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Gamification of active travel to school: A pilot evaluation of the Beat the Street physical activity intervention

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ABSTRACT

Beat the Street aims to get children more active by encouraging them to walk and cycle in their neighbourhood using tracking technology with a reward scheme. This pilot study evaluates the impact of Beat the Street on active travel to school in Norwich, UK. Eighty children 8–10 yrs were recruited via an intervention and control school. They wore an accelerometer for 7 days at baseline, mid-intervention and post-intervention (+20 weeks), and completed a travel diary. Physical activity overall was not higher at follow-up amongst intervention children compared to controls. However, there was a positive association between moderate-to-vigorous physical activity (MVPA) during school commute times and the number of days on which children touched a Beat the Street sensor. This equated to 3.46 min extra daily MVPA during commute times for children who touched a sensor on 14.5 days (the mean number of days), compared to those who did not engage. We also found weekly active travel increased at the intervention school (+10.0% per child) while it decreased at the control (−7.0%), p=0.056. Further work is needed to understand how improved engagement with the intervention might impact outcomes.

1. Introduction

Physical activity levels in children are low, with less than a quarter of English 5–15 year olds achieving the recommended 60 min of moderate-to-vigorous physical activity 7 days a week (Townsend et al., 2015). It has been suggested that a contributing factor to childhood inactivity and associated obesity is excessive use of technology, including video games (Lamboglia et al., 2013; Arango et al., 2014). However, while video gaming is seen as having a negative impact on children's physical activity levels, a growing body of research has examined whether it is possible to use the principles by which gaming works to get children more active and thus provide part of the solution to inactivity (Boulos and Yang, 2013; Lister et al., 2014). This process is known as gamification, which is defined as the use of game design elements in non-game contexts (Deterding et al., 2011). The theory behind gamification is that if health promotion initiatives can capture the components that make games addictive, then they can be used to improve the effectiveness of interventions by also making pro-health behaviours addictive and hence more likely to be habitualised (Cugelman, 2013).

Active travel (walking or cycling for transport), has been shown to be a major contributor to overall physical activity in children, and cross-sectional studies have demonstrated that those who actively travel to school accumulate between five and thirty-seven more minutes of MVPA per day compared to those using motorised transport (Lee et al., 2008; Faulkner et al., 2009; Southward et al., 2012; Schoeppe et al., 2013). Despite this, a recent study found that only just over half of children (58%) actively travelled to school in a sample of English 10-16 year olds (Voss and Sandercock, 2010), and data suggest that the proportion of youth actively travelling is likely to decline in the absence of initiatives to increase its prevalence (Pabayo et al., 2011). Thus interventions that successfully maintain or initiate active travel behaviours are likely to provide substantial health benefits. Gamification theory suggests it should be possible to make a routine non-game activity such as active travel into a game that is engaging and fun (Cugelman, 2013). This could be done by adding elements such as earning points for walking to school or work and allowing players to compete against themselves and each other by travelling greater distances by active means.

A recent study by Walsh and Golbeck (2014) evaluated the potential of gamification to increase levels of walking. They recruited 74 adults to wear Fitbits, a personal activity monitoring device that tracked the number of steps taken in a day, and compared step totals in three experimental conditions: a control, a social interaction experience, and a social game they developed

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called StepCity. They found that for newer Fitbit users, the StepCity game led to users taking more steps than they did in the control condition, suggesting that gamification played a role in initiating and maintaining increased walking levels in that study. Similarly, gamification is now incorporated into many running and cycling apps where users can gain points for each mile accrued or for reaching a target time to compete against themselves or against others (Lister et al., 2014).

The focus of this study is a recently developed intervention called Beat the Street, which incorporates gamification components. Beat the Street aims to encourage residents to walk and cycle around their local environment via the use of walk tracking technology linked to a reward scheme, with the aim that the intervention will promote long term changes in healthy behaviours (Intelligent Health, 2015). Residents are issued with a smartcard that they touch on sensors known as 'Beat Boxes', which are installed on lampposts around the local area. Residents are awarded a point each time they touch-in at a sensor and they compete to see who can achieve the most walks over a month, with high scorers being rewarded. For example, children receive points for their school that can be used to obtain books, whereas adults are entered into a prize draw. Beat the Street attempts to engage participants by using several key gamification strategies including providing feedback on players' performance to allow them to set goals and monitor their improvement, allowing them to compare their progress with others, and rewarding positive behaviour, all of which are components in initiating behaviour change (Cugelman, 2013).

