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Experiences, Perceptions of Risk, and Lasting Impacts of COVID-19 for Employees in the Public Transport Sector

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Abstract

Background: Age-standardized mortality rates for taxi drivers, chauffeurs, bus and coach drivers show that public transport workers were at high risk at the beginning of the COVID-19 pandemic. Nevertheless, the public transport sector was required to continue services throughout the pandemic.
Objectives: This paper aims to develop a better understanding of the experiences of organizational leaders and workers within the UK public transport sector (bus, rail, and tram). Specifically, it aims to explore the perceived balance of risk and mitigation of SARS-CoV-2 transmission, report on their perceptions of safety in public transport during the pandemic and in the future, and consider how these perceptions and changes impact on long-term worker health and wellbeing.
Methods: This study formed part of a larger stakeholder engagement with the public transport sector. Organizational leaders and workers were recruited ($n = 18$) and semi-structured interviews carried out between January and May 2021. Data were analysed thematically.
Results: Overarching and subthemes were identified. Themes relating to perceptions and impacts of risk of COVID-19 for employees included: acceptability of risk for workers, perceptions of risk mitigation effectiveness, changes to working practices and their impact on morale and wellbeing, issues with compliance to mitigations such as social distancing and face coverings in passenger and co-worker groups alongside a lack of power to challenge behaviour effectively, and the roles of leadership and messaging. Themes related to long-lasting impacts of COVID-19 on working practices and

What's important about this paper

The COVID-19 pandemic had a significant impact on operations in the public transport sector. This study used qualitative methods to explore the experiences and perceptions of risk among workers in the public transport sector, and found impacts on health and wellbeing from both the risk of viral infection as well as the risk mitigation strategies. Understanding the complexities of the pandemic experience is crucial for appropriately designing mitigation strategies and modified working practices that promote employee health and wellbeing as the pandemic continues, and for future proofing the sector for ongoing resilience and sustainability.

effects on health and wellbeing included: continuing mitigations, impact of increasing passenger numbers, impact of vaccination programme, and impact of changes to business structure.

Conclusions: Most public transport employees reported feeling safe, related to the extent to which their role was public-facing. However, data were collected during a time of very low passenger numbers. Current mitigation measures were thought effective in reducing the risk of viral transmission, although measures may have a detrimental effect on worker morale and wellbeing. Issues relating to non-compliance with guidance and 'in-group' behaviour were identified. Impacts on wider business sustainability and individual wellbeing of staff should be considered when developing responses to any future pandemics. Recommendations are made for prioritizing employee engagement with colleagues, and the importance of strong leadership and clear messaging in promoting adherence to behavioural mitigations.

Keywords: COVID-19; employees; public transport; qualitative; risk perception; SARS-CoV-2; transmission; workers

Introduction

Public transport was identified as a potential high-risk sector for transmission at the beginning of the COVID-19 pandemic (Nafilyan *et al.*, 2021; Beale *et al.*, 2022). Relatively little was known about the risk of transmission and the effectiveness of measures to reduce infection on various types of transport. Transport employees in the UK were designated 'essential workers' and continued working with advised mitigations (Department for Transport (DfT), 2020).

Government messaging during lockdown phases advised avoiding non-essential public transport journeys, thus passenger numbers were considerably reduced from March 2020 (Barbieri *et al.*, 2021; DfT, 2021; Marsden *et al.*, 2021). The impact of the pandemic on working practices within the public transport sector was unprecedented. While reduced services, encouragement for home-working where possible and the furlough scheme permitted some public transport workers to remain at home for extended periods during 2020 and 2021, many other workers had public-facing or essential operational/maintenance roles. A range of mitigations were introduced by transport companies to reduce the risk of viral transmission in public transport spaces, including: increased cleaning regimes, mandatory face coverings, social distancing, reduced capacity on vehicles, increased ventilation, efforts to reduce contact between people (e.g. work bubbles), and prioritization of employee health by public transport companies (Tirachini and Cats, 2020; Shen *et al.*, 2021; Coleman *et al.*, 2022). Research has focussed mainly on either mortality rates within transport workers, or on transmission risks on public transport (Gartland *et al.*, 2022), but few studies have investigated the impact of the pandemic on working practices and wellbeing for employees within the sector.

