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A qualitative evaluation of the implementation, outcomes, and sustainability of 'School Streets'

Abstract

Introduction

Increasing physical activity in children is a public health priority. Active travel for the journey to and from school may provide the best opportunity to address this. Modifications to the environment through 'School Streets' road closures may help, but they are not always successful. Previous research has suggested this may be due to limited understanding of the setting, the community, and the processes of change in such interventions. However, an in-depth exploration of the experiences of stakeholders is lacking.

Method

We conducted a qualitative process evaluation of two School Streets interventions in a town in England. Interviews and focus groups were conducted with 20 stakeholders from the schools and local communities, and thematic analysis was undertaken. Three overarching themes were explored: implementation, outcomes, and sustainability.

Results

Findings suggest that the schemes were challenging to implement, trigger causal mechanisms, and change behaviour. This was due to practicalities of implementing and delivering a volunteer-run scheme, complexities of the geographical and local context, diverse needs and interests of stakeholders, and the influence of the wider transport and active travel system. Additional measures and alternatives were suggested.

Conclusions

Understanding and involving all stakeholders is necessary for a community-based solution to a public health issue. Changing active travel behaviour will require more than the closure of a street; wider systems change is needed.

Key words

Active travel, physical activity, community intervention, School Streets, road safety, environment, context

1. Introduction

Despite the wide-ranging physical, psychological, and social benefits of physical activity for children (Chalkley et al., 2015), many remain insufficiently active (Office for Health Improvement & Disparities, 2022; World Health Organization, 2022). Finding ways to increase physical activity in children is a public health priority (World Health Organization, 2018). One area for action, as set out in both national and global strategies (Department for Culture Media and Sport 2023; World Health Organization, 2018), is to encourage active travel – 'modes of travel that involve a level of activity' (Department for Transport, 2022), such as cycling, walking, wheeling (using self- or partially self-propelled wheelchairs or other walking aids), scooting, skating or skateboarding – to and from school. Indeed, evidence suggests this may be the best opportunity for pupils to increase habitual physical activity (Prince et al., 2022; World Health Organization, 2021).

Previous systematic reviews of active school travel interventions have reported mixed findings. Interventions such as walking buses and the development and implementation of education strategies (e.g. story reading, knowledge lessons) show potential (Jones et al., 2019), although it is challenging to determine the most effective approaches due to heterogeneity of interventions and the use of poor-quality and varied evaluation methods (Larouche et al., 2018; Villa-González et al., 2018). Environmental interventions, which involve changing the physical environment outside of the school, often supported by policies to implement and enforce these changes, are another potential strategy for behaviour change. Two systematic reviews found that schools taking part in the Safe Routes to School Program in America, which introduced environmental interventions in the form of engineering improvements, addressing sidewalks, cycle lanes and traffic calming measures, saw a greater increase in active travel than those using educational strategies alone (Larouche et al., 2018), and were associated with a 18% relative increase in active travel (McDonald et al., 2014).

In the UK, few environmental interventions have been used to encourage active travel to school (Jones et al., 2019). However, an intervention known as 'School Streets', whereby roads adjacent to schools are closed to vehicular traffic at drop off and pick up times, has been recently implemented at schools in at least six towns and cities (including 27% of state-funded primary schools in London) (Department for Transport, 2024; Thomas et al., 2022). The aim is to create 'a happier, safer and healthier street environment for everyone' through increased active travel and reduced car use outside schools (Sustrans, 2019). Preliminary evidence suggests that School Streets can lead to reduced traffic and an improved environment outside schools, leading to increased active travel and public support (Davis, 2020). However, not all planned schemes are successfully implemented, potentially due to a lack of understanding of the setting, the community, and the processes of change (Smith et al., 2022). The UK government has published School Streets guidance for local authorities (Department for Transport, 2024), yet to date, School Streets has not been comprehensively evaluated and the evidence is largely quantitative.

The success of community-based interventions like School Streets is influenced by the extent to which they are community-centred and participatory (Forrester et al., 2020; Public Health England, 2015; Smith et al., 2022; South et al., 2017; South et al., 2019), and developed with the different groups who might be affected by or affect them. In the case of School Streets, this includes school staff, parents, residents, and businesses. The aim of this study was to qualitatively explore, through discussions with a wider range of stakeholders than in previous studies, the contextual factors influencing the implementation, outcomes, and sustainability, in terms of the ability of the scheme to continue to be delivered in the future, of two new School Streets schemes.

