

Active design of built environments for increasing levels of physical activity in adults: the ENABLE London natural experiment study

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Scientific summary

The ENABLE London natural experiment study

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Scientific summary

Background

Although the built environment may be an important influence on physical activity patterns, particularly on the uptake of walking and cycling to everyday destinations, there is a dearth of longitudinal evidence. The East Village development offered a unique opportunity for a longitudinal natural experiment to assess the impact of relocation to a purpose-designed walkable urban built environment on physical activity patterns. The transformation of East Village into social, affordable/intermediate and market-rent housing was carried out in a rapid timescale (with the first residents scheduled for occupancy in 2013, after the London 2012 Olympic and Paralympic Games) and was specifically conceived with active design features (including improved access to public transport, secure bicycle spaces allocated for every home and restrictions on car ownership). The development is further enhanced by regeneration of the surrounding area (particularly the extension of walkways and cycle paths to the Lee Valley and connection to the London Cycle Network). The accommodation is for those from widely differing socioeconomic backgrounds, allowing social inequalities in use of the area to be gauged. The rapid transformation allowed change in physical activity levels (as well as in other health behaviours/outcomes) to be compared between residents who relocated to East Village and control participants who remained in their original housing or moved elsewhere over a defined period. This is a unique opportunity as it (1) represents a natural experiment of people from diverse social backgrounds relocating into a new walkable neighbourhood and (2) reduces the effects of time-dependent factors that may override the potential effects of change in the built environment, which would be a factor in most new housing developments that often take much longer to complete.

Aims

The primary aims of the Examining Neighbourhood Activities in Built Living Environments in London (ENABLE London) study were to address the following research questions:

1. Do those living in social, intermediate and market-rent housing in East Village show a sustained change in their physical activity levels compared with their levels before moving and compared with the physical activity change among those who did not move into East Village?
2. Are any changes in physical activity observed among those who moved to East Village attributable to differences in mode of travel (particularly use of public transport, levels of walking and cycling) and/or use of the local built environment (e.g. open spaces, cycle paths, pedestrian walkways, recreational or green space, sporting venues)? In addition, are any changes modified by housing tenure, socioeconomic position, housing type or use and perceptions of the local environment and its specific features?

In addition, the ENABLE London study sought to answer the following secondary research questions:

3. Are there any changes in adiposity levels among those living in East Village and do these show a sustained change from levels before moving into East Village, in comparison with changes observed among those who did not move to East Village over the same time period?
4. Does moving to East Village improve levels of mental health (depression and anxiety) and well-being (including levels of life satisfaction, happiness and feelings of worthiness) compared with remaining outside East Village throughout?

Another important issue for the ENABLE London study was to investigate change in the built environment associated with the East Village development (i.e. the primary exposure variable), without which the change in the outcome variables would not be expected. Hence, we also sought to:

5. Quantify change in objective measures of the built environment (including neighbourhood walkability, land use mix, proximity to parks and public transport accessibility) comparing the areas in which residents were living before and after moving to East Village with control areas.

Although a primary goal of the study was to examine families, it was not possible to examine change in children's physical activity levels because the number of children recruited was small (see *Overall research design*).

Methods

Overall research design

We carried out a longitudinal study to evaluate the natural experiment provided by the opening of East Village. The length of follow-up was extended from the initially proposed 1 year to 2 years owing to delays in the alterations of East Village, which resulted in a staggered release of different tenured accommodation ready for occupancy. This was an unforeseen delay that was out of the control of the researchers. The original study design planned to collect baseline measures during 2013, prior to the scheduled completion of East Village in the summer of 2013, with repeat measures in 2014. However, East Village residents did not start to move in until 2014, with the social sector residents moving in before the development was complete. Intermediate and market-rent residents moved in when the development was more fully open, with unrestricted access to the immediate and surrounding area. Follow-up in the control group (those who were seeking to move but did not) also had to be delayed to ensure that interviews were carried out during the same period as interviews with the East Village group (i.e. those who moved to East Village) to provide controlled comparisons and to avoid any potential time-dependent effects.

