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Research Article

Evaluating delivery of cycling activity and training programmes for disabled people in the UK

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ABSTRACT

Globally, a 15% of the population has some form of disability [1]. While cycling is becoming a popular transport mode, it is crucial to accommodate disabled cyclists, and key for this would be appropriate cycling training for the disabled and those who are involved in the training.

This study investigated the delivery of cycling activity and training sessions for disabled people in the UK. The study focused on 1) the delivery systems, in particular the methods, supporting materials, instructor training, and 2) the perceptions of participants, parents/carers, and instructors. It involved semi-structured interviews with promotors and training/activity providers, and a questionnaire survey for instructors, people with disabilities and their carers. It was found that most participants come to training/activity sessions on voluntary basis for physical exercise and socialising. As a result, sessions are often unstructured and designed as 'activity' rather than 'training'.

Looking forward it is recommended to, whilst continuing to accommodate the need for flexibility and inclusiveness, introduce a top-down approach designed specifically for disabled participants and initiated by policymakers, with potential for disability-specific structured sessions in the course of time. The importance of raising awareness among disabled people and their parents and carers is instrumental, as is accessible provision of educational resources for instructors.

1. Introduction

Exercise is an important factor in maintaining physical and mental health in adults and children. Cycling for transport and leisure can be a key part of healthy lifestyle. This applies not only to non-disabled individuals, but also disabled people, including intellectual and developmental disabilities [2]. For disabled people, cycling has potential for improving transport opportunities by providing direct, door-to-door means of travelling and could bring a wider benefit of tackling the socio-economic and health inequalities resulting from disability simultaneously [3].

Unfortunately, currently disabled people are often less likely to participate in physical activities, limiting their access to these benefits [4]. Goodman and Aldred [5] examined how disability is associated with levels of cycling, and indicated that those with a physical disability were around half as likely to have cycled in the past four weeks, both for leisure and transport cycling compared to non-disabled. Woodmansee et al. [6] compared the differences between children with disability and children with typical development and found out that disabled children were less likely to participate day-to-day physical recreation activities such as walking and cycling. This lack of cycling uptake by disabled cyclists may be caused by a variety of reasons, including existing transport barriers [3]. Special equipment could help disabled people overcome physical barriers [7]. This can include adapted cycles such as tricycles, tandems, hand cycles or low-step bicycles, and it is also possible to modify a standard two-wheel bicycle to suit person's needs through measures such as placing brakes and gears on one handle or adding footplates. However, in addition to such physical and environmental barriers, mindsets of relevant people could act as barriers as well. Clayton and Parkin [8] pointed out misperception that cycling is not an activity accessible to people with disability, which they claimed is not true by referring to adapted cycles, which are generally cheaper than adapted cars. Burkett and Mellifont [7] stated that presumption that disabled people cannot cycle, is often owned not only by disabled people but also by their parents and carers, and that, by referring to sport science and coaching in Paralympic cycling, training programs can be useful to change the presumption. It should be noted that there is distinction between leisure and transport cycling. Leisure cycling, e.g. a person rides a bicycle for fun or exercise, is performed usually in

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off-road settings, while transport cycling, e.g. cycling to go to shops, to meet a friend, to work, in on-road settings. In the latter's case, fear about traffic on the road can act as a deterrent for cycling uptake [9]. It is conceivable that creating opportunities, including training sessions, for disabled people to cycle would change such presumption.

Cycling training in general, i.e. not just training only for disabled people, can be a good complimentary measure to cycling infrastructure [10]. Cycling training in countries with higher levels of cycling such as Netherlands, Denmark and Germany is typically delivered as a part of school curriculum and involves classroom education and cycling in off-road and on-road environments [11]. In the US, cycling training courses are also delivered in schools as an initiative by National Ministry of Education and insurance companies. Other training programs are offered by local governments and community organisations often targeting groups such as children, women, older adults, and recent immigrants, with special needs [12]. In Paris, intensive bicycling training courses for adults are offered twice a month [13]. In the case of the UK, to promote healthier modes of travel, including cycling, a number of initiatives, including England-wide training scheme Bikeability, were introduced. Bikeability is a government-funded cycling training scheme designed to target primary and secondary school pupils and teach the trainees the necessary skills to ride confidently on today's roads [14]. It is currently non-compulsory and there is also flexibility on which of three training levels children attend, catering for skillsets from beginner to experienced commuter or rider.

Regarding the existing academic literature on cycling training programmes, Johnson and Margolis [15] emphasised lack of research on and prominent gaps in understanding of such programmes. Their study, which evaluated the cycling training for adults in Tower Hamlets in London, which offered up to 4 h of one-to-one sessions with cycling instructors, found that 1) people most likely to participate in such training were new or returning cyclists, and 2) the training had a significant, positive impact on samples' confidence cycling on the road, with those stating they were either 'very confident' or 'confident' jumped from 16% prior to training to over 53% in three months after their lessons [15]. Zander et al. [16] researched a cycling promotion program for older adults delivered in Sydney, which included a cycling skills course to develop participants' cycling ability, safety knowledge, and confidence, and involved mentors based in the local area, and provided participants with supplementary resource pack with maps and information about local cycling groups and rides. This Australian study concluded that bike-handling skills and route-planning (knowledge of the route) were key for cycling confidence and helped overcome the key barrier to cycling - fear of cars and traffic [16]. According to Johnson et al. [10], training measures around safe active travel can have a positive influence on travel behaviour by reducing concerns about safety risks (real or perceived). In terms of the effects of training on participants' travel behaviour, Telfer et al. [17], who studied an adult cycling training programme run by Central Sydney Area Health Service, showed that 56% of participants were cycling more two months after the course. Yet, none of these existing studies on cycling training for the public, not focused on disabled people, suggests that effectiveness of training is dependable on session delivery process or explores how further benefits could be achieved through adjusting it.

Cycling training sessions for disabled people take place in several countries including the Netherlands [18] and Japan [19]. In the UK, the government published 'Delivering Inclusive Cycling Training: A Good Practice Guide' [20] to make inclusive the aforementioned Bikeability programme. In addition, British Cycling, the main national governing body for cycle sport in Great Britain, has also developed a 'Coaching Riders with Disability' handbook [21] and runs a workshop which focuses on teaching qualified instructors how to make training more inclusive [22]. There are other disability-focused local schemes run by independent charitable organisations specialising in providing cycling activity sessions for the people with disabilities, such as Wheels for All, Bikeworks and Wheels for Wellbeing. However, the Transport for London research revealed that while 76% of disabled people can cycle, only 15% use a bike to get around regularly or occasionally [23]. This disparity implies that significant improvements in the delivery of cycling training for disabled people would be necessary to provide them with skills and confidence to cycle independently, with or without support or supervision. Unfortunately, there is little collective understanding of how the sessions are presently delivered in the UK - there needs to be research on how they are run and whether there is room for improvement.