2. Materials and methods

2.1 The intervention and study area

In spring 2022, 'School Streets' were implemented at two primary schools in a town in eastern England. The schools were chosen based on the following criteria: interest in introducing a School Street; the road hierarchy and availability of alternative route(s) for traffic; the traffic sensitivity designation (whether changing the street would cause significant delays and disruption to road users); bus route(s) impacted; accessibility to community establishments that could be impacted (primary care, community centres, care homes, and local businesses); local footway/cycleway facilities; existing parking restrictions/availability; and the percentage of pupils living within 1km of the school. Both schools had identified traffic as a concern for the safety of their pupils, but neither had used traffic restrictions to reduce vehicular traffic.

The schemes were managed locally, with no involvement from central government, apart from the funding provided through the UK government's Active Travel Fund (Active Travel England, 2024). This is consistent with the Traffic Management Act 2004, which gives local authorities in England responsibility for managing road networks and traffic, and power for enforcing parking and traffic contraventions via Civil Enforcement Officers.

The roads outside the schools were closed twice daily, Monday to Friday, during the morning drop-off and afternoon pick-up times, with certain exemptions such as residents within the zone, vehicles delivering goods to those residents, and disabled people. The closures lasted for up to 45 minutes each time, and the schools had legal permission to run the schemes for a trial period of up to 18 months. Volunteer stewards were recruited to implement and enforce the closures (albeit with no legal powers) using moveable barriers, allowing exempt traffic to pass through the closure points and advising other drivers where necessary.

An intended outcome of the intervention was to establish a delivery model for School Streets schemes across the county. The UK-based charity, Sustrans, coordinated the overall planning, implementation, and delivery of the intervention (Sustrans, 2019), in consultation with the schools and teams at the local authority, following wider consultation with the schools, parents and carers, and residents (Norfolk County Council, 2022).

School 1 was relatively large, in an area with low levels of socioeconomic deprivation compared to other areas in England (Table 1). It had a small 100m section of road closed immediately outside the school, which was on a through route into the town centre, also used as a high school and public bus route. The school was in a residential housing estate with a high density of dwellings and dense road network with many adjoining side streets. School 2 was relatively small and located in an area with very low levels of deprivation. It had a ~400m length of road closed, which was on a through route and adjoined by the school, several residential properties, a nursing home and recreation ground, and an adjoining residential cul-de-sac (no through road). Simple schematics of the two schemes are provided in Figure 1.There is no 'typical' School Street road closure, as closure length, number of roads, and type of roads closed, depend on the school, number of entrances and unique circumstances (Department for Transport, 2024). The distinct characteristics of the two schools enabled the evaluation of the intervention in different contexts.

Table 1*. Characteristics of the study schools compared to the average primary school in England.*

School	Number of pupils[1,2]	Age of pupils (years)[1,2]	Pupils eligible for free school meals (%)[1,2]	Index of Multiple Deprivation (IMD) decile[3]	Population density (persons per sq km)[4]
School 1	621	4-11	19.0	8	2628
School 2	258	2-11	14.9	10	2655
England, average, 2021/22[6]	283	4-11	22.5	4[7]	Not known

[1]Study schools data from GOV.UK (GOV.UK, 2023); [2]data for the England averages from GOV.UK (GOV.UK, 2022); [3]Index of Multiple Deprivation (IMD) data (Ministry of Housing Communities & Local Government, 2019) for the Census Local Super Output Area (LSOA) in which the school is located, using school postcode. LSOAs in decile 1 fall within the most deprived 10% of LSOAs nationally and LSOAs in decile 10 fall within the least deprived 10% of LSOAs nationally. [4]For the Census Output Area (OA) in which the school is located, from Office for National Statistics (ONS) Census data 2021 (Office for National Statitsics, 2021). [6]State-funded primary schools. [7]This is indicative, as it is the decile based on the average IMD score across LSOAs nationally, not LSOAs with primary schools located in them.

2.2 Study design and theoretical approach

A qualitative process evaluation was conducted to understand whether the intervention was implemented as intended, how it was working in practice (exploring both benefits and potential issues), and the outcomes, as well as to inform the delivery of School Streets schemes in the future. The evaluation was guided by the UK Medical Research Council framework for the process evaluation of complex interventions (Moore et al., 2015), which states the need to focus on understanding processes of implementation, mechanisms, and context, to evaluate if and how an intervention and associated outcomes might be reproduced elsewhere. This guidance states that firstly, the casual assumptions underpinning the intervention must be explicitly identified, before establishing what was implemented in practice, testing if/how the assumed mechanisms and casual pathways operated, then assessing how external factors (context) influenced (and were influenced by) the implementation and outcomes.