Recent work has also demonstrated a significant impact of the pandemic on worker wellbeing and productivity. A recent US study of 3607 employees found that more than half reported increases in stress, anxiety, fatigue, and feeling unsafe during the pandemic (Senerat *et al.*, 2021). Furthermore, high levels of isolation (70% of employees) and reduction in productivity (43% of employees) were noted. Other reports and research papers (e.g. Business in the Community, 2020; Robillard *et al.*, 2020) consistently illustrate the pandemic impact on mental health and psychological stress. Additionally, Robillard *et al.* (2020) discuss the higher stress risk of those physically working with the public, such as public transport workers. However, none of this work has explored public transport specifically; the importance of

this sector for providing an essential service to the population, and the documented COVID-19 risk for transport workers, mean this sector deserves in-depth exploration.

The research reported in this paper was part of the PROTECT (Partnership for Research in Occupational, Transport, Environmental COVID Transmission) project. A qualitative 'deep-dive' was conducted in the public transport sector to develop a comprehensive overview of the perceptions of transmission risk and effectiveness of risk mitigation measures to control transmission, from the perspective of the main stakeholders working with/in the sector (e.g. experts, organization leaders including unions, regulators, employees, and passengers). In this paper, we report on the perspectives of the organizational leaders (OL) and workers (W) only. The work was designed to provide an improved understanding of the perceived balance between risk and mitigation, and the impact of this on feelings of safety in the workplace. In addition, considerations for the future and continued impact on health and wellbeing were explored.

We focussed mainly on two modes of surface public transport in the UK—bus and rail, due to common usage (DfT, 2018). This research was carried out between January and May 2021, while the UK was in the second wave of the pandemic with associated lockdown measures in place. Therefore, ridership on public transport was at a low level.

Aims

This work aimed to answer the following research questions:

1. How was the *balance of risk and mitigation* of SARS-CoV-2 transmission perceived by surface public transport organizational leaders and workers?
2. How did participants perceive *future risk of transmission* on public transport?
3. How did the pandemic and risk mitigation measures *impact on long-term worker health and wellbeing*?

Methods

Design
This qualitative study was co-created with key sector stakeholders working in/with the public transport sector. We engaged informally at the outset to identify relevant issues from the sector, and scheduled regular contact throughout development and implementation. These stakeholders were initially identified through existing contacts within the UK Health and Safety

Executive (HSE) and the DfT. From here, snowballing was used to build a wider network of sector leads, academics, regulators, Trade Union officers and user representatives. Engagement with stakeholders led to the identification of relevant issues in the evolving pandemic situation, and raised important topics where data could aid future decision making; these discussions informed the development of the interview schedules (Turner, 2010; Kallio *et al.*, 2016). After the initial stakeholder engagement exercise, as part of a wider study (Coleman *et al.*, 2022) semi-structured interviews were carried out with organizational representatives (*N* = 13, including unions) and workers (*N* = 5). The interview schedules were piloted initially with the first in each stakeholder group; no substantial changes were required to the interview schedules and therefore data from all interviews were considered in analysis. Interviews were carried out between late January and May 2021. Ethics approval was granted from the University of Manchester Proportionate Review Committee (Ref: 2021-10535-17496).

Participants
As this was a relatively rapid piece of qualitative research, where timely results were required, we were limited in the number of respondents we could speak to, especially under COVID-19 conditions. Interviews were conducted with organizational leaders identified via snowballing following the engagement exercise and purposefully sampled to cover a broad range of transport modes (e.g. train, bus, tram) and job types (e.g. directors/unions/health and safety), who then provided a route into worker groups (public-facing, office-based). The majority of organizational leaders invited to participate agreed to speak to us (76%). We recruited workers via the companies where we had already spoken to organizational leads and via Trade Unions. However, recruiting for this group was more challenging (40% of those initially contacted participated).

Table 1 shows information about the background of study participants. For clarity, organizational leaders and workers are referred to with these titles; where 'employees' are referred to, this includes both organizational leaders and workers.

