the parks, and existing programmes

Exclusion criteria
Not detailed</td>
<td>residents and its approximation in features (presence of playground and soccer/baseball area) to Park A and B

Data Collection:
Observational data was collected using the System for Observing Play and Recreation in Communities (SOPARC). Observers scan for females that fall into each of four age groups (child, teen, adult, and senior) and make a separate scan to note the number of females who are at each of three PA levels (sedentary, moderate, vigorous). Scans are repeated for males. On average, observers completed each scan within the space of a few minutes. The authors did not provide any information on the specific ages of the park users or how they defined sedentary, moderate or vigorous physical activity.</td>
<td>moderately active visitors increased 3+ fold, and vigorously active visitors increased 2+fold.

<u>Mean number of males and females per observation at each of three activity levels (sedentary, moderate, and vigorous</u>
<table>
<tr><th></th><th>Baseline (2006)</th><th>Follow-up (2007)</th><th>p value (2-tailed) males/females</th><th>7-day total (2006)</th><th>7-day total (2007)</th></tr>
<tr><td colspan="6">Park A</td></tr>
<tr><td>Sedentary</td><td>2.13</td><td>14.01</td><td><0.001/<0.001</td><td>117</td><td>788</td></tr>
<tr><td>Moderate</td><td>1.64</td><td>7.8</td><td><0.001/<0.001</td><td>90</td><td>437</td></tr>
<tr><td>Vigorous</td><td>1.04</td><td>2.5</td><td>0.04/0.05</td><td>57</td><td>140</td></tr>
<tr><td colspan="6">Park B</td></tr>
<tr><td>Sedentary</td><td>0.84</td><td>13.95</td><td><0.001/<0.001</td><td>46</td><td>837</td></tr>
<tr><td>Moderate</td><td>3.22</td><td>14.22</td><td><0.001/<0.001</td><td>177</td><td>853</td></tr>
<tr><td>Vigorous</td><td>0.65</td><td>4.18</td><td><0.0001/0.03</td><td>36</td><td>251</td></tr>
<tr><td colspan="6">Park C(Control)</td></tr>
<tr><td>Sedentary</td><td>5.24</td><td>4.39</td><td>0.4/0.65</td><td>293</td><td>246</td></tr>
<tr><td>Moderate</td><td>1.95</td><td>4.57</td><td>0.01/0.2</td><td>109</td><td>256</td></tr>
<tr><td>Vigorous</td><td>1.45</td><td>1.48</td><td>0.83/0.53</td><td>81</td><td>83</td></tr>
</table>

Analysis
The researchers compared the numbers of playfield visitors before and after the interventions and performed 2-tailed independent t-tests of the means. Analysis of visitors per observation in other areas was also undertaken with the intention of examining for potential “spill over” to these non-playfield sections. The researchers also compared the pre and post intervention numbers of male and female playfield visitors who were observed to be at each of the PA levels (sedentary, moderate and vigorous)
Two-tailed independent t-test of the means were performed and the null hypothesis of mean equivalence was rejected when p<0.05.</td>
<td></td>
</tr>
</table>

125 Veitch et al 2012

Study details	Population	Intervention/ comparator	Results	Notes
Reference Veitch et al 2012 **Quality score** - **Study type** Controlled before and after study **Location** Victoria - Australia **Study aims** To assess the change in park use and park-based activity in a park which has undergone improvement interventions, compared with a park which has undergone no interventions. **Length of follow up** Baseline: August 2009	**Number of participants** <u>Intervention park</u> *Baseline(August 2009)* N=235 *Follow –up (March 2010)* N=582 *Follow up (August 2010)* N=985 <u>Control park</u> *Baseline(August 2009)* N=83 *3 month Follow –up (March 2010)* N=114 *12 month Follow up (August 2010)* N=51 This is visits to park, not individuals – individuals may be represented here multiple times. **Participant characteristics** Neighbourhood reported as being in the most disadvantaged decile of Victoria, Australia. Intervention: 55.3% male, 44.7% female. 6% 2-4 years old; 24% 5-18 years old; 70% over 18.	**Intervention** One park was refurbished. This included establishment of a fenced leash-free area for dogs, an all-abilities playground; a walking track (365metre); a barbeque area; landscaping and fencing to ensure the park was traffic-free. **Comparator** One control park located in the same neighbourhood as the intervention park, and with similar features at baseline (authors do not report what similar features). **Data Collection:** A modified version of the System for Observing Play and Recreation in Communities (SOPARC) was used (reliability high). Trained observers collected the	**Intervention:** Refurbished park **Control:** Park with no refurbishment intervention **Outcomes** <u>Total number of users (Intervention and control):</u> Intervention: baseline 235, 3-month follow-up 582, 8 month follow-up 985. Control: baseline 83, 3-month follow-up 114, 8 month follow-up 51. The results show that there was a statistically significant increase in park use for the refurbished park over time compared to the control park. There was a significant interaction between park and time for total counts of park users, $F(2, 154) = 14.99$, $p = 0.0005$. <u>Number of people observed walking (intervention and control):</u> Intervention: baseline 155, 3-month follow-up 195, 8 month follow-up 369. Control: baseline 75, 3-month follow-up 92, 8 month follow-up 51. The results show there was a statistically significant increase in the number of people observed walking in the intervention park over time compared to the control park. There was a significant interaction between park and time for counts of people walking $F(2, 154) = 11.70$, $p = 0.0005$. <u>Number of people observed being vigorously active (intervention and control):</u> Intervention: baseline 38, 3-month follow-up 137, 8 month follow-up 257. Control: baseline 5, 3-month follow-up 1, 8 month follow-up 0. The results show there was statistically significant increase in the number of people observed engaging in vigorous physical activity in the intervention park over time compared to the control park. There was a significant interaction between park and time for counts of people being vigorously active $F(2, 154) = 4.98$, $p = 0.008$. <u>Number of people observed lying/sitting (intervention and control):</u> Intervention: baseline 6, 3-month follow-up 119, 8 month follow-up 61. Control: baseline 0, 3-month follow-up 4, 8 month follow-up 0. Significance of interaction between park and time not reported	**Limitations identified by the author** Only one intervention and one control park were used – limits reliability. Control park was smaller than intervention park (by more than 50%). After adjusting for park size, results remained unchanged (results not reported). Not possible to tell whether existing users changed behaviour, or whether new users were exhibiting the observed behaviour (i.e. not panel data – could be different participants at each time point). **Limitations identified by the review team** Control park was affected by the intervention, so not truly a control (contamination) as users were displaced to the newer park. No statistical power calculated **Other comments**