Beat the Street was initially trialled in the UK city of Reading and has since been implemented internationally across neighbourhoods in London, New York, Shanghai, and Vancouver. The intervention has not been formally evaluated with the exception of one recent mixed-methods study by Hunter et al. (2015), which examined whether Beat the Street increased children's walking to and from school in cities in the UK and Canada but found somewhat mixed findings. From self-report Hunter et al. (2015) found that 97% of children reported post-intervention that walking to school helped them stay healthy, feel happy (81%), and stay alert in class (76%). However, data on the number of walks to and from school, which was measured using swipecard tracking technology, suggested that the prevalence of children walking to school declined during the 4-week intervention from 29% at week 1 to 12% at week 4. A limitation of this study however, was that it did not include a control school or collect an objective measure of physical activity levels and, given the mixed findings highlighted in that work, further research is needed to better understand the impact of Beat the Street on activity levels longer term.

In this pilot study, we quantitatively evaluate the impact of Beat the Street on levels of active travel using objective measures of change in physical activity recorded by accelerometry. Whilst Beat the Street adopts a whole-community approach that is aimed at increasing active travel within entire neighbourhoods, we focus on the impact of the intervention on active travel to school in a sample of children in the city of Norwich, UK.

2. Methods

2.1. Intervention

Beat the Street took place within the city of Norwich, UK, for 9 weeks during May-July 2014 and the present study focuses on this scheme. The intervention was restricted to three neighbourhoods located in the northeast of the city; Sprowston, Heartsease, and Thorpe St Andrew, which together covered an area of approximately 5.7 km^2. In total 40 Beat Boxes were installed in the street environment; 38 were placed on lampposts in the three intervention neighbourhoods and an additional 2 were placed in the city centre approximately 3 km away. One of the aims of Beat the Street was to encourage children to actively travel to school, with the premise that children walking or cycling would find it easier to touch their smartcards on sensors than those using motorised transport. Notably the scheme encouraged children who lived too far from school to be able to walk the entire length of their journey, to take part by either asking their parents to stop the car further from the school gate and walk the remaining part of the journey, or by getting off the bus a stop or two earlier to walk.

Participants were awarded a point each time they touched their smartcard on a sensor, allowing children to compete against other pupils at their school to see who could achieve the most points. Furthermore, the distances between sensors were computed to provide estimates of distances walked and cycled and a target was set for all participating children to "walk and cycle around the world" during the 9 week programme. There was also a wider competition where schools competed against each other, with the winning school at the end of the 9 weeks receiving funding to spend on sports equipment, books, or resources. Schools were also able to compete against other groups taking part in Beat the Street, such as local workplaces, for weekly spot prizes donated by local businesses. A series of promotional events took place regularly while the intervention was running to promote interest in the scheme and encourage participation.

2.2. Study design

This study was a pilot non-randomised controlled evaluation of a 9 week intervention. The evaluation was designed using a logic model for the intervention (Table 1) which was developed in collaboration with staff at Intelligent Health, the organisation that designed and implemented Beat the Street. We were guided by CONSORT and STROBE guidelines for reporting of methods and results. Ethical approval was obtained from the Research Ethics Committee at the University of East Anglia prior to the study commencing.

2.3. Sample population and recruitment

Children were recruited to take part in the evaluation via two schools; a primary school in the intervention area, plus a control primary school located 7.5 km away on the opposite side of the city, chosen in order to minimise contamination from the intervention. The Headteacher at each school was contacted via a letter and follow-up call to invite their school to participate in the study. Once approval had been obtained, all children in Years 4 and 5 (aged 8–10 years) at both schools were invited to take part. Each child was given an information sheet for themselves, one for their parents, and a consent form in a take-home pack. Children were encouraged to discuss the study with their parents and return the jointly signed consent form within a week. In total, 150 children were invited at the intervention school with 51 (34.0%) agreeing to participate, whereas 56 children were invited at the control school with 29 (51.8%) consenting to take part. Upon completion of the study each child received a certificate and a Frisbee to thank them for their participation.

2.4. Data collection

Demographic characteristics including the child's gender, school they attended, and their school year were collected at the start of the study when children completed their consent form. The children were then measured at three time points including baseline (Week 0, May 2014), during the intervention (Week 7, July