Procedure
Interviews with participants were carried out by two qualitative researchers using video conferencing platforms (Zoom/Teams). All interviews were conducted between January 2021 and May 2021, were recorded with permission of the participants and transcribed verbatim. The interview

schedules covered a range of pre-established categories: about the individual; changes in what respondents and respondents organization did in response to COVID-19; views about keeping everyone safe who uses/works for public transport; and respondents' own experiences of COVID-19 for context.

Analysis

Transcripts were analysed using NViVo software (V11), and emergent thematic analysis conducted to generate the overarching themes and subthemes. Thematic saturation was continually monitored through discussion between the two researchers who conducted the interviews and analysis, and was agreed to have been reached when no new themes were identified from interviews. Two researchers undertook all the interviews and coding, and wrote brief field notes before recordings were transcribed verbatim. To assure consistency, double coding of several interviews was undertaken. A coding framework (Table 2) devised by the research team was used. This combined the pre-established categories used for the schedules and new themes identified during the interviews to enable answering the research questions (see Aims).

Quotes are used to illustrate findings where appropriate, each with an anonymous identification code prefixed OL (organizational leaders) and W (workers).

Table 1. Background of study participants.

Type of participant	Number	Total	Characteristics	ID number prefix
Organizational leader/union—bus	5	13	12 males/1 female	OL
Organizational leader/union—rail	7		9 directors/2 unions/2 health and safety	
Organizational leader/union—tram/light rail	1			
Workers—rail	3	5	2 males/3 females	W
Workers—bus	2		3 public-facing/2 office-based	

Table 2. Coding themes.

Overarching themes	Subthemes	Description
A. Perceptions and impacts of risk of COVID-19 for employees (both organizational leaders and workers)	i. Acceptability of risk for workers	Perceptions of level of risk at work, and how comfortable respondents felt with this level of risk, including variability/differences across occupational groups
	ii. Perceptions of risk mitigation effectiveness	Perceptions of how effective implemented mitigation measures were at reducing risk, and what information informed these perceptions
	iii. Changes to working practices and impact on morale and wellbeing	Reports of any positive or negative impacts of changes to working practices made as a result of the pandemic
	iv. Issues with compliance to mitigations	Examples of non-compliance with mitigations by both colleagues and passengers; including both wilful non-compliance and forgetting mitigations when with familiar people
	v. Role of leadership and messaging	Perceptions of communication and messaging within companies, as well as from Government
B. Long-term impacts of COVID-19 on working practices and effects on health and wellbeing	i. Continuing COVID-19 mitigations	Perceptions and expectations of mitigations in the future, and how this relates to perceptions of future risk
	ii. Impact of increasing passenger numbers	Consideration of what would happen to transmission risks with increasing numbers of passengers, and implications for mitigations
	iii. Impact of vaccination programme	Perceptions of changes to transmission risk with roll out of COVID-19 vaccines and consequent actions
	iv. Impact of changes to business structure	Implications of business uncertainty for workers, as well as changes to staff management as a result of the pandemic

Results

The sample (Table 1) included 18 participants (13 organizational leaders, and 5 workers). Within the category of organizational leader, two participants were union representatives.

Nine subthemes were identified and structured into two overarching themes: (A) perceptions and impacts of risk of COVID-19 for employees, and (B) long-lasting impacts of COVID-19 on working practices and effects on health and wellbeing (Table 2). The results are presented under the main theme headings with representative quotations.

A. Perceptions and impacts of risk of COVID-19 for employees (both organizational leaders and workers)

Findings describe perceptions and impacts of risk of COVID-19 for organizational leaders and workers at the time of one of the peaks of the pandemic (early 2021). Subthemes are shown in Table 2.

i. Acceptability of risk for workers

Workers within the transport industry presented mixed assessments of their perceptions of personal risk at work. Most reported feeling safe generally, but also highlighted particular circumstances where they felt at risk. Office-based workers reported feeling very safe, while public-facing workers highlighted more risks. Organizational leaders also recognized a variability in the level of risk felt by workers, both between different groups and at different times during the pandemic.