The research was guided by principles from the Theory-Based Evaluation (TBE) framework, whereby the evaluator maps the anticipated casual pathway (theory) of change (the conceptual element), gathers information from all stages in that pathway to understand what happened in practice, and reflects on whether/how the intervention theory might work in practice and lead to the anticipated outcomes (the empirical element) (Birckmayer and Weiss, 2000; Carter, 2012; INTRAC, 2017). The theory of change for the Schools Streets intervention was established from existing literature (Davis, 2020), and through discussions with the provider, Sustrans, and is presented in Figure 2. The theory (Step 1) was that implementing road closures would reduce motor vehicle traffic at the school, making the school environment more appealing for active travel (Step 2: causal mechanism), leading to increased active travel and an improved environment (Step 3: outcomes).

2.3 Recruitment to the study

Residents and parents were recruited via an evaluation survey, conducted by Sustrans, six weeks after initial implementation of the intervention. Residents were invited to take part in the survey via flyers dropped through their letterboxes with a survey link, QR code and phone number (~500 houses in adjacent and surrounding streets), as well as posters in the street and posts on social media. Parents were invited to take part via a message from the head teacher of their

child/children's school through a parent/school app and the school newsletter. Respondents were asked to tick a box to express interest in taking part in a focus group and were offered a £20 shopping voucher as a gesture of thanks if they went on to do so. The two headteachers were contacted directly and invited to take part. The headteachers, in turn, approached school staff. Following this purposeful sampling approach, those who expressed interest were invited to take part in group discussions, or one-to-one interviews when necessary or preferred.

2.4 Data collection

Focus groups and interviews were held between July and September 2022. The purpose of these discussions was to evaluate the schemes from the perspective of a range of stakeholders. A topic guide was created by the research team to direct the semi-structured interviews and focus groups, which included a series of questions and relevant prompts. This was steered by the need to test the theory of change set out in Figure 2 through an exploration of stakeholder experiences of the intervention, to see if/how the causal mechanisms worked in practice, the role of context, and what might be needed to replicate the intervention elsewhere. Questions were asked in chronological order as a logical way to explore the participant's experiences during differences stage of the schemes: implementation, outcomes and sustainability. Recruitment continued until data saturation was achieved, whereby no new themes or findings emerged from the discussions (Ahmed, 2025). All focus groups and interviews were audio recorded, with consent.

2.5 Data analysis

The focus group and interview recordings were transcribed verbatim (firstly using MS Teams or transcription software 'Transcribe' by Wreally LLC[1], then checked and amended manually by the lead author). Thematic analysis was carried out to provide insight into experiences of the School Streets intervention in reality, an approach that is apt for exploring common or shared meanings across a data set (Kiger and Varpio, 2020). This approach allowed the researchers to familiarise themselves with the data, understand stakeholder experiences, and identify recurring patterns and themes across the data. Transcripts were opened in NVivo 1.7.1 (QSR International, 2022) and independently coded by two qualified researchers (AD and KM). Initially, a deductive approach was taken for the analysis, using three high-level themes to guide the coding: implementation, outcomes, and sustainability. These over-arching themes were chosen based on the literature (Smith et al., 2022), the research questions, and the topic guide. The two researchers then used an inductive approach to independently code the data into sub-themes, before meeting to discuss and agree the final coding framework. AD went through the transcripts for a second time, coding according to the agreed final structure. KM checked for inconsistencies and verified that the final coding was correct. This approach helps to ensure rigour and replicability in qualitative research (Roberts et al., 2019).

2.6 Ethical approval

[1] https://transcribe.wreally.com/

Participant consent was obtained for their contact details to be collected by Sustrans and shared with the research team for the purposes of inviting them to take part in a focus group or interview. Approval for the study was granted by the Faculty of Medicine and Health Sciences Research Ethics Committee at the University of East Anglia (reference number 2016/17 14SE).

3. Results

3.1 Participants and data

From the initial surveys to parents and residents, 60 people (11 residents and 49 parents) expressed interest in taking part in a focus group, and all were invited. In addition, six members of school staff agreed to participate. Three focus groups and seven interviews were subsequently held with 20 people when both interventions were up and running, comprising nine parents (five School 1, four School 2), six staff members including the two headteachers (one School 1, five School 2), and five residents (one School 1, four School 2).

Transcripts were coded into the three main themes and associated sub-themes detailed in Table 2.