Study details	Population	Intervention/ comparator	Results	Notes
Intervention: Nov-Dec 2009. 3-month follow-up: March 2010, immediately after intervention implemented 8-month follow-up: August 2010, 12 months after baseline. **Source of funding** Australian national health and Medical Research Council. National heart Foundation of Australia Victorian health Promotion Foundation	Control: 51.8% male; 48.2% female. 1.2% 2-4 years old; 16.9% 5-18 years old; 81.9%% over 18. Significance of differences not reported. **Inclusion criteria** All individuals visiting either the intervention or the control park in data collection hours. **Exclusion criteria** Individuals visiting outside of data collection hours, individuals visiting other parks.	following data through observation: apparent gender; apparent age group (2-4, 5-18, adult); and activity (sedentary, walking, or very active/vigorous). At each data collection point (baseline, 3-month follow-up; 8-month follow-up) data was collected on 9 days spread over 4 weeks – this comprised of 5 week days and 4 weekend days. On each day, observations were conducted every 15 minutes for 1.5 hours (90 minutes) between 07.30-09.00; 11.30-13.00; and 15.30-17.00.	<u>Number of people observed standing (intervention and control):</u> Intervention: baseline 36, 3-month follow-up 131, 8 month follow-up 298. Control: baseline 3, 3-month follow-up 17, 8 month follow-up 0. Significance of interaction between park and time not reported There tended to be more people in the parks at weekends than weekdays for intervention (970 vs 832) but not for control (120 vs 128). No significance reported. **Analysis** Counts of the total number of people using the park and the number of people walking and being vigorously active were positively skewed and trans-formed with square root or logarithmic transformations. Two-way ANOVAs examined the effects of park (intervention vs control) and time point (baseline vs 3-month follow-up vs 8-month follow-up) on the total number of people observed in the park, and the number of people walking and being vigorously active. Statistical significance is only reported for difference in difference (i.e. the difference between changes over time for intervention, and changes over time for control).	Parks were located in a neighbourhood in the most disadvantaged decile of Victoria, Australia. At baseline for intervention park, 25 observations were taken (all other time points had 27: 9 days with three observation times [morning, noon, afternoon] on each day). Significance testing assumed to be at p≤ 0.05 No other outcomes reported