This exploratory study attempts to fill in this gap in knowledge on inclusive cycling sessions with particular focus on elements such as the session structure and contents, and delivery systems in general including instructor training. Delivery of cycling sessions, both training and activity, for disabled people is currently an unregulated and informal area in the UK. Therefore, there is no centralised database or platform to access information. Instead the researchers had to rely on searching engines and word of mouth. While initially the research explored all inclusive cycling provision available, in the process the focus narrowed down to cycle activity sessions, which are the most common and accessible option for disabled people. This study concentrated on the UK practice, however the findings can be applicable worldwide.

2. Methods

The approach of this research combined a questionnaire survey and semi-structured interviews. The former is expected to provide quantified results while the latter would give in-depth views. These research methodologies were regarded as complimentary, and facilitated collection of diverse views. This study was approved by UCL CEGE Departmental Ethics Committee.

2.1. Survey 1: online and on-site questionnaire

This survey consisted of between 15 and 25 questions, depending on the type of participant it was aimed at as well as individual answers due to conditional branching. Questions covered respondent's context such as travel habits, training experience, impact of disability on travel behaviour, inclusive session delivery, use of supporting materials and accessibility of sessions. It was designed for three groups of respondents, namely disabled people, their carers and instructors involved in running sessions for disabled people, and all the three versions have similar questions with some variations according to their roles, e.g. question "What types of 'disability-specific' training could help the instructors deliver cycling training for disabled people?" was asked for cycling instructors only. There were also multiple open-ended questions, where clarification or additional detail was welcomed, e.g. to name the disability-specific instructor training courses attended.

The study relied on the snowball sampling method [24]. The participants were recruited through two methods: 1) circulating a weblink to the on-line version of the survey on the networks such as mailing lists, topical social media groups and social media channels of practitioners involved in the delivery of inclusive cycling sessions, many of whom have participated in the Survey 2; and 2) on-site recruitment after sessions of cycling training for disabled people where the researcher was present. The online survey was prepared using software Opinio.

This research dealt with a 'hard to reach' population groups and hence, in order to maximise the number of respondents, very broad inclusion criteria were applied. For disabled people the age was the key criteria with participants over 18 years old approved. In case of participants with learning disabilities, the severity of disability was considered, to guarantee that the respondent was able to fully understand and answer questions. For other respondent groups the only requirements were being a parent, a carer or a companion for a disabled person and working as a cycling instructor.

The participants did not receive compensation for their participation. As an incentive they had an option to be entered into a prize

draw to win one of three £35 Amazon vouchers. The questionnaire was disseminated in March 2018.

In total 115 responses were collected among people with disabilities, both participants and non-participants of inclusive cycling sessions (53 responses), parents, carers and companions of people with disabilities (35 responses) and cycling instructors with and without experience of delivering inclusive cycling training (27 responses). All the participants lived in the UK. The respondents in were 'disabled people' category were predominantly female (71%), physically disabled (90%, though participants were allowed to select multiple disability types) and 46–55 (31%), 56–65 (26%) and 26–35 years old (20%). This was regarded as representative considering that '*the most commonly-reported impairments are those that affect mobility, lifting or carrying*' and '*the prevalence of disability rises with age*' [25] in the UK.

Most survey participants in the 'caretaker' category were parents (64%). Table 1 shows the sample composition, Table 2 the characteristics of disabled participants, Table 3 of parents and carers and Table 4 of cycling instructors.

Overall, people with disabilities were easier to be reached online than during the session, where they typically spend their time actively cycling or socialising. Parents and carers were the main target group in the on-site recruitment, in which they were approached by a researcher of this study while observing their carees attending a training session in the waiting area.

The combination of collecting responses online and on-site created a risk of bias – especially in respect to questions on session delivery as seven of the on-site respondents were recruited on a specific cycle activity session. Therefore, to avoid distortion, three survey questions were analysed using only responses from online respondents (see Figs. 1, 2, 3). This was because the sessions attended had specific characteristics-were unstructured, there was no traffic safety education and there were no materials used to support their delivery.

For one question (see Fig. 7) only answers of people with disabilities who attended cycling sessions were covered, but combined online and on-site responses. This is because this question was directed only at disabled people who had an experience of attending a cycle activity or training session.

It is worth pointing out that online respondents in the category of disabled people have not necessarily attended a cycling activity session – 31% of participants attended one in the past and 69% did not. Responses from those who did not were regarded as valuable as the obtained knowledge contributes to a better understanding of how to deliver sessions with maximum appeal to potential attendees.

2.2. Survey 2: Semi-structured interviews

Seventeen semi-structured interviews with seventeen representatives of 12 different organisations based in the UK involved in the delivery of inclusive cycling training and activity sessions were conducted in two stages between October 2016 to January 2017 and January to March 2018. The organisations included governmental departments, local authorities, cycle training providers and non-governmental organisations which deliver inclusive cycle sessions. Tables 5 and 6 present a number of interviewees, including overview of their roles and organisations.

Table 1
Sample composition.

Respondents	Online	On-site	Total completed
Cycling Instructors	22	5	27
Disabled People	46	7	53
Parents /Carers	23	12	35

Table 2
Characteristics of disabled respondents (online and on-site combined).

Socio-demographic characteristics	**Gender**	Male	29%	Impairement	Physical	90%
		Female	71%		Sensory (Auditory)	24%
	Age	18–25	6%		Sensory (Visual)	29%
		26–35	20%		Mental Health	24%
		36–45	12%		Learning	16%
		46–55	31%		Other	8%
		56–65	26%			
		66+	5%			

Table 3
Characteristics of parents/carers and disabled person they look after (online and on-site combined).