Table 2*. Themes and sub-themes identified from the process evaluation.*

Main theme	Sub-theme
Implementation – what happened?	School resources Logistics External support Volunteers Enforcement Communication and engagement Acceptability and objections
Outcomes – what changed, how, why?	Traffic Perceptions of safety Active travel attitudes/behaviour Pleasantness
Sustainability – what needs to happen?	Additional measures and alternative interventions

3.2 Findings

Participant quotations are woven into the narrative to help illustrate the findings and aid interpretation (Lingard, 2019); codes are used to represent participant type (P = parent, R = resident, S = school staff), participant number, and school (Sc1 or Sc2). An expanded table of the themes and subthemes with selected quotes is provided in Supplementary Table 1.

3.2.1 Implementation - What happened?

In terms of reach, the target audience – everyone travelling to or past the schools, including parents, staff, residents, business operators, delivery drivers, bus drivers, and other passers-by – all encountered the intervention when it was in operation. In terms of fidelity and dose, the

intervention was delivered twice a day, every day, at School 1, as planned. At School 2, the closures initially went ahead twice a day, every day, but towards the end of the implementation period, the closures were not always in place for one or more of the two daily sessions. The reasons why the implementation was not straightforward and why the intervention may or may not have been delivered as planned (theory of change Step 1) are described below.

School resources

The headteachers were actively involved in the planning and launch of the intervention at each school, alongside senior leadership teams, motivated by a desire to address traffic issues and improve road safety outside the school gates. Teaching assistants (TAs) were asked to help deliver the intervention at School 2, with an expectation that parent volunteers would take over this role. However, insufficient parents were recruited, meaning the TAs were required to stay in this role to sustain delivery of the intervention. One parent and all the staff at School 2 felt that it was inappropriate for TAs to be delivering the intervention, when their role is to be inside the school looking after the children. School 1 used staff to provide childcare in school for the volunteer's children but did not use staff to deliver the scheme. Teachers spoke of the unmanageable *'amount of input and staffing from the school' (S5, Sc2)* for training, organising, delivering, and maintaining the intervention. It was felt to put stress on staff to organise and run it, and it was challenging to find cover *'if somebody can't make it or they are ill' (S2, Sc2),* with staff unwilling to share personal mobile numbers with parents.

Logistics

Stakeholders at School 1 felt that having a shorter stretch of closed road, immediately outside the school, made it easier to manage logistically and could be operated with only one person at each closure point. School 2 was on a longer road, requiring considerable time to reach the closure point. Some stakeholders at School 1 felt that the lack of signage meant vehicles were approaching the closure zone and having to do *'three point turns to go back at a really busy junction' (R4, Sc1).* In terms of deciding who could pass through the barrier, one member of staff spoke of the difficulty in deciding who should be exempt based on their physical disability, leading to *'A bit of disgruntlement with regard to who gets a pass and who doesn't get a pass' (S6, Sc1).* The inconsistent implementation at School 2 was reported to cause some parents to become frustrated and confused, and thus continue to drive up to the closure point *'then if they come along and they see the barriers are up, then they'll go and park elsewhere, but otherwise, they'll just come and park on [the] road' (S5, Sc2).*

Path width, traffic calming measures, parking opportunities, side streets, complexity of the road network, through roads on main routes, and overall road hierarchy were mentioned in relation to logistics of implementation. One resident (a retired schoolteacher) suggested that the road layout and context determined a school's suitability for the intervention, with School 2 being an appropriate location because *'there's other ways round, there's places to park' (R5, Sc2)*, compared to other core through roads where a closure would not have been possible. The local context was thought to determine suitability for a School Streets intervention as *'every school is so different' (P06, Sc2)* in terms of size, catchment area and location.

External support

Sustrans guided the two schools through the planning and implementation processes, provided training and guidance to help volunteers and staff to implement the intervention, '*and have been really supportive and responsive' (S6, Sc1)*. Some staff at School 2 had expected Sustrans to remain involved in the management and supply of volunteers and expressed disappointment that this could not happen.

Volunteers

Having a large and *'really committed team' (S6, Sc1)* of parent volunteers, and a good system for coordinating them and appealing for help at short notice, was seen as key to successful implementation and ongoing delivery at School 1. The school had a travel group in place prior to the intervention, which helped with this. It was also mentioned that they are still successfully recruiting volunteers, although a lack of childcare was a barrier for some.