Multicomponent

Chomitz et al 2012

Study details	Population	Intervention/ comparator	Results	Notes
Reference Chomitz et al 2012 **Quality score** - **Study type** Controlled before and after study (Authors call this a controlled study, but control only used at follow-up) **Location** USA - Massachusetts **Study aims** To assess the effect of the Active Living By Design (ALBD, run by Shape Up Somerville) programme on middle- and high-school and adult residents meeting physical activity guidelines, and to compare	**Number of participants** **Baseline (total 3,562):** *Intervention* Somerville schools = 1098 middle school students (90% response rate); 1,383 high school students (81% response rate). Not randomly selected. Somerville adults = 1081. Stratified random sample of households used. Response rates for adults survey not split by location: overall rate is 32.7%. *Control* No data at baseline **Follow-up (total 5,792):** *Intervention* Somerville schools = 926 (88%) middle school students; 1125 (79%) high school students. Everett schools = 1059 (92%) middle school. Students, 1430 (81%) Everett high school students. Not randomly selected Somerville adults (stratified random sample) = 644 *Control* Everett adults (stratified random sample) = 608	**Intervention** Active Living By Design (ALBD) project, enabled by a 5-year grant, in intervention town (Somerville). ALBD is part of a wider community effort, "Shape Up Somerville". City-level bike and pedestrian coordinator positions created: these "enhanced opportunities for active transportation… through advocacy". Authors report that they supported implementation of environmental changes (crosswalks, park renovations etc). $3 million grant to extend the walking path in conjunction with a subway expansion project (connecting the intervention town with Boston). No further information on the path extension is given. **Comparator** No true comparator – but a second town (Everett) without the intervention was surveyed at follow-up only (not at baseline) to serve as a comparator. **Data Collection:** Youth Risk Behaviour Survey (YRBS) (students only): self-reported behavioural data for school students aged 11-18. Completed at school. In the intervention town, completed in	**Intervention:** Active Living By Design project (Somerville) **Control:** Town with no ALBD project (Everett) **Outcomes** Main outcome is achievement of either moderate (MPA) or vigorous physical activity (VPA) guidelines. All results adjusted for gender, race, language, health status and current smoking. Youth survey results also adjusted for TV viewing and adult survey also adjusted for BMI. <u>Physical Activity time effects (intervention town, baseline compared with follow-up) (Odds Ratio [95% Confidence Interval]):</u> Adults: 40% reported meeting moderate activity (MPA) or vigorous activity (VPA) guidelines at baseline, and 62% at follow-up. Adjusted odds ratio for meeting MPA or VPA guidelines is significant at 2.36 (2.29, 2.43) compared with baseline. High School Students: 52% reported meeting MPA / VPA guidelines at baseline, and 62% at follow-up. Adjusted odds ratio for meeting MPA and/or VPA guidelines is 1.61 (1.34, 1.92), compared with baseline. Middle school students: 70% reported meeting MPA / VPA guidelines at baseline, and 73% at follow-up. Changes were not significant (1.13 [0.90, 1.40]). <u>Physical Activity group effects (Somerville follow-up scores compared with Everett follow-up scores) (Odds Ratio [95% Confidence Interval]):</u> Adults meeting MPA/VPA guidelines: Somerville = 62%, Everett = 55%. Somerville adults had a significant odds ratio for meeting MPA and/or VPA guidelines of 1.10 (1.04, 1.17) after adjustment compared with Everett adults. High School Students meeting MPA / VPA guidelines: Somerville = 62%, Everett = 57%. Somerville high school students had a non-significant odds ratio for meeting MPA and/or VPA guidelines of 1.24 (0.98, 1.58) after adjustment compared with Everett high school students. Middle School Students meeting MPA / VPA guidelines: Somerville = 73%, Everett = 72%.Odds ratio comparing middle school students	**Limitations identified by the author** Over the time period of the study, middle school students will have moved up to be surveyed as high school students, and high school students potentially surveyed as adults. Adult survey was phone based, and so limited to those with phones. Low response rate in adults means responses may not be representative. Authors state that the control city is "non-equivalent". Intervention city not randomised to receive intervention – possible self-selection bias. Lack of baseline data in control city means no change effects can be compared. **Limitations identified by the review team** Walking to school measure not available for high-schoolers at baseline.