Relationship	Carer/ Personal Assistant	23%	Impairement of disabled participant supervised	Physical	63%
	Parent	64%		Sensory (Auditory)	11%
	Other	13%		Sensory (Visual)	20%
Age of disabled session participant supervised	6–11	23%		Mental health	26%
	12–14	2%		Learning	86%
	15–17	7%		Other	14%
	18–25	27%			
	26–35	9%			
	36–45	9%			
	46–55	9%			
	56–65	14%			
	66+	0%			

All interviews were conducted in person and took approximately 1–2 h. The core themes included:

- Existing inclusive cycling training guidance
- The structure of the inclusive cycling training delivery system and the role of stakeholders (central government, local authorities, independent organisations, individual)
- The importance of traffic safety education
- Differentiation of training according to the type of disability
- Knowledge of disability among cycling instructors
- Differences in cycling training for disabled children and adults and
- Overall assessment of challenges and lessons learnt.

The choice of themes was put forward by the research funder and adjusted by the researcher based on the UK context.

This study applied inductive approach to qualitative data analysis, due to very limited prior knowledge on the study phenomenon. It relied on thematic content analysis, which involved identifying themes from interview transcripts. Quotes from semi-structured interviews were then extracted and grouped according to key emerging themes to illustrate the outlook on the delivery of inclusive cycling sessions in the UK and are summarised in the Section 3.2. Due to a low number of interviews, as well as its supplementary nature to Survey 1, the analysis was done 'by hand', without the use of any software.

2.3. Organisations involved and sessions attended in Survey 1 and 2

Table 7 presents an overview of typical sessions available in the UK. Local providers differ depending on location, the ones specified below are based in London.

Table 4
Characteristics of cycling instructors (online and on-site combined).

Work AS cycling instructor	Less than 1 year	11%	How often work with people with disabilities	Everyday	5	14%
	1–3 years	42%		1–3 times a week	13	36%
	4–6 years	19%		A few times a month	10	28%
	More than 6 years	28%		Rarely	8	22%
Work with people with disabilities	Less than 1 year	6%	Cycling training for which impairements	Physical disabilities	29	
	1–3 years	36%		Sensory disabilities (Auditory)	15	
	4–6 years	17%		Sensory disabilities (visual)	18	
	More than 6 years	33%		Mental disabilities	29	
	Never	8%		Learning disabilities	34	
				Other	1	

Table 5
List of organisations and number and proportion of interviewees represented.

Organisation	Number of participants	≈% Of total participants
Central government	1	6%
Transport authority	1	6%
Local authority (council)	2	12%
Non-governmental organisation	6	35%
Cycling training providers/ independent cycling training instructors	5	29%
Other - private sector	1	6%
Other - volunteer	1	6%

Table 6
List of roles and number and proportion of interviewees represented.

Role	Number of participants	≈% Of total participants
Policy-makers	3	18%
Transport and cycling planners	3	18%
Directors of non-governmental organisations	3	18%
Cycling training providers and instructors	5	29%
Volunteers	1	6%
Other	2	12%

2.4. Definitions

For the purpose of both surveys the following definitions of key terms were adopted and summerised in Table 8.

3. Results

3.1. Perspectives of people with disabilities, their parents and carers and cycling instructors

Fig. 1 compares the views on session structure between disabled participants and cycling instructors. 78% of people with disabilities claimed that the session was not structured – in comparison to 50% of cycling instructors.

Some cycling instructors elaborated, stating that the sessions involve '*just vaguely supervised provision of specialist bikes*' or describing it as '*a fun session allowing disabled people the opportunity to be out on a suitable bike in a safe park*' and '*group or drop in providing a fun, relaxed and social cycling activity*'. One provided details on more structured approach claiming that '*there is an initial assessment to establish the correct bike and helmet etc for the user, then they develop skills for a cycle passport. The passport includes tasks such as cycling a straight line, stopping in a box etc once the rider can complete these tasks they are able to cycle out with the training area with a cycle leader or volunteer. Some riders bring their own bikes and work on developing confidence and skills a follow up assessment is made approx. every 6 weeks to establish skill development*'. Another cycling instructor stated '*I use the same structure for training disabled/non-disabled students. The only difference being the number of training sessions required will be more numerous for people with disabilities*'.

Fig. 2 below demonstrates the presence of traffic safety education as the element of inclusive cycling training in the UK. Traffic safety education is designed to keep people safe while cycling through teaching about traffic law, cycle-handling, importance of wearing safety gear,

Table 7
Overview of programmes and cycling sessions.

Scale of delivery	Leading organisation	Programme	Type of sessions	Participants	Researcher attendance
Nationwide	Department for Transport	Bikeability	Structured cycle training with focus on non-disabled participants	Primarily children at schools; some councils provide sessions for adults	Not attended due to privacy rules in schools; instead the researcher attended an exemplary session run by Bikeability instructor
Nationwide	Wheels for All	Wheels for All Training	Inclusive cycling activity in off-road locations, provide access to adapted cycles	Everyone (children and adults, various impairements)	Attended
Local	Wheels for Wellbeing	Inclusive cycling sessions	Inclusive cycling activity in off road locations, provide access to adapted cycles	Everyone (children and adults, various impairements)	Attended
Local	Bikeworks	Inclusive cycling sessions	Inclusive cycling activity in off-road locations, provide access to adapted cycles	Everyone (children and adults)	Attended
Local	Vibrant Partnerships	Disabled cycling sports training	Track cycling	Depends on a session	Not attended, focus of these sessions is primarily on Paralympic legacy and sports training
Unknown	Mind UK	Cycling sessions prescribed by GP	Cycling session in off-road location	Adults with mental health disorders	Attended

Table 8
Glossary of terms.

Term	Definition
Session structure	Pre-planned set of activities and exercises used to guide participants towards a specific learning objective (for example step-by-step system)
Supporting materials	Resources to facilitate learning such as handouts, presentations or leaflets
Traffic safety education	Education on traffic rules that should be abided when cycling on road
Cycling (or cycle)-ability	Being able to cycle or learn to cycle

cycle maintenance. 56% of cycling instructors stated that traffic safety education is not included in inclusive session they deliver, while 32% claimed it is (but to different extent). Only 8% of sessions prepare participants to cycle safely on road in the future. In comparison, 67% of people with disabilities answered that traffic safety education was not included in sessions they attended and 11% claimed that it was provided but only as basic knowledge. Interestingly, the survey showed that 68% of instructors believe that traffic safety education should not be included in inclusive cycling sessions.

Fig. 3 presents the use of supporting materials during the delivery of cycling sessions – they are not used in the majority of sessions. More people with disabilities (33%) claimed that supporting materials were used, compared to only 24% of cycling instructors. Limited use of supporting materials, might be linked to the way the sessions are currently delivered.