Parents and staff of School 2 mentioned problems with recruiting and retaining sufficient volunteers to sustain delivery of the intervention. Reasons suggested included the small size of the school; the long road; time required to reach the closure point and feeling isolated once there; having no system to appeal for help at the last minute; fear of abuse; dislike of the physical nature of moving barriers; being outdoors in poor weather; and the need for volunteers to be trained in advance, therefore restricting the number of people that can be used. Personal circumstances meant that volunteering was not an option for some parents (caring responsibilities, work commitments), even with provision of childcare for volunteers at School 1. Retention was also reported as a challenge, as some volunteers had received '*upsetting'* abuse from '*irate*' car drivers, which in turn may have put other people off volunteering, particularly alone, as *'you are challenged when you are on your own' (S2, Sc2)*.

One parent at School 2 felt that the school needed to communicate a strong message and clear benefits to the parents to build the volunteer base. However, none of the staff felt relying on volunteers in the long-term would work as the scheme would *'be reliant on adults out with fluorescent jackets, in the middle of the rain, half an hour every day' (S6, Sc1).*

Enforcement

Parents and residents at both schools spoke about the challenge of *'policing' (R5, Sc2)* the closure, with no legal powers to issue penalty notices, no police presence, and no cameras. Staff at School 2 mentioned having documents to show approval for the road closure, but with the advice to guide drivers rather than enforce the closure. This meant that car drivers could still drive through closure zones (people with and without passes), or park on double-yellow lines near the closure zone.

Communication and engagement

At School 1, parents mostly felt that the pre-implementation information and communication methods had not been adequate, and details about the intervention, such as which roads would be closed, were not provided. Some stakeholders were disappointed to have found out *'when I was reading the [local paper]' (P5, Sc1)* or from *'a flier through the door' (R5, Sc1)*. Others received an

email shortly before the intervention was in place, and another reported that an A4 notice was attached to a lamppost after the scheme had started.

At School 2, all participating parents and staff felt that the communication and engagement prior to implementation of the intervention had been good, with information events, *'hour drop-in sessions for questions' (P3, Sc2),* social media posts, boards and posters, updates in newsletters, and school assemblies, with a chance to feedback and extend the proposed closure zone. Two of the residents found out from posters in the street and the local press and felt this was appropriate. Some residents suggested they did not receive any information or have a chance to give their views as there was no *'proper consultation' (R4, Sc1)*, with one noting that if there were posters in the street or put through their letterbox, they would be unlikely to read any that were about 'schools' as they did not *'see themselves as being connected to the school' (R2, Sc2).* Sharing learning about the schemes, for example through statistics and using *'sound bites from the children' (P8, Sc1),* was flagged as necessary for obtaining support at the start and retaining that support over time.

Acceptability and objections

All the parents attending the focus groups were accepting of the scheme, for example they said: '*I have to say I love it. Yeah, absolutely love it. Nearly everyone does' (P3, Sc2)* and '*I've been quite impressed actually*. *Yes, It's a lot better. Its heaven now*' *(P8, Sc1)*. However, it was also suggested that *'there's just been a few gaps with it, which has kind of caused some frustration. So, I don't think it's got much support, from what I've heard anyway' (P9, Sc2).* One disabled parent reported being treated badly by other parents *'people who are regularly shouting into our car, asking how long we've been sat there for to get parked outside the school, not realising that we've got a pass' (P1, Sc1).*

There were mixed views among the residents; whilst many were accepting of the scheme *'I am broadly, really supportive of it.' (R5)* or indifferent *'The School Street has no impact to me [as a non-car driver]' (R3)*, others strongly objected, citing inconvenience, invasion of civil liberties and a lack of evidence and rationale to justify the scheme.

3.2.2 Outcomes - What changed, how and why?

According to the theory of change, implementing the interventions (Step 1) would alter the environment around the school, trigger mechanisms of change on the ground (Step 2), and produce the intended outcomes (Step 3). Stakeholder experiences were examined to explore these causal assumptions, and the role of contextual influences.

Traffic

While many participants felt that the roads were 'less congested', 'quieter' and 'calmer', and that buses proceeded more cautiously than before, others suggested that the intervention had simply displaced the traffic, making *'other areas a little bit more chaotic' (P1, Sc1).* This may have made the situation more difficult for existing cyclists, whereby '*As a cyclist, all you are doing is pushing the cars a little bit further out and that is where you go cycling through… [the road closure] is just those last few metres…and you're already there. It's not really helping' (P5, Sc1).* The nature and location of the closed road and the surrounding street network was frequently mentioned as having an impact on

how effective the School Streets were in reducing traffic and improving safety. All parents at School 1 felt that car use, traffic and safety improved only immediately outside the school, and that surrounding areas were still as busy as pre-intervention times. Parents could still park as they could before the intervention was in place *'because you've pretty much only got rid of four, five, six, spaces, it's not really had an impact, as you're only talking about a few parking spaces'. (P2, Sc1).*

Some participants felt the impact of the scheme on traffic was hard to judge as road works starting at a similar time to the intervention had impacted on traffic across the whole area. Finally, there were reports of parents modifying their behaviour in unintended ways, including arriving at school early before the barriers are in place, as well as anti-social parking, such as parking on pavements and on double yellow lines.