Study details	Population	Intervention/ comparator	Results	Notes
differences in meeting physical activity guidelines in the intervention town compared with a second town with no intervention at follow-up. **Length of follow up** 3-5 years between data collection points (baseline data collected in 2003 and 2004. Follow-up data collected in 2007 and 2008). Intervention took place gradually over 5 years (2003-2008). **Source of funding** Robert Wood Johnson Foundation Institute for Community Health	**Participant characteristics** Data only collected from intervention town at baseline (not for control town, Everett). Authors report that both towns have similar ethnic profiles and high rates of students identified as low income. No statistical significance reported Intervention town: *Middle school*: 50% White, 15% Black, 19% Hispanic. 46% primary language not English. *High school*: 45% White, 17% Black, 17% Hispanic. 49% primary language not English. *Adult*: 75% White, 16% Hispanic, 5% Asian/Pacific Islander. **Inclusion criteria** Youth Risk Behaviour Survey (YRBS): Students of schools in intervention and control towns, age 11-18. All students that completed the YRBS were included. Behavioural Risk Factor Surveillance Survey (BRFSS): Non-institutionalised adults aged 18+ in intervention and control towns. **Exclusion criteria** Children aged 10 and under.	2003/2004 (baseline), and 2007/2008 (follow-up). In comparator town, completed only in 2007 (follow-up). At follow-up, questions added regarding ALBD project. Behavioural Risk Factor Surveillance Survey (BRFSS) (adults only): Administered in 2002 to intervention town (baseline) and in 2008 to both intervention and control town (follow-up). Used a stratified random sample of households (random digit dial). Data collected in the surveys included: • Demographic characteristics: gender, ethnicity. BRFSS also included age, level of education completed, and household income. • Health and physical activity related behaviours: YRBS included walking to school y/n available to middle-schoolers at all time points and high schoolers at follow-up only. BRFSS collated self-rated health, smoking status, BMI. Both surveys measured TV viewing. • Use of recreational space: follow-up only in both surveys. Use of various spaces in the past month was dichotomised (y/n). Spaces included parks and playgrounds.	between intervention and control was not significant with or without adjustment (1.06 [0.78, 1.45]). <u>Covariate effects on meeting physical activity guidelines at follow-up among youth in Somerville (Odds Ratio [95% Confidence Interval]):</u> *Middle school students:* Using neighbourhood parks (2.17 [1.28, 3.65]) and indoor recreation centres (1.83 [1.09, 3.07]) as opposed to community paths, home/yard, or playground. *High school students:* Using indoor recreation centres (3.39 [2.20, 5.23]) as opposed to community paths, home/yard, neighbourhood park or playground. *Adults:* Individuals who had used community paths (1.27 [1.19, 1.35]), sidewalks (1.32 [1.11, 1.56]), parks (1.37 [1.28, 1.46]), or indoor recreation centres (2.09 [1.97, 2.23]) were all more likely to have met PA guidelines. **Analysis** Univariate statistics (Means and SDs for continuous variables, counts and percentages for categorical variables) used to describe the demographic characteristics, physical activity–and health-related behaviours, recreational space usage, and encouragement/awareness of each sample. Bivariate methods (chi-square/ Fisher's exact tests for categorical data, two-sample t-tests for continuous) were used in each sample to compare these variables over time (within Somerville, baseline versus follow-up) and to compare these variables between cities (Somerville versus Everett at follow- up) in each study sample. To test for a time effect (within Somerville, baseline versus follow-up) or city effect (Somerville versus Everett at follow-up) in meeting the moderate– or vigorous–physical activity guidelines, separate logistic regression models were used.	Higher self-reported rates of meeting PA guidelines at follow-up could be due to increased education and encouragement to exercise creating heightened awareness of need to exercise, and therefore strengthening social desirability bias in responses. **Other comments** Other outcomes: Data was also collected on how much encouragement participants had received to be physically active: this is excluded as it is outside of the scope of the guideline. MPA: students = ≥30 minutes low intensity PA on ≥5 of previous 7 days. Adults = ≥30 minutes moderate activities on ≥5 days in a 'usual' week. VPA: students = ≥20 minutes of high intensity activity on ≥3 of previous 7 days. Adults = ≥20 minutes VPA on ≥3 days in a 'usual' week. Power not reported. Statistical significance = ≤0.05

Droomers et al 2016

Study details	Population	Intervention/ comparator	Results	Notes
Reference Droomers et al 2016 **Quality score** + **Study type** Controlled before and after study **Location** Netherlands - multiple **Study aims** To evaluate the impacts of changes to green space on physical activity (PA) and self-reported perceived health of residents of affected neighbourhoods around the Netherlands. **Length of follow up** Follow-up period extends to 3.5 years	**Number of participants** Intervention: 1,018 Narrow control: 1,918 Broad Control: 3,344 Netherlands Control: 46,885 12 non-green District Approach neighbourhoods Control: 229 (see comparator section for detail) Response rate to Dutch national Health Interview Survey (HIS) survey approx. 60-65% (no more exact figures provided). **Participant characteristics** No information given on characteristics of individuals,	**Intervention** Neighbourhoods in which “The District Approach” was implemented, *and* which addressed green space through this programme (n = 24). District Approach was a national effort (mid-2008 to 2012) to reduce problems of unemployment, poor education and other social factors in 40 most deprived neighbourhoods of Netherlands. Green space was addressed either through creating new public parks (n = 9 districts), redeveloping existing parks (n = 9 districts), creating natural playgrounds, community gardens, fishponds, public allotments etc. Other neighbourhoods (n = 6 districts) improved green character such as planting flower bulbs, constructing wall gardens, refurbishing streets. **Comparator** 1) Narrow: control neighbourhoods whose measures of physical and social characteristics were in the same range as intervention	**Intervention:** Funded “district approach” neighbourhoods which have implemented green space interventions **Control:** (1) Narrow control neighbourhoods, (2) broad control neighbourhoods, (3) national control, (4) “district approach” neighbourhoods not implementing green space interventions **Outcomes** Baseline measures of walking varies between both intervention and control areas, from around 84% to around 57% prevalence (Note: interpreted by NICE team from unclear and unlabelled graph in paper), and are not controlled for in the analysis. <u>Prevalence of leisure walking ≥1/week: Intervention and control groups, follow-up vs. baseline (regression coefficient [95% Confidence Interval]).</u> Prevalence of leisure walking (%) varies between groups over time: no one group is consistently highest. (Note: interpreted by NICE team from unclear and unlabelled graph in paper) Time effect: Only control 4 exhibited a significant change between baseline and follow-up (follow-up vs baseline trend: Intervention 0.08 [-0.05, 0.20]; Control 1 0.06 [-0.03, 0.15]; control 2 0.05 [-0.02, 0.12]; control 3 0.02 [0.00, 0.04]; Control 4 0.44 [0.15; 0.73]. Group x Time effect: When comparing intervention to each of the control groups, the difference in trend is only significant for a comparison with control 4: -0.36 (-0.67, -0.05), indicating that control 4 had significantly more positive change than intervention. Actual prevalence data not reported, only regression coefficients. <u>Prevalence of leisure cycling ≥1/week: Intervention and control groups, follow-up vs. baseline (regression coefficient [95% Confidence Interval]).</u> Prevalence of leisure cycling (%) was highest in control 3 over the whole study period. (Note: interpreted by NICE team from unclear and unlabelled graph in paper) There were no significant time, or group x time effects in any of the groups. Group x Time effect: Intervention -0.08 (-0.20, 0.04); control 1 0.02 (-0.07, 0.10); control 2 0.00 (-0.06, 0.07); control 3 0.02 (0.00, 0.04); control 4 -0.01 (-0.28, 0.26). Actual prevalence data not reported, only regression coefficients. <u>Prevalence of leisure sports ≥1/week: Intervention and control groups, follow-up vs. baseline (regression coefficient [95% Confidence Interval]).</u> Prevalence of leisure sports is generally highest in control 3 throughout the study period. Control 4 peaks and is higher at one time point in 2008 only. (Note: interpreted by NICE team from unclear and unlabelled graph in paper) There were no significant time, or group x time effects in any of the groups.	**Limitations identified by the author** Selective non-response may have affected results Long timeframe means migration may have occurred through study period. Longer-term effects may require extended observation periods to detect – changes may be underestimated. Measuring *all* physical activity (including that outside the neighbourhood) may obscure effects of interventions on within-neighbourhood PA. Large variation in types of interventions means conclusions cannot be drawn on which are most effective **Limitations identified by the review team** Study period is split into two parts – baseline and follow-up, with no time period to allow for