As shown in Fig. 4 the survey showed that the majority of people with disabilities (35%) would ideally attend group sessions with others with the same type of impairment. 27% would like one-to-one sessions with the instructor and 24% a group session with disabled participants with a variety of impairments. Only 14% indicated a group session with non-disabled participants as their preference.

Fig. 5 presents the perceived impact of disability on cycle-ability from perspective of parents and carers and people with disabilities. 69% of parents and carers responded that disability affects the ability to cycle of the person they are supporting. 82% of disabled people stated that their disability affects their ability to cycle for leisure and 89% for transport.

Some of the disabled respondents elaborated on their perceived obstacles to cycling. These included the inability to control a bike, lack of confidence, anxiety and stress levels, pain, lack of balance, no sense of direction, fatigue and poor muscle strength. In comparison, the barriers to cycling for transport included ability to only cycle short distances, poor visibility on a handbike, anxiety about arriving on time, required assistance in traffic due to mental health, difficulty with locking up the cycle, inaccessibility of public transport network, fears about personal safety and inability to cycle on footways if needed. However, these were identified by online respondents among whom only 20% attended a cycling activity session in the past – therefore, are mainly a perception.

Fig. 6 shows that only 50% of cycling instructors received 'disability specific' training. There was no one specific training course. Instead the following (and more) were mentioned: disability awareness training, certificate of professional competence training on inclusiveness, adapted cycle ride leader course, training at which types of bikes are best suited to specific disabilities, training on how to communicate and interpret needs of clients, National Standard Instructor training, mental health first aid course, in-house training explaining different learning disabilities, workshop on teaching Bikeability to disabled clients.

Even less, only 31% use supporting materials to educate themselves about disability and/or improve the delivery of inclusive cycling sessions. The submissions of non-compulsory open-ended question where respondents were encourage to elaborate indicate that some relied on informal mentoring from colleagues, previous experience of disability in different context through other work or their own impairment, independent research or learnt on the job through conversations with disabled participants.

The respondents gave examples of training that would benefit them in the delivery of inclusive cycling training for people with disabilities through an open-ended question. The following courses were identified: on specific disabilities and possible impacts on cycling, on the variety of adapted cycles and accessories such as straps or adapted pedals, on matching person with a bike, on how people with disabilities can achieve National Standard, on communication skills and strategies, on risk management, safeguarding and session logistics, mental health awareness. Moreover, one of the respondents implied availability of volunteering opportunities would allow instructors to gain hand-on experience before committing to delivering the sessions themselves.

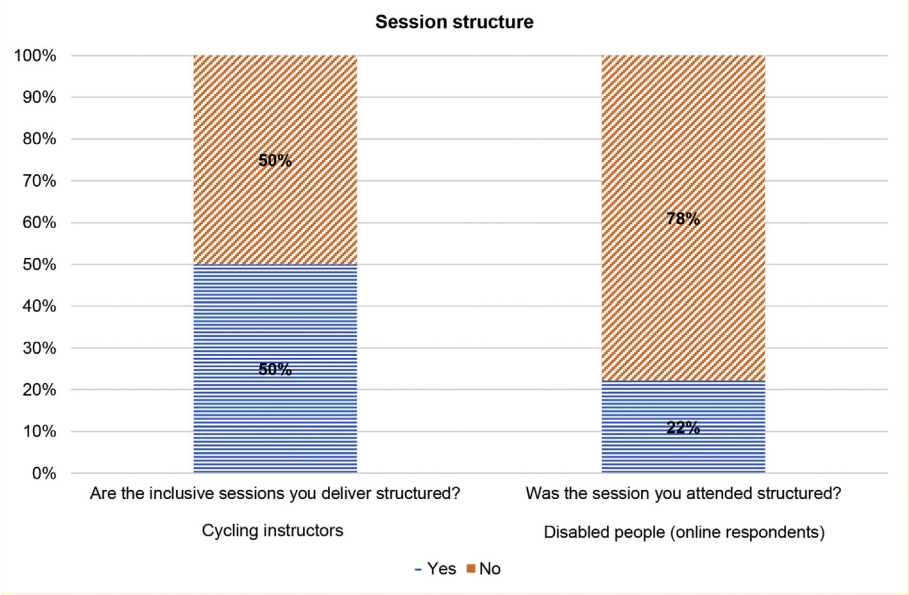

Fig. 1. Session structure.

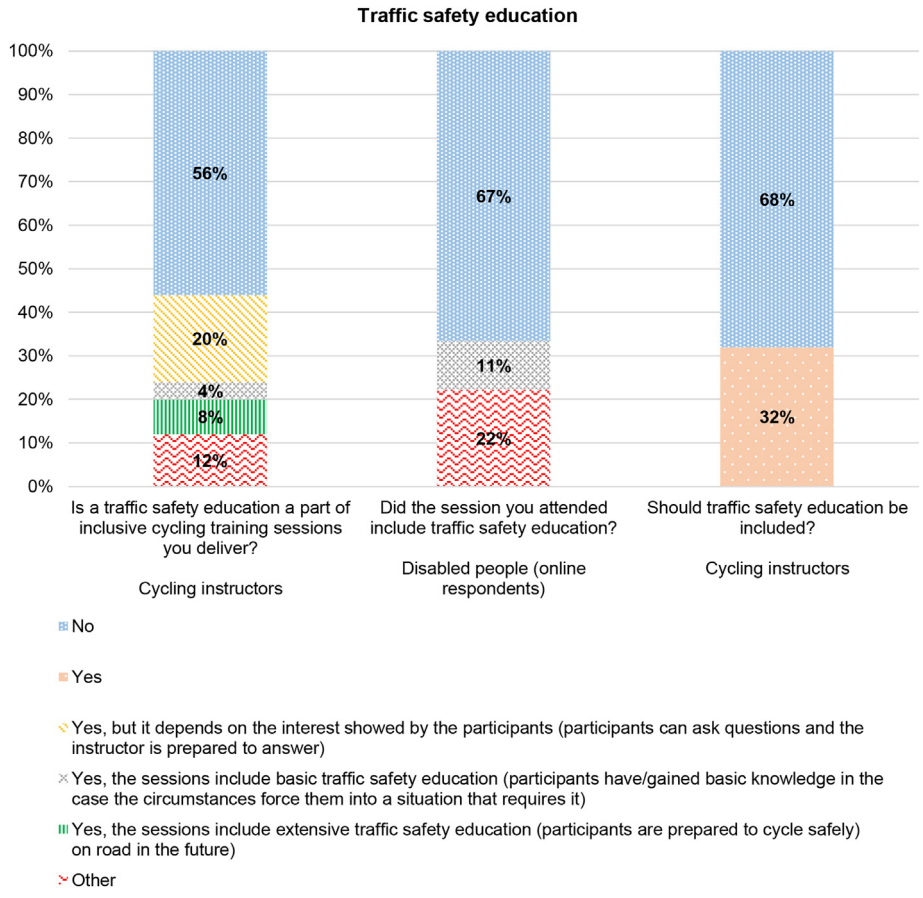

Fig. 2. Traffic safety education.