Participant recruitment and follow-up

A cohort of adults seeking to move into three different housing tenures in East Village were recruited between January 2013 and January 2016. East Thames Group housing association was responsible for social housing in East Village, Triathlon Homes for the intermediate accommodation (affordable market-rent/shared-ownership/shared-equity) and Get Living London for market-rent (private rent). Recruitment was carried out by the East Thames Group for the social sector and ENABLE London researchers for the remainder. Of the 1819 households invited, 1006 (55%) agreed to take part, and 1278 adults and 219 children from these households were examined at baseline; the children were recruited mainly from the social housing sector. We expected to recruit similar numbers of adults and children, and the small number of children was unforeseen. East Village accommodation mainly consists of houses of three or four bedrooms but it did not attract the number of families that were expected. Unfortunately, the number of children was insufficient and underpowered to examine change in physical activity, as well as in other health outcomes; hence, only adults were considered further. Participants were grouped into type of housing tenure being sought, which was largely based on level of income. Participation rates were slightly lower among those seeking social rented housing (52%) than among those seeking intermediate housing (57%) and market-rent (58%). The 2-year follow-up of the cohort began in February 2015 and was completed in October 2017. In total, 877 adults (follow-up rate 69%) from 710 households (71%) were re-examined; 440 adults (50%) were living in East Village and 437 adults (50%) were living at their baseline address or had moved elsewhere (control group). This was remarkably similar to what we initially proposed (70% and 50%, respectively), although there was some imbalance between East Village and control groups among the different housing sectors.

Baseline and follow-up examinations

Baseline and follow-up examinations were carried out in the participants' homes. Adult self-complete computer-assisted personal interviewing collected information on sociodemographic data, occupation, mental health and well-being, travel to and from work, physical activity and neighbourhood perceptions. Trained researchers took measures of height, weight and bioimpedance (to obtain a more direct measure of body fat). Participants were invited to wear an accelerometer (ActiGraph GT3X+; ActiGraph LLC, Pensacola, FL, USA) for objective assessment of physical activity and a Global Positioning System monitor (BT-1000XT; QStarz International Co, Ltd, Taipei, Taiwan) to investigate their movements, on an elasticated belt around the waist, for 7 consecutive days (removing devices for sleep, swimming and bathing), and were asked to return the instruments to the research team by post in a prepaid postal envelope at the end of the measurement period.

Results

Participant characteristics at baseline and follow-up

Participants recruited from the social housing sector were older (mean age 31 years vs. 29 years for other housing tenures), more often female (73%), mainly from ethnic minority backgrounds (82% non-white) and living in larger households (i.e. 58% with households of four or more people, which included children) than intermediate and market-rent participants, who were largely of white ethnicity (69%), with similar numbers of males and females (46% female), and mostly (39%) living in two-person adult households. Only half (49%) of social housing participants were employed, compared with approximately 90% of the intermediate and market-rent participants. Despite these housing sector differences in baseline characteristics, there were no appreciable differences in sociodemographic factors (i.e. in age, sex or ethnic group) between those followed up and those not followed up, although those followed up had a slightly higher National Statistics Socioeconomic Classification socioeconomic status and recorded more sedentary time at baseline than those who were not followed up.

Physical activity and adiposity

At baseline, objective measures of physical activity showed lower levels of activity among those in social housing, with fewer daily steps (8298 steps vs. 9390 steps for other housing tenures) and less time spent in higher levels of activity (i.e. time spent in moderate to vigorous physical activity, 54 minutes per day vs. 63 minutes per day for other housing tenures). Measures of body size showed higher levels of adiposity among those in the social housing sector (median body mass index 26 kg/m²; median fat mass 18 kg) than among those in other housing sectors, with similar levels among those seeking intermediate and market-rent accommodation (median body mass index 24 kg/m²; median fat mass 15 kg). At follow-up, a modest increase in the number of daily steps was associated with moving to East Village, with a 154-step (95% confidence interval -231 to 539 steps) increase overall and a larger (433 steps, 95% confidence interval -175 to 1042 steps) difference among the intermediate housing sector than among those who remained outside East Village throughout. However, none of these differences was statistically significant. There were no appreciable effects of moving to East Village on other physical activity outcomes (including overall activity counts, time spent in moderate to vigorous physical activity and sedentary time) and measures of adiposity (including body mass index and percentage fat mass).

Travel mode

Using a novel automated approach of identifying mode of travel from the combined accelerometry and Global Positioning System data, most of the cohort at baseline (75%) used public transport to travel to or from their place of work or study and half (50%) participated in some active travel (i.e. walking, cycling or jogging). There were marked differences by housing sector; social housing participants were less likely to walk, cycle or jog, recorded less time travelling by train and underground and were more likely to use private transport (e.g. travel by car) than intermediate and market-rent housing participants, who showed similar travel patterns. At 2-year follow-up, there was no change in the time spent walking or cycling among those who moved to East Village compared with those living elsewhere, which was commensurate

with the primary finding of little overall change in physical activity levels. However, there was some suggestion that vehicle travel had decreased (by 8.3 minutes per day, 95% confidence interval 2.5 to 14.0 minutes per day) particularly in the intermediate sector (9.6 minutes per day, 95% confidence interval 2.2 to 16.9 minutes per day) and that underground travel had increased (by 3.9 minutes per day, 95% confidence interval 1.2 to 6.5 minutes per day), more so in the market-rent sector (11.5 minutes per day, 95% confidence interval 4.4 to 18.6 minutes per day). Although underground use also appeared to increase among the social sector (by 4.0 minutes per day, 95% confidence interval -0.1 to 8.1 minutes per day), time spent walking marginally decreased, although not significantly (by 1.8 minutes per day, 95% confidence interval -4.8 to 8.4 minutes per day).