Study details	Population	Intervention/ comparator	Results	Notes
after start of intervention implementation (no information on when interventions were completed). Baseline (pre-intervention period) was Jan 2004 – June 2008; Follow-up (post-intervention period) was Jul 2008 – Dec 2011. **Source of funding** Netherlands Organisation for Health Research and Development (ZonMw) Dutch Ministry of the Interior and Kingdom Relations Dutch Ministry of Economic Affairs	or of intervention / control areas / neighbourhoods. **Inclusion criteria** Individuals who have completed the HIS survey between 2004 and 2011, and who are 18 and over and live in either an intervention neighbourhood or one of the selected control areas. **Exclusion criteria** Individuals who have completed the HIS survey who are under 18 years old or who live outside of any of the designated study areas.	neighbourhoods. Number of neighbourhoods not given. 2) Broad: 10% of areas with similar physical and social characteristics (implies larger number of neighbourhoods than option 1, but number of not given). 3) All other respondents to the HIS survey in the Netherlands 4) The remaining 12 neighbourhoods in "the District Approach" (all chose not to implement a green space element in their interventions). **Data Collection** The HIS survey is carried out through the year with new interview respondents each month. Data used from between 2004 and 2011. Part 1 of HIS is an interview (either web-based, telephone-based, or face to face). Part 2 is an internet / paper questionnaire including the SQUASH survey which measures frequency (days per week) and duration (minutes per day) of leisure time walking, cycling and sports during a typical week. Also measures self-reported general health.	Group x Time effect: Intervention -0.10 (-0.23, 0.02); control 1 0.03 (-0.06, 0.13); control 2 -0.03 (-0.10, 0.04); control 3 -0.01 (-0.03, 0.01); control 4 -0.06 (-0.34, 0.23). Actual prevalence data not reported, only regression coefficients. <u>Prevalence of self-reported good general health: Intervention and control groups, follow-up vs. baseline (regression coefficient [95% Confidence Interval]).</u> Prevalence of good general health is consistently highest in control 3. Control 4 is initially lowest, but peaks and is highest at one time point in 2008 only, before returning to have the lowest prevalence of all the groups. [Obtained from visual graphs in the paper. No actual numbers given for each point so unable to report]. Only control 3 experienced a significant difference between baseline trend and follow-up trend (baseline 0.01 [0.01, 0.02-; follow-up -0.02 [-0.03, -0.03]; follow-up vs baseline -0.04 [-0.06, -0.02]). Follow-up was less positive than baseline. Intervention and the other control groups were not significant: Intervention -0.09 (-0.20, 0.01); control 1 -0.07 (-0.16, 0.02); control 2 -0.06 (-0.13, 0.00); control 4 -0.19 (-0.43, 0.05). Actual prevalence data not reported, only regression coefficients. <u>Comparison of outcomes between baseline and follow-up (follow-up vs baseline) for intervention neighbourhoods implementing green space *to be used by* residents (i.e. parks as opposed to tree planting) (n = 18 neighbourhoods) (regression coefficient [95% Confidence Interval])</u> Authors report that results were similar when evaluating only a subset of intervention neighbourhoods. Authors conclude that the trend change in the prevalence of being physically active at least once a week, as well as good perceived general health, did not differ between the deprived neighbourhoods that implemented interventions involving green space, and the control areas. **Analysis** Frequency and duration of leisure exercising was dichotomised. General health was dichotomised (good / very good; fine / bad / very bad). Multilevel analyses applied to take into account clustering within neighbourhoods. Generalised mixed models were fitted to estimate linear trend in prevalence of PA and good general health every 6-months throughout study period. Group by time effects calculated. Analyses adjusted for age, sex, household composition, ethnicity, education, and standardised disposable household income at individual level. Data was also controlled for overall intensity of the District Approach but the results were unaltered, so not reported.	intervention construction. Interventions were implemented at various points, clouding results. Activity was self-reported, subject to social desirability bias. **Other comments** Other outcomes: no other outcomes reported in this study. Study setting is 40 deprived communities around the Netherlands. Of the 24 intervention neighbourhoods, 8 started interventions in 2008, a further 8 in 2009, and the remaining 8 at later dates (not given), but all had been in place for ≥1 year at time of "inventory" (assumed that this means by the end of the follow-up period). Power not reported. Statistical significance = ≤0.05.