As presented in Fig. 7 below, as a consequence of the existing delivery of inclusive cycling sessions, only 33% of people with disabilities believe that the sessions provide them with skills to cycle independently for any purpose. In comparison, 47% claimed that the sessions provide them with skills to cycle independently but only in an off-road environment. However, from the perspective of parents and carers, even after receiving appropriate training only 21% would be comfortable for the disabled person to cycle on their own. 38% would be comfortable but only in the off-road environment and, while 41% would not be comfortable regardless the circumstances. Yet, parents and carers acknowledged some benefit of ability to cycle with 66% stating that if the disabled person could cycle they would go out more often for leisure purposes. More concerns appears regarding cycling for transport – only 31% responded that if the disabled person could cycle they would go out for transport more.

3.2. Perspectives of policy-makers, third-sector representatives and session and training providers

3.2.1. Types of inclusive cycling sessions

Four main types of inclusive cycling sessions delivered in the UK were identified: cycling activity sessions, Bikeability training, cycling

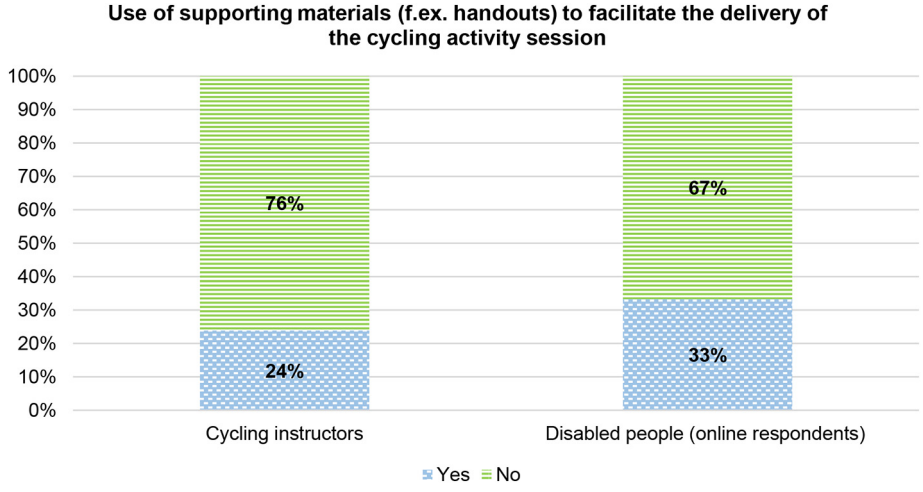

Fig. 3. Use of supporting materials during session delivery.

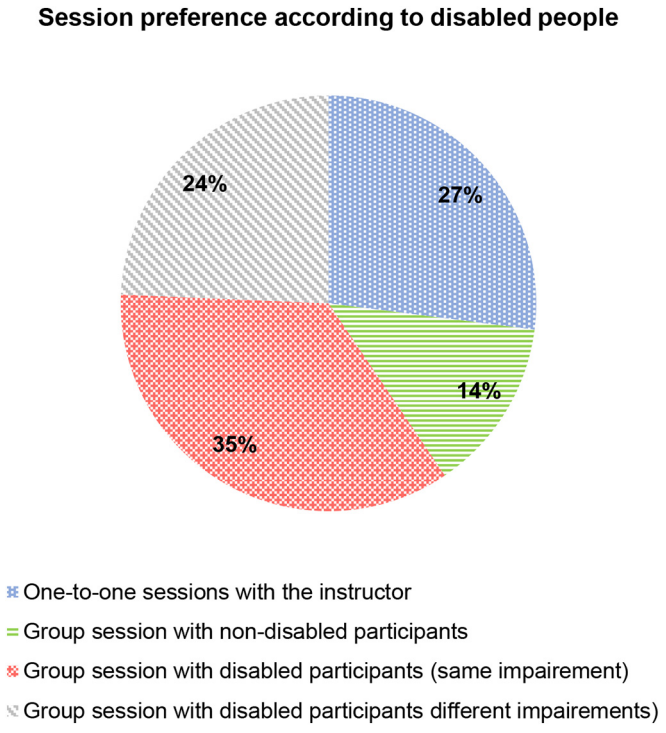

Fig. 4. Session preference according to disabled people.

sessions prescribed by medical doctors for health benefits and competitive cycling training, each of them with different objectives and delivery framework.

Cycling activity sessions are the most popular among disabled people. They are typically organised in accessible, off-road environments and offer a selection of adapted cycles stored on-site which participants can use. These sessions apply 'inclusive for all' philosophy and cater for all types and severities of impairments, with none to little differentiation in session delivery. The majority of interviewees stated most sessions are '*show up and ride*' and '*mostly people who come along would be accompanied by parents or carers who are used to cycling*'. The main motivation of participants is exercise and socialising. According to a welfare co-ordinator who oversees inclusive cycling sessions in one of London's parks, the focus is on providing an activity and experience of cycling as the larger part of participants' *will not be riding on their own...The level of disability we are providing for, it's all about giving them the experience of being on a bike or having a slight control over a bike*'.

Bikeability training, which is supposed to be inclusive, '*but miss out many (*disabled children*) due to lack of adapted cycles and special needs schools and local authorities not opting for Bikability funding*'. One of the surveyed cycling instructors stated: "*Working for a local authority where the training is delivered within Bikeability guidelines, which claim to be 'inclusive'. However, the Bikeability guidelines are quite specific about what a participant has to be able to do in order to complete each Bikeability level* (and hence disabled children cannot participate). *Therefore, this is not really inclusive and is not flexible*".