Perceptions of safety

Participant views were mixed on whether the intervention improved safety. Most participants, including parents, residents and staff, agreed that traffic outside the schools had reduced and slowed, therefore *'the benefits greatly outweigh [any inconvenience] in terms of the safety of the children more than anything else' (R5, Sc2).* However, some of these parents noted that safety improvements were only evident immediately outside the schools. There was a feeling that the route to school was still unsafe, and that safety had become a problem elsewhere, with many parents parking in a different location. Some parents and residents suggested that the scheme had made the area less safe by creating *'a false sense of security' (R4, Sc1)* and children not looking before crossing the road, which still had traffic passing along it. Vehicles having to *'U-turn' (P2, Sc1)* was also thought to contribute to a dangerous environment.

Active travel attitudes and behaviour

Regarding impact on active travel, all staff and parents from School 2 said that some parents were parking further away and walking a bit further, and for others there had been a shift away from the car as a direct result of the closure, whereby *'there are more bikes going up and down, and I have on occasion actually gone on my bike. I'd never do that before' (P3, Sc2)*. Conversely, at School 1, none of the parents thought active travel had increased.

Pleasantness

Parents from both schools spoke about the positive social impact where *'suddenly there feels like there's a real sense of community.' (P8, Sc1)*, and that *'we've become a bit more social' (P6, Sc2)*, with similar views shared by staff from School 2. Views from the residents were mixed; some felt the environment outside the school was much improved because of the road closure, despite parents still driving their children to school and no apparent modal change. However, others felt that any benefits were confined to a small area and the cars were still impacting the wider environment and community.

3.2.3 Sustainability - What needs to happen?

Stakeholders reflected on the sustainability and replicability of the schemes. There was general agreement that additional measures would be necessary for both the sustained delivery of School Streets, and for the intervention to trigger the causal mechanisms for change (making active travel more appealing and driving less so). It is noted that only one of the schemes in this study was still running at the time of writing: in October 2023, School 1 was granted permission for the road closure to be permanent, allowing implementation of the intervention on an ongoing basis. The intervention at School 2 ran until Autumn 2022.

Additional and alternative measures

Additional resources to sustain the delivery were suggested, including having a good rota and communication system for volunteers. Holding mass training for all new parents, alongside offering morning childcare, might extend the volunteer base, as would financial incentives and being clear on expectations in terms of time commitment. Using alternative delivery methods to a volunteer-led system for road closures were mentioned, such as putting bollards in the road or a fixed barrier, using fixed penalties and wardens to enforce, and recruiting paid helpers. Installing automatic number plate recognition (ANPR) cameras to enforce the scheme by fining drivers would help to increase compliance, although this could '*create more antagonism to the system rather than helping people to endorse it' (R5, Sc2).*

Additional environmental interventions to reduce vehicular traffic at school were suggested, to make driving to school less attractive, and active travel more attractive. These included the provision and promotion of appropriate, and more, alternative parking (suggestions included free parking in public car parks, maps to show parking options, promotion of alternatives with emphasis on the benefits, and having this approach as standard for new schools). Changes to road and traffic control were suggested, including staggered drop-off and pick-up times, disabled only parking spaces, 20mph speed limits and signs, pedestrian or traffic light crossings, traffic calming (e.g., speed bumps), a crossing with railings, double yellow lines, and additional signage ('children crossing', 'pedestrians', 'slow down', flashing lights, children designed signs).

Concurrent campaigns and measures were seen as important by many of the stakeholders. Recommendations included education and awareness campaigns for car drivers (the dangers of kerb parking/driving and leaving the engine running), children (road safety), and parents (health and wellbeing benefits of travelling actively). Cycle safety and scooter workshops were suggested as a way of increasing children's confidence to travel actively to school, along with improving cycling facilities at school (cycling drop off points, bike and scooter racks), and improving provision and accessibility of active travel infrastructure at, and on the way to, school (cycle lanes, wider footpaths, pedestrian and cycle crossings).

One resident suggested that closing the road was not an appropriate intervention to improve the environment around schools, and that alternative measures would be more suitable, such as additional double yellow lines, a one-way system, school crossing patrol, road safety education for children and drivers, a no drop area or *'if you had a 20 mile limit on the street, you could leave it there all day' (R4, Sc2).* Another resident, who felt that a road closure could be delivered using ANPR rather than physical barriers, felt that *'traffic calming measures' (R2, Sc2)* were a more suitable alternative.