Norwood et al 2014

Study details	Population	Intervention/ comparator	Results	Notes
Reference Norwood et al 2014 **Quality score** - **Study type** Controlled before and after study **Location** UK - Scotland **Study aims** To assess the effect of the *Smarter Choices, Smarter Places* (SCSP) programme on physical activity (PA) in adults **Length of follow up** Baseline: May/June 2009 Follow-up: May/June 2012. Dates of interventions not reported.	**Number of participants** Baseline (intervention and control): 12,411 Follow-up (intervention and control): 9.542 Response rates: Intervention: baseline 14%, follow-up 14%. Control: baseline 15%, follow-up 14%. **Participant characteristics** There were statistically significant differences in work status, self-reported health, age distribution, and education level between groups. These were controlled for in the analysis. Intervention: At baseline, 38.6% were employed, 8.3% were unemployed, 38.5% were retired. 43% were male. 23% reported a disability. Health: 7.5% poor, 12.7% fair, 26.7% good, 33.6% very good, 19.1% excellent. 21.2% were ≤34, 9.9% were ≥75. 37.1% had no qualifications, 19% had higher education. 98.2% were white Control: At baseline, 37.8% were employed, 5.0% were unemployed, 44.5% were	**Intervention** Seven locations which had received funding for *Smarter Choices, Smarter Places* (SCSP) programme (2009-2012): Barrhead, Dumfries, Dundee, Glasgow East End, Kirkintilloch / Lenzie, Kirkwall and Larbert / Stenhousemuir. These seven areas were combined to create one set of intervention data. Intervention aims to increase uptake of walking and cycling, and public transport use (as an alternative to car use). Other online sources about this programme state that interventions involved introducing new bus services and shelters, ticketing improvements, and so on. Promotion activity also included but not detailed here as out of scope of guideline. **Comparator** Three control locations (Arbroath, Bearsden and Dalkeith) which had not applied for SCSP funding and were similar to intervention areas such as population density, car ownership, proportion cycling to work and other characteristics thought to impact on travel	**Intervention:** 7 *Smarter Choices, Smarter Places* locations in Scotland **Control:** 3 locations which did not apply for SCSP funding, in Scotland **Outcomes** <u>Proportion of participants meeting moderate physical activity (MPA) guidelines (intervention vs control; baseline vs 3-year follow-up):</u> Baseline: The proportion of participants meeting MPA guidelines was significantly different between control and intervention areas (p = <0.01; intervention = 34.2%; control = 39.8%). 3-year follow-up: The proportion of participants meeting MPA guidelines was significantly different between control and intervention areas (p = <0.01; intervention = 30.8%; control = 24.9%). Change over time: Percentage of people meeting MPA guidelines was reduced in both groups between baseline and follow-up but this was greater in the control compared to the intervention (absolute reduction of 14.9% reduction vs. 3.4%). Significance is reported in the form of a regression analysis (below). <u>Proportion of participants who were active at all (intervention vs control; baseline vs 3-year follow-up):</u> Baseline: The proportion of participants who were active at all was significantly different between control and intervention areas (p = <0.01; intervention = 70.6%; control = 79.3%) 3-year follow-up: The proportion of participants who were active at all was not significantly different between control and intervention areas (P value not reported; intervention = 69.9%; control = 70.1%). Change over time: Proportions of participants who were active at all reduced in both groups between baseline and follow-up but this was greater in the control compared with	**Limitations identified by the author** Authors state that participant areas were not random or completely representative as they competed for funding provided for the SCSP. Local authorities selected for SCSP funding were selected partly on proven track record of delivering on similar projects – self-selection an issue. The association between meeting the PA recommendations and the intervention cannot be interpreted as causal. Follow-up is insufficient to see longer-term effects. Questions on PA were not particularly sensitive (required 30 mins in a day) so may have underestimated effect of intervention on shorter periods of exercise per day. **Limitations identified by the review team** Intervention includes elements of promotion, encouragement, and information provision which are outside of the scope of this guideline. Impact on outcomes of