Cycling sessions for referral health groups consist of '*people who have been prescribed physical activity*' and delivered in a way that relies on cycling as a way of meeting the goal. As the collaboration between public health and transport institutions remains limited, such programmes are rare.

Competitive cycling programme is very well structured with a clearly defined '*structure of becoming a cyclist*' supported by '*talent development sessions*' and an '*award system*'. However, this programme is specifically designed for athletes and therefore is not for people with disabilities who just want to cycle for leisure and transport.

3.2.2. Step-by-step system

In the UK, '*there is no step-by-step system*' for delivering inclusive cycling training and '*no specific provision for all-ability cycling*'. Another interviewee mentioned that '*it's not a structured programme*', and this view was shared by all representatives of organisations that work on a local level, with the exception of those involved in Bikeability

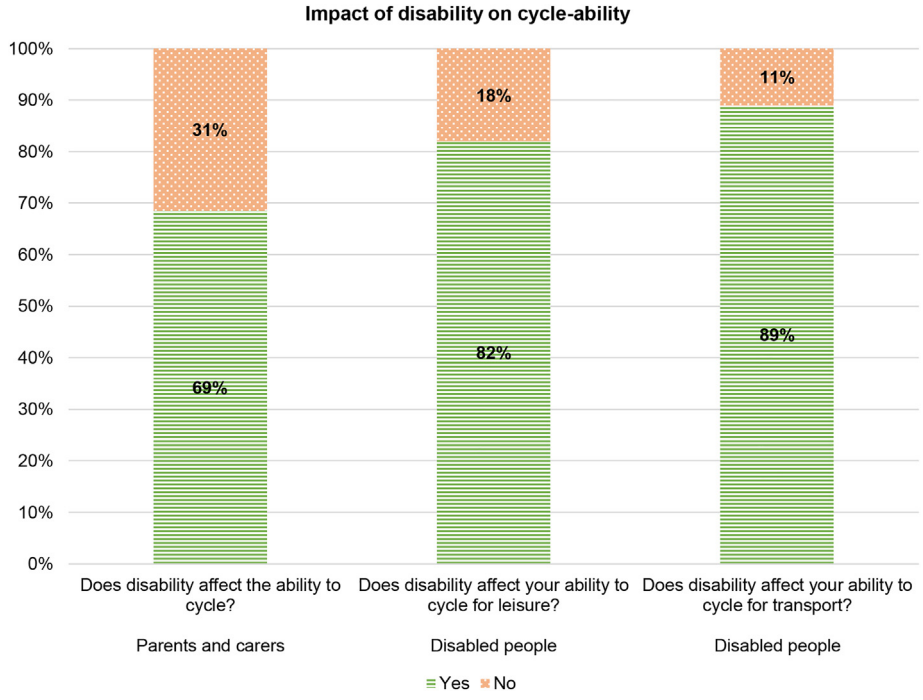

Fig. 5. Impact of disability on cycle-ability.

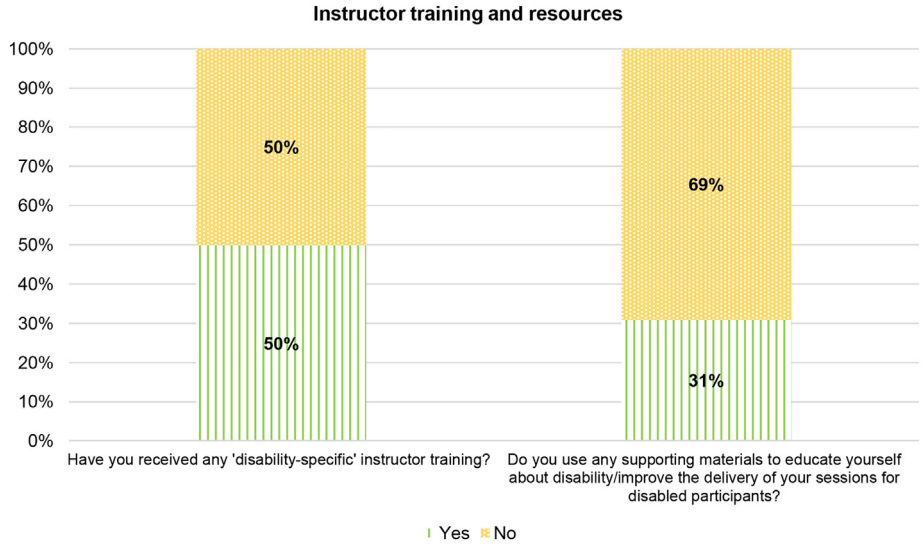

Fig. 6. Instructor training and resources.

programme, and was also picked up by the researcher through participant observation. In fact, the majority of available sessions focus on physical activity and '*experience of cycling*', rather than teaching cycling as a skill. This is partially because '*until you have the environment you can cycle in, the benefits of training the disabled are very limited*'. A minority of sessions are structured if delivered to a consistent group with particular goals. These tend to be primarily in schools and, occasionally, for specific groups. Even in school, however, the main ethos of cycling sessions is '*activity provision for all*' rather than '*training for some*' or '*training for all*'.

The only top-down structured framework is applied within the Paralympian programme - step-by-step system is essential to '*see if people have potential*'. However, such sessions were not the focus of this research.

3.2.3. Traffic safety education

Traffic safety education can be a key part of cycling training for non-disabled children and adults, and therefore its presence within the session can be an indicator of whether the session aims to provide skills to cycle safely on public highways.

Policy-maker from the Department for Transport views cycling training as an inclusive activity, pointing out that '*cycling is often a leveller, picking up cycling skills is different than academic (skills)*'. While some traffic safety concepts may require alternative approach when teaching disabled people, in particular with learning disabilities, it does not imply that they will not be understood or applied.