Mental health and well-being

Baseline levels of self-reported mental health and well-being showed that 14% of the whole cohort reported depression, 31% reported anxiety and one-quarter reported poor well-being. Participants from the social housing sector reported poorer mental health and well-being than those seeking intermediate and market-rent accommodation. At 2-year follow-up, there were no consistent effects associated with moving to East Village on depression and anxiety in comparison with the control group, although there was some evidence to suggest that there were improvements in well-being, with improved life satisfaction among the intermediate sector in particular [improvement in score on a scale of 0 (low) to 10 (high) of 0.3, 95% confidence interval 0.0 to 0.6].

The built environment and neighbourhood perceptions

There were sizeable improvements in objective measures of the built environment associated with moving to East Village. Compared with baseline data, participants in East Village lived closer to their nearest park (by 531 m, 95% confidence interval 488 to 574 m), had better access to public transport (change in accessibility score 1.6 units, 95% confidence interval 1.3 to 1.9 units) and lived in a more walkable area (change in walkability score of 2.4 units, 95% confidence interval 2.1 to 2.7 units). For baseline neighbourhood perceptions of crime-free neighbourhood and neighbourhood quality, perceptions of baseline residence were lower among the social housing sector than among other housing sectors; that is, the social housing sector perceived higher levels of crime and poorer neighbourhood quality at baseline than intermediate and market-rent sectors. However, at follow-up, marked improvements in neighbourhood perception scores were observed among those who moved to East Village, compared with those who did not move. These marked differences were observed both overall (change in crime-free neighbourhood score 3.36 units, 95% confidence interval 2.83 to 3.90 units; quality score 4.98 units, 95% confidence interval 4.48 to 5.48 units) and by housing sector. The largest improvement in perceptions of crime-free neighbourhood was among the social housing sector who moved into East Village (where the change in crime-free neighbourhood score was 3.95 units, 95% confidence interval 2.97 to 4.94 units).

Qualitative findings

Two separate pieces of qualitative analyses, based on a total of 30 ENABLE London participants, provided important contextual information about the perceived effects of moving to East Village, allowing consistency with measured effects in the cohort at large to be established as well as investigating factors that are difficult to measure quantitatively. Findings indicated that those who moved into East Village housing enjoyed their new homes and living in the area, which was perceived as attractive and safe. However, concerns over the high cost of living, restrictions on the playing times of children (particularly during summer months) and facilities for young people were raised (although this may have reflected the partial opening of East Village for some of the earlier interviews). Consistent with quantitative data, participants had generally more positive perceptions of their new environment than their old environment and recognised many features of the built environment that encouraged physical activity, particularly those that encouraged leisure-time activities. However, any effect of these more positive perceptions on physical activity may have been offset by changes in transport-related activity. The relatively sophisticated and accessible transport options in East Village may have reduced the walking required to access transport hubs. Further development of retail and

leisure-related space in East Village will continue to diversify the area and increase opportunities for social interactions, which could encourage physical activity and improve other health behaviours. However, any such changes might be affected by recent plans to create high-storey living space, leading to reduced recreational green space.

Conclusions

Cross-sectional evidence has suggested larger effects of the neighbourhood built environment on physical activity and other health-related outcomes than evidence from longitudinal studies. Very few studies have evaluated housing regeneration projects. The ENABLE London study provided a unique opportunity. At 2-year follow-up, moving to East Village, a neighbourhood designed for healthy active living that showed sizeable improvements in the built environment and neighbourhood perceptions, did not have consistent beneficial effects on objectively measured physical activity, adiposity, mental health or well-being, which are of public health importance. This study suggests that the built environment alone is insufficient to change physical activity behaviour.

Research recommendations

More evidence from similar studies is needed to confirm these findings, in particular high-quality evidence from longitudinal relocation studies that examine the effect of change in the built environment on changes in physical activity levels, focusing on potential movers as opposed to 'mover versus stayer' populations with different health behaviours to avoid potential biases. However, opportunities for large-scale relocation studies are rare, and the difficulties, time needed and costs make such studies challenging; alternative innovative population-based approaches (perhaps harnessing the latest developments in technologies) to evaluate the effect of housing regeneration projects on health will be needed to inform and evaluate future evidence-based housing policy.

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