4. Discussion

Using a qualitative process evaluation, this study explored the factors influencing the implementation, outcomes, and sustainability of School Streets interventions. The findings suggest that even with dedicated staff time, the schemes were challenging to implement, meaning that causal mechanisms for change were not always triggered and outcomes were not achieved. This study builds on recommendations from a systematic review (Panter et al., 2019), which suggested that the role of context and mechanisms in environmental interventions targeting walking and cycling was rarely evaluated, and a systematic review of school active travel interventions (Larouche et al., 2018), which noted that moderators and mediators external to the intervention were under researched. This study of two School Streets schemes sought to state, then explore, the theorised mechanisms, to better understand how and why such an intervention might work, its potential for replicability elsewhere, and to make recommendations for practice and policy. Our findings build on preliminary research in the UK that had not fully explored stakeholder involvement (Davis, 2020).

Our findings agree with those from a Canadian study, which suggested that schemes may fail if they do not consider partnerships, legitimacy, collaborative governance, and community mobilisation (Smith et al., 2022). Improving safety around schools is likely a way to gain stakeholder buy-in the School Streets schemes, the necessary precursor to implementation, acceptance and behaviour change (Vasey et al., 2022; Zougheibe et al., 2021). Our findings concur with evaluations of other community-based environmental interventions to reduce/restrict car use, through highlighting that context is key in whether they result in safer environments, encourage physical activity, and have public health benefits (Milton et al., 2021; Nieuwenhuijsen, 2021). Defining what makes a school suitable for an intervention is challenging; while schools in areas of highest traffic and highest pollution may be the most in need and stand the most to gain, they may also be less likely to be chosen as they pose the biggest obstacles for implementation (Thomas et al., 2022).

School Streets is an example of a community-based public health intervention involving two communities: the geographical community of people and features in which the school is physically located, and the school community comprising teachers, parents and pupils/students who may or may not be part of the geographical community. Changes in behaviour, perception and capacity is required of both communities for a community-based intervention to be successful. School Streets took a needs/deficit-based approach to improving the local environment outside schools, rather than an asset-based approach (South et al., 2019). An asset-based, community embedded approach is likely to be more appropriate, whereby the wider community is engaged as active collaborators from the outset (Forrester et al., 2020; Public Health England, 2015; South et al., 2017; South et al., 2019). However, this approach presents challenges: the significant time commitment to map, identify, engage and retain community assets; having a large resource base of different groups within the community; avoiding the use of unfamiliar terminology and concepts, and using relatable language; changing mindsets; sustaining momentum; and managing competition, power relations and conflicting needs of stakeholders (Duggal et al., 2021; Forrester et al., 2020; Kramer et al., 2012; South et al., 2017).

4.1 Implications for research

There are some important takeaways for research from this study. The implementation of School Streets interventions is highly dependent on the local geographical, social, and cultural context, and behaviour is deeply set within these contexts (National Institute for Health and Care Excellence (NICE), 2007). Research needs to explore how these factors influence outcomes and adapt interventions accordingly.

School Streets alone are insufficient to drive significant behavioural changes in active travel. Further steps to make walking, cycling, or wheeling a more attractive option than driving to school are necessary. Research should focus on integrating broader systemic changes, such as improving active travel infrastructure and addressing barriers beyond the immediate school environment. In addition, alternative delivery models should be considered, as there are significant problems with delivering a scheme that is dependent on volunteers. Robust and consistent evaluation methods are also needed to measure the implementation, causal mechanisms, and outcomes of interventions, including longer-term impacts. Future studies should emphasise sharing insights and lessons across schools and regions to refine best practices and address implementation challenges.

4.2 Implications for practice

This study suggests that various contextual factors influence an intervention so as to prevent successful implementation and/or disable the mechanisms necessary for an implemented School Street to lead to the desired outcomes. A sufficient resource base of volunteers is necessary to implement and sustain delivery of the scheme, yet this alone may not deliver behaviour change. Several factors appear to be particularly critical for delivery of outcomes: a simple road network around the school, not a busy through route for traffic and with traffic calming measures, car parking not available at the school but within a short walk, active travel infrastructure available at and on the way to school, and the school actively promoting active travel and road safety education to its pupils.