In terms of including traffic safety education as a part of session delivery for people with disabilities, different interviewees shared different experiences, though the amount varied from none to little. '*Most sessions are run in a closed, off-road environment which does not require traffic safety education*'. In other cases, *'the participants will learn about traffic safety but the training is very basic', as 'the participants are usually higher dependency individuals'.*

Sometimes it can vary depending on the type of disability - physical, mental or learning. For example, '*for young people with learning disabilities, they can usually pedal the bikes themselves and in such cases part of the session would be training.*'

3.2.4. Knowledge of participants' disabilities

The instructors have 'no background knowledge of the disabilities the participants have'. The cycle-ability is typically assessed on site based on the conversations with participants, parents and carers and

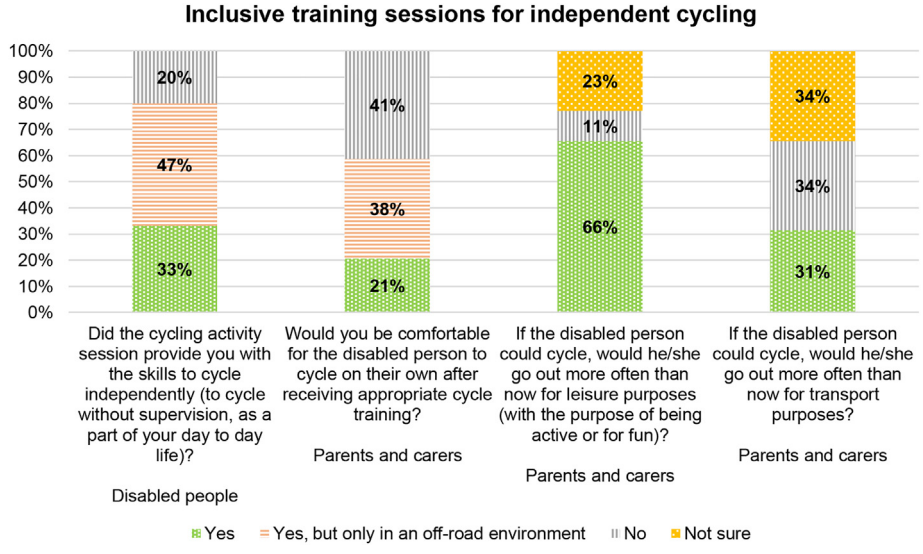

Fig. 7. Inclusive training sessions for independent cycling.

professional judgement. Such assessment typically affects the choice of adapted cycle for the participant but has little to no impact on how the session is delivered.

One of the interviewees described in more detail how cycling sessions delivered by one of mental health charities work stating that the organisation '*chooses who participates'* and *'sometimes carers come along*'. '*The instructors do not know about what mental disability the participants have. (…) Before training takes place a risk assessment for each trainee needs to be completed by* [the charity] *and the instructors. This may not include details of individual's diagnosis except when it might affect the training*'.

3.2.5. Monitoring

Referring to the community engagement project manager from local transport authority '*there is very little formal monitoring of disability via* our organisation', while for Bikeability '*we only record whether a child has a disability'*. The majority of sessions organised by third-sector are '*turn-up and ride'*, with participants arriving irregularly and at different times. The rationale for that is that '*the idea is to get as many people active as possible'*, which creates a division between '*focus versus getting as many people as possible*'.

3.2.6. Recommendations to improve the delivery

The recommendations to improve the delivery of inclusive cycling measures identified by the interviewees included ensuring that the sessions '*are self-sufficient*', '*organising sessions in public spaces*', '*getting families and carers more* involved' and '*targeting children'*. They also emphasised the '*importance of volunteers'* and '*up-skilling cycling instructors and carers*'.

4. Discussion

This study explored the provision of cycling training and activity sessions in the UK. Collecting data in two stages and targeting different stakeholders allowed the researchers to assess the existing system of delivery from multiple perspectives and open up the discussion on impact of disability on the approach towards structuring inclusive cycling sessions and the role of traffic safety education, resources and instructor training.

4.1. Overview of findings

The research found that there is no step-by-step system, especially for the delivery of cycling activity sessions, which make up the majority of inclusive cycling training (**Section 3.2.2**). Bikeability scheme has a top-down framework, which is initiated by the central government, and set standards – yet, it appears that such an approach does not ensure inclusivity (**Section 3.2.1**). As a consequence, disabled children might struggle to access it, for both institutional and technical reasons such as lack of adapted cycles, due to cost and maintenance and storage requirements. This is despite its 'Bikeability for everyone' slogans and inclusive image represented on Bikeability official website [14].

For disabled people who want to experience cycling, there is an alternative in cycle activity sessions – however, according to the survey results, these tend to be unstructured (see Fig. 1).: the sessions tend to prioritize providing the participants with the 'experience of cycling' rather than skills and knowledge to use cycling as a means of transport (see **Section 3.2.1**). Only 22% of disabled people who attended cycling activity sessions stated they were structured. Although a higher number (50%) of cycling instructors declared that the sessions are structured (Fig. 1), this difference is likely due to different levels of exposure to variety of available sessions. The difference also implies that the issue can be accessibility of inclusive structured sessions for disabled adults – while the instructors teach variety of age groups, the disabled survey respondents were all over 18 years old (**Section 3.2.3**) and thus did not have access to Bikeability sessions which are structured. This lack of a structure can stem from participants' stated motivations for attending cycling sessions, which are primarily physical exercise and socialising (See **Section 3.2.1**). However, an underlying reason can be the nature of sessions available; and the motivations might have varied if an alternative (such as sessions focused on teaching participants to cycle for transport) was obtainable. It is also likely that the motivations are linked to the perception of people with disabilities and their parents and carers, on their disability and its impact on cycle-ability (see Fig. 5).

As a consequence, disabled people miss out on the benefits of structured cycling training, with past research showing that, in the case of cycling training for able-bodied children, 95% of parents think that structured cycling training like Bikeability is important [10]. It is likely that if a similar programme like Bikeability was more accessible to disabled people, whilst this might depend on the severity and type of the impairment, the recorded impacts, such as higher frequency of cycling post-training and improved confidence among participants, could be similar. However, this research showed that from the perspective of parents and carers, even after receiving appropriate training only 21% would be comfortable for the disabled person to cycle on their own (see Fig. 7). Even if the person could cycle, only 31% of parents and carers believe that they would go out for transport more. This implies that there is deeply-rooted apprehension towards independent cycling, yet, that might be linked to the existing provision of cycling training for disabled people, i.e. sessions being unstructured. It is also likely that the concern could be linked to hazardous road environment, illegality of cycling on footways and poor provision of cycling facilities.