Study details	Population	Intervention/ comparator	Results	Notes
Source of funding Transport Scotland (in association with the Convention of Scottish Local Authorities)	retired. 41.7% were male. 23% reported a disability. Health: 6.3% poor, 13.8% fair, 24.4% good, 37.2% very good, 17.6% excellent. 15.9% were ≤34, 12.4% were≥75. 26.3|% had no qualifications, 29% had higher education. 97.8% were white. **Inclusion criteria** Age 16 and over, willing to participate in survey, resident in relevant areas. **Exclusion criteria** Age 15 and under, not resident in relevant areas (NICE team assumptions).	choices at the area level. These three areas were combined to create one set of control data. **Data Collection:** Baseline: questionnaires left at households (selected from a random sample of households within postcode areas) for one adult per household to complete (selected using "next birthday"). Follow-up: questionnaires used a computer assisted survey approach, which meant face-to-face interaction between participant and surveyor. Participants chosen in the same way as at baseline, but unlikely to be the same individuals. Data was collected through the surveys on demographic characteristics; how many days/week (outside of work) they undertook ≥30 mins of moderate physical activity (MPA) (incl. walking and cycling). Work-related exercise excluded as authors believe this is less likely to be affected by SCSP.	the intervention (absolute reduction of 9.2% vs 0.7%). Significance is reported in the form of a regression analysis (below). <u>Regression analysis</u> Regression analysis, controlling for age, ownership of a car, employment status, health status, age, ethnicity, education level suggests that the likelihood of PA participation is significantly higher in the intervention areas relative to the control areas (p = <0.01, regression coefficient for area by year is 0.39.), Those who are physically active are significantly more likely to meet physical activity guidelines in the intervention areas relative to the control areas (regression coefficient 0.13; p = <0.05). **Analysis** Difference in Differences analysis, i.e. the difference between the change observed in control over time, compared with the change observed in intervention over time. *T* tests were estimated on the equality of means between control and intervention areas. Responses to question on MPA made binary: score of 1 if participant reported MPA for ≥30 mins/day for ≥5 days/week. Score of 0 for anything less. A second binary outcome was created: decided to do any exercise (=1) versus those who are inactive (=0). .	structural changes compared to promotional elements unclear. Follow-up survey conducted face to face and self-reported – could lead to greater social desirability bias on second than first survey, exaggerating positive results. Wider contextual factors which may have caused the reductions in MPA in both groups are not explored by / included in this study. Unclear when interventions were implemented, and how soon after these the follow-up data was collected. Likely to vary between locations. Not panel data: i.e. participants at baseline and follow-up likely to be different individuals. **Other comments** Other outcomes: No other outcomes are reported in the study. Questions are validated. Power not reported. Statistical significance ≤0.05.

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133 O'Brien and Morris 2009

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>Reference

O'Brien and Morris 2009

Quality score

-

Study type

Uncontrolled before and after study

Location

UK – Kent, Devon, Derbyshire

Study aims

To evaluate the impact of 3 woodland projects on visitor demographics and physical activity.

Length of follow up

Varies between sites: baseline measures taken</td>
<td>Number of participants

N = 1,467 for all data collection points combined. Across 3 sites, 753 participants in 2004; 407 in 2006; 307 in 2007.

Participant characteristics

3 sites presented combined characteristics, so cannot tell difference between groups.

Baseline at 3 sites combined: 16-44 years old 39.7%; 45+ years old 60.3%. Largest proportions of visitors are working full time; working part time, or retired (actual figures not given). 1.7% of visitors BME; 98.3% are</td>
<td>Intervention

3 3-year woodland projects as part of Active England Programme (2005/6-2008/9). Sites were Kent [Bedgebury Forest], Devon [Haldon Forest park], Derbyshire [Rosliston in National Forest].

Kent: new children's play area; new visitor centre; 10km cycle track, introduction of walking trails; installation of showers. Devon: Butterfly trail; new cycle trail, freeride area (for cycles). Derbyshire: climbing wall, various groups and events, conservation activity.

Comparator

No comparator

Data Collection:

Counts: not clear how counts were conducted</td>
<td>Intervention: Active England woodland projects in 3 locations
Control: No control

Outcomes
Change in proportion demographic make-up of visitors; change in proportion of visitors exercising >5 times per day; frequency of visits; duration of visits; activities undertaken during visits.

<u>Total numbers of visitors:</u>
Kent: Baseline 51,837 visitors (2005/6); 1-3 year follow-up 273,081 (2007/8); 426.8% increase.
Devon: baseline 10,000 (2003); 4-5 year follow-up 224,280 (2007/8); 2,142.8% increase
Derbyshire: baseline 129,340 (2005/6); 1-3 year follow-up 189,905 (2007/8); 46.8% increase.

<table>
<tr><th>Site</th><th>Number participants completing on-site surveys at all time points combined</th></tr>
<tr><td>Devon</td><td>694</td></tr>
<tr><td>Kent</td><td>391</td></tr>
<tr><td>Derbyshire</td><td>382</td></tr>
<tr><td>TOTAL</td><td>1,467</td></tr>
</table>

<u>Demographics of visitors</u>
People with disabilities: No significant changes in number of visitors with blue badges (actual numbers not given), however there was a decrease in proportion of people reporting having a long term illness (13.9% at baseline, 7.2% at follow-up (p = <0.001; actual numbers not reported).
BME groups: BME individuals as a proportion of all visitors increased from 1.7% at baseline to 5.2% at follow up (p = <0.001).
Percentage of visitors coming to the site with family increased from 35.9% to 59.5%, while people visiting on their own decreased (17.7% to 9.5%, as did visiting with just a partner (30.4% to 11.5%).