There are some important takeaways for practice from this study. Stakeholder support and wider 'buy-in', via engagement, is crucial for successful implementation (Milton et al., 2022). An intervention may get off the ground without wider community support, but a lack of acceptance by the school community (parents and staff) and/or local community (residents and businesses, if applicable) will affect implementation and delivery. This will likely impact long-term outcomes in terms of an improved environment for everyone in the community in which the school is physically located. Engaging the local community is important, as some residents do not see themselves as part of a solution to a school-based problem. Clear and effective communication is critical to inform and engage stakeholders, give them a chance to voice any concerns, amend aspects of the implementation, manage expectations, and secure support for the intervention. School Streets interventions must be adapted to the unique context of each school, considering factors such as geography, road layout, traffic patterns, and local needs. Each school is set within a complex system, influenced by the local environmental, social, cultural and behavioural context.

There are also differing needs and interests of multiple stakeholders (residents, parents, schools, businesses, transport providers, delivery drivers, and so forth). Scheme sustainability requires planning for practical challenges, such as volunteer recruitment, enforcement mechanisms, and funding. Complementary measures, such as better cycling and pedestrian infrastructure, traffic calming, and designated parking areas, are necessary to support active travel and improve safety. Educational campaigns for parents, children, and drivers can help reinforce the importance of active travel and encourage long-term behaviour change. Careful planning is needed to mitigate potential negative outcomes at the outset, such as displaced traffic and conflicts between stakeholders, as found with other studies of community-based environmental interventions (Cleland et al., 2021). Schools and communities should actively share experiences and lessons learned to improve the design and implementation of similar initiatives.

4.3 Implications for theory

Reflecting on the theory of change model (Figure 2), it is apparent that the reality of a community-based intervention is much more complex than this linear model might suggest; change is not a linear process. The findings from this study concur with other studies (Panter et al., 2019), whereby an intervention might lead to an intermediate outcome (reduced car traffic outside the school) and alter the context (quieter environment), triggering a causal mechanism (increased feelings of safety, cycling becomes more attractive) to lead to a further outcome (increased cycling to school). Expanding this discussion outside the domain of travel-based behaviour change, McLeroy et al (2003) advocate for the seldom-used theory of *community* change for community-based public health interventions. They state the need to set out the 'how' and 'why' of change, depicting causal relationships between activities and outcomes, perhaps in a logic model, and noting possible mediating and confounding components. Potential causal pathways and effects across communities need to be identified at the early stages of intervention development (Breuer et al., 2016). This process must be iterative, for example, starting with agreement of a 'shared mission' with relevant stakeholders (Hernandez and Hodges, 2006) and working together over time to address local needs (Cooper et al., 2021). Having a clear theory of community change at the outset would have helped the operation of School Streets and would have indicated other changes necessary to influence active travel behaviour.

4.4 Strengths and limitations

Some strengths and limitations of this work should be acknowledged. All parents, residents, and staff from school and residential communities at both schools were invited to participate in this research but only a small number chose to do so, raising the possibility of response bias. It is noted that the participants were self-selecting. However, the sample did include people who were 'for' and 'against' the schemes, as well as those who expressed more neutral views. Stakeholders who took part included those directly involved in planning and/or delivery, and those who were not, offering different perspectives and interests. This study explored only two School Streets schemes, and therefore there was not enough heterogeneity of settings to attempt a formal analysis into the role of context. This study focused on an area of eastern England, but the findings are likely applicable more broadly. Further in-depth research into other School Streets schemes is needed to expand learning on how this community-based intervention can work in practice to deliver public health benefits.

5. Conclusions

This is the first qualitative study to comprehensively evaluate the implementation, outcomes, and sustainability of two School Streets schemes from the perspective of a range of key stakeholders. The results suggest that School Streets is not 'one thing', although the principle is the same across schemes – to close the street outside a school to vehicular traffic to create a safer and more pleasant environment. What these schemes look like in practice is inevitably influenced by the wider context. This study suggests that road closures will only lead to behaviour change if the context is conducive to it, in terms of road and parking set-up, supportive active travel infrastructure, and having school policies to promote active travel and road safety. Furthermore, although gaining wide support from stakeholders is necessary for the outcome of a better street environment for everyone, methods of communication and engagement must be appropriate, particular for residents not from the school community. Volunteer-led School Streets schemes are difficult to sustain, which may affect intervention fidelity, and are associated with implementation challenges, such as lack of power to enforce road closures or penalise non-compliance. These findings provide insights for those

designing and delivering School Streets interventions. An important development would be for all community-based public health interventions to map out a theory of community change at an early stage to direct their design, implementation and evaluation at the outset. This will allow greater understanding of the specific circumstances leading to outcomes for a particular community.

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