Traffic safety education within the session can be an indicator of whether the session is in consideration of a coherent structure. Presently, sessions are typically run in a way where traffic safety education, which is an essential part of cycling for transport, is ad-hoc (see **Section 3.2.3**). Its presence in cycle sessions for disabled people is limited and depends on multiple factors including the type of session, preference of cycling instructor, types of disability of participants, participants' attitude and interest in issues related to traffic safety (see **Section 3.2.3**). The assessment on whether traffic safety education should be included is typically done on-site by the instructors and depends on the severity and type of participants' disabilities, as well as their personal views and support system of family or carers (see **Section 3.2.3**). As a consequence, traffic safety education is regarded as an extra part of cycling training. In fact, the majority (68%) of surveyed cycling instructors believe that traffic safety education should not be a part of cycling activity session for people with disabilities (see Fig. 2). However, as safety concerns are typically a key deterrent from cycling (see **Section 1, paragraph 4**), presence of traffic safety education within inclusive cycling curriculum could make a significant difference in building confidence to cycling independently and changing caregivers' attitudes highlighted in the paragraph above.

In order to effectively deliver structured and inclusive cycling training, cycle instructors need to be equipped with background knowledge and a good understanding of disability in the context of cycling. This research identified gaps in suitable training and resources (see Fig. 6), which would prepare cycling instructors better to working with disabled people. Moreover, while sometimes resources are available including a variety of training courses or guides on the internet [26] [21] [20] [19], there is limited information and no formal requirement as a part of regular instructor training as to how cycle instructors should use them. The survey indicated that 50% of cycling instructors received disability-specific training in the past (see Fig. 6). Yet, despite multiple training courses (see **Section 3.1**), those involved in the delivery of inclusive cycling training believe that there is a limited number of go-to resources for cycling instructors who are interested in disability cycling. 70% of cycling instructors do not use any supporting materials to educate themselves or improve the delivery of the session (see Fig. 6). Some instructors suggested suitable training that, if available, would help them deliver cycling training (see **Section 3.1**). Those who did not have access to training or resources stated that they learnt relevant

skills through informal mentoring, previous working experience with people with disabilities, research, their own disability, and conversations with people with disabilities (see **Section 3.1**). Such approach has a lot of benefits such as avoidance of mistake repetition, personalised approach, access to wisdom rather than just information, learning directly from the recipients and consideration for context and individual needs, but also carries the risk of misinformation.

The responses given by all interviewees and their description of the projects they run showed that the majority of sessions adopt a philosophy of full inclusion with a wide range of adapted bikes prepared – and therefore cater for different severities and types of impairments (see **Section 3.2.4**). Whilst this principle sounds good, in reality this may be one reason why the sessions are unstructured because existing gaps in disability expertise mean that all types of impairments are perceived equally even when their impact on cycle-ability differs (see **Section 3.2.4**) and because logistically it is challenging to run a structured session for a wide range of participants, and thus instructors let participants do whatever they like in a controlled and safe environment. A question that arises is whether such a full-inclusion approach humpers improvement of cycling skills of the participants, thereby leading to mis-perception of how the disability affects individual's 'cycle-ability' (see Fig. 5). Disability-specific approach to cycling training has been successfully adopted elsewhere (e.g. the VISIO in the Netherlands; [18]). In contrast, our results showed when differentiation takes places, it focuses on the most basic differences: between physical, mental and learning disabilities (**Section 3.2.1**). The training might vary between participants within the sessions; however, this depends on the willingness and initiative of the cycling instructor to introduce a more individual approach, and in fact the variability according to the types of impairments is limited (**Section 3.2.1**).

4.2. Study limitations

The findings were impacted by study limitations. The key challenges were lack of previous research studies on the topic and the reachability of representative sample. When recruiting disabled people, researchers reached out only to adult participants. Otherwise, the inclusion criteria were very broad. All data was self-reported which is anticipated to have resulted in potential bias. For example, the responses on session delivery could have been different because the respondents' personal experiences and exposure varied – typically cycling instructors teach multiple different sessions, as they often work freelance for multiple organisations. Meanwhile respondents with disabilities may have been exposed to only one type of cycling activity sessions.

The researchers attempted to minimise the potential impact of such factors by diversifying the types of respondents and supplementing the findings by qualitative Survey 2.

4.3. Implications for practitioners

In conclusion, this research has investigated the delivery of cycling activity and training sessions through questionnaire surveys. It has, as a first step, focused on how cycling activity and training sessions are delivered.

The study found that the primary objective of the current cycling activity sessions run by charitable organisations is to provide an opportunity to be active and socialise, and hence these sessions are not structured (see Fig. 1, **Section 3.2.1**), thereby missing out chances to learn cycling as a skill. Simultaneously, mainstream cycling training sessions like Bikeability are regarded as not inclusive. There is an opportunity to address this, however a coordinated effort from policy-makers, lobbying organisations, training providers and cycling instructors will be essential.

A top-down approach driven by policy-makers and designed specifically with disabled participants in mind and initiated by central or local governments can be useful. It could combine a range of measures varying from funding for adapted bikes, to creation of an information portal for instructors. Among such measures, perhaps the most important can be improvement of awareness among disabled people and breaking 'perception' barriers of disabled participants as well as their parents and carers. This could be overcome by introducing a Bikeability-like, monitored programme in special needs schools and for adults in addition to the current enjoyment-focused cycling activity sessions and by involving 'caregivers' more. Additionally, making Bikeability more inclusive can normalise cycling among disabled people, increase awareness and teach inclusiveness from the early age. However, it is unlikely that such measures will successfully contribute to uptake of cycling on their own. To maximise the impact, it would be essential to introduce them simultaneously with cycling infrastructure which is in the hands of transport planners and engineers and other accessibility measures, such as changes in legislation to legalise cycles as mobility aids. The argument here refers to the critical mass of cycling of the public in the context of car-dominant traffic [27].

From cycling instructors' and training providers' perspective, once the perception is improved and more disabled people attend sessions, then it may be possible to, for example, deliver different sessions according to the types and degrees of disability, which from could reduce logistic challenges of running sessions and enable more structured approaches, which can then be beneficial to disabled people. In fact, the highest percentage (35%) of respondents claimed prefer a group session with other disabled participants with the same type of impairments (see Fig. 4). Yet, it is critical to consider that such shift will require more in-depth understanding of disability within the industry that is already lacking a formalised education and professional training base. Therefore, the need to provide learning resources for instructors in more accessible and coherent ways, e.g. an online platform and introduce better knowledge sharing systems will be critical.

Further research is recommended to investigate the effects of various types of sessions on perception barriers with larger sample sizes, as well as look into inclusivity of training schemes for children such as Bikeability.

Declaration of Competing Interest

None.

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