<u>Changes to perceived barriers to accessing forests for physical activity:</u></td>
<td>Limitations identified by the author

Timeframe does not allow sustainability of all projects to be assessed.

Other "non-project" activities at sites could be affecting outcomes.

Staff-led monitoring and evaluation subject to their time and availability, and potentially varying in methodology.

Limitations identified by the review team

Most figures are presented as percentages of whole population of visitors. Not possible to calculate actual numbers as unclear whether percentages are of participants, total numbers of visitors, or some other number. Due to assertions that absolute numbers visiting increased, it is impossible to tell whether a reduced percentage between before and after is showing a reduced, stable, or increased absolute figure.

No data is split by site – all 3 intervention sites combined. Cannot tell whether results were different between sites.

Interventions will have been implemented at various times and therefore be at varying stages at time of follow-up – some more embedded than others.

Data collectors likely to be involved closely with projects at each site, which could introduce bias.</td>
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</table>

<table>
<tr><th>Study details</th><th>Population</th><th>Intervention/ comparator</th><th>Results</th><th>Notes</th></tr>
<tr>
<td>between 2003 and 2006; follow-up measures taken in 2007/8. Intervention implementation dates vary.

Source of funding

Forestry Commission (Forest Research)</td>
<td>reported as British – assumed by NICE team to mean white British. No further information reported.

Inclusion criteria

Any visitor to the park for count data. Survey data obtained only from those 16 and over, and participants appears to be opportunistically identified

Exclusion criteria

Surveys were not distributed to people aged 15 and under.</td>
<td>– likely to vary between sites.
Surveys: On site surveys to monitor changes in visitors and the frequency / type of visitor activities (starting with a baseline survey of existing users before the new projects were developed). These were administered by employees of the park / green space. Survey questions only reported for Kent. Physical activity questions included: what do you intend to do in the forest today; how did you get to the forest; do you consider any of the following to be barriers to using [location] for physical activity? (all multiple choice). No other information on questions reported.</td>
<td>[To note – Actual numbers and statistical significance not reported. NICE team derived this information from a bar chart with no number labels].
The largest changes in perceived barriers occurred in: lack of facilities, antisocial behaviour and lack of information (where there was a decrease in perceived barrier from baseline to follow-up). Compared with baseline, respondents were more likely to perceive weather as a barrier and have a preference for other countryside areas.

<u>Change in frequency of visits (as % of all visitors)</u>
<table>
<tr><th></th><th>Every day</th><th>4-6 / week</th><th>1-3 / week</th><th>1-3 / month</th><th>4-6 / year</th><th>1-3 / year</th><th>Less often</th></tr>
<tr><td>Before</td><td>7.3</td><td>6.7</td><td>19.0</td><td>22.3</td><td>9.0</td><td>19.7</td><td>15.9</td></tr>
<tr><td>After</td><td>2.2</td><td>3.0</td><td>19.0</td><td>27.6</td><td>19.2</td><td>18.8</td><td>10.1</td></tr>
</table>

Those visiting every day or 4-6 times per week declined as a proportion of all visitors. Those visiting 1-3 times per month and 4-6 times per year saw the greatest increase as a proportion of all visitors. Average visit time reportedly increased from 1.74 (standard error 0.04) to 2.33 (standard error 0.04). Presumed unit is hours (not reported). Statistical significance cannot be calculated (no N).

<u>Activities Undertaken (as % of all visitors):</u>
Between baseline and follow-up, greatest increases in activities as a proportion of all those undertaken by visitors appear to be use of play area, cycling, and mountain biking (interpretation by NICE team from bar chart with no numbers given). Proportion of visitors taking ≥5 days exercise/week declined from 55.9% to 36.1% between baseline and follow-up ($p = <0.001$).

Analysis
Analysis is largely descriptive (presented in percentages). Some p-values reported, but the tests to obtain these are not reported.</td>
<td>Details of data collection methods not given so cannot tell whether robust.

Wider promotional activities (include groups and clubs) were also underway which might have affected results.

Other comments

Other outcomes: This study also reports on motivations to participate in the interventions as a qualitative analysis. However, this only relates to people participating in new activity groups (i.e. mountain biking group, Asian Walkers group), which are behavioural interventions and so are out of the scope of this guideline, so were not extracted.

Target groups of wider programme include women and girls, people with disabilities, Black and Minority Ethnic (BME) groups, <16 years old, >45 years old, and low income.

2 community forest locations were also part of this study but only implemented behavioural interventions which are outside of the scope of this guideline, so not extracted.

Statistical significance = ≤0.05.

Power not reported.

Survey not validated and very specific to this investigation.</td>
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