'I think it's variable…The ones who I think have found it most difficult and struggle are the train dispatch staff who have to be there all the time. […] They are in the front line with the public, they've got people coming up to them, asking them questions, maybe invading their personal space on a regular basis and we haven't been able to say to any of those people look, we can step you down for a bit because as long as the train service runs, you've got to have those people there to make sure that the trains leave the station safely.' (OL4)

'I mean, personally, I felt fine. I've never felt particularly uncomfortable being on board, I felt that the procedures in place were very safe. I know some of my colleagues felt less comfortable. But I felt that I had the mask on, and I was keeping my distance, and I knew that I washing my hands a lot, and I was using sanitiser.' (W5, public-facing)

ii. Perceptions of risk mitigation effectiveness

Broadly, the range of risk mitigation measures were perceived to be effective in reducing the risk of transmission. In some cases, this was inferred from a lack of cases being identified associated with the workplace.

'So, effectively what we did was put into place all of the various protocols that you would expect to see in terms of personal PPE, cleaning, distance and information in order to keep people safe. And looking back it worked because we've had very few cases and we've only had one instance since March last year of workplace transmission.' (OL12)

One worker described an outbreak of COVID-19 at their workplace. They discussed how their perception of mitigation measure effectiveness was affected by this, as they felt they had been adhering to all guidance before the outbreak and that there was little further action they could take after the outbreak.

'Aye, I do feel safe. But I think that's what bothered us the most is because we were taking all the precautions. We all had our masks on when were in the same office and we sanitised…you take a layer of skin off your hands with the amount of sanitiser you're using and the fact you still caught it.' (W7, office-based)

iii. Changes to working practices and impact on morale and wellbeing

Many changes to work practices were brought in on public transport with the aim of reducing transmission risk (outlined above). Organizational leaders also outlined updates to policies to accommodate changes to working practice, including flexible working policies, family friendly policies, and conducting wellbeing surveys. Some organizations specifically recognized the negative impact of the lack of contact between colleagues, and made attempts to combat this by creating opportunities for colleagues to engage with each other. This was seen to have a positive effect on worker satisfaction.

'We also put in arrangements so that they could stay in touch with each other. So the crews in particular, the on board crews they started a thing called Community Cafes, which were essentially times during the day where they would get together and have a chat basically, but on Microsoft Teams, to keep engaged.' (OL5)

In some instances, new procedures were reported to have a detrimental effect on worker morale and wellbeing, particularly where procedures reduced contact between colleagues. This had a significant impact on job satisfaction and support.

'I've worked on the trains for many, many years and we were used to working in teams. Well, now we're just working by ourselves. So like for me, I'll just be in First Class by myself, the other person will be up in Standard by themselves. And that has been a big change…and not really in a good way either because, you're just alone all day and you don't have that camaraderie that you have and the support from your colleagues.' (W4, public-facing)

iv. Issues with compliance to mitigations

All participants talked about instances where mitigations were not followed by either colleagues or passengers (e.g. use of face coverings, social distancing, non-essential travel). This was seen as a source of increased risk, and as a consequence a threat to their health. This problem was ongoing at the time of interview, and no one reported the implementation of effective solutions to these problems. Compliance issues fell into two distinct categories: wilful non-compliance (both colleagues and passengers), and in-group thinking where colleagues felt safe with one another and did not feel the need for mitigation. In the case of wilful non-compliance, this behaviour was explained as being because the person did not perceive a risk to themselves, or because they did not care about their risk to others. Therefore, these individuals were often viewed negatively by participants.

> 'Some of my colleagues were perhaps reluctant to follow everything…When I hadn't seen them for a while, they were coming up and wanting to hug you, colleagues of mine not always wearing their masks, they'd pull them down in certain situations, I felt that wasn't right personally, well I certainly wasn't going to hug anybody, but I was sort of almost pushing people away. So, I think difficulties would have been mainly from my point of view, people, colleagues and customers not adhering to the rules. […] I just think they feel they're not at risk for any reason.' (W5, public-facing)

> 'They do understand, they know they're supposed to be wearing it but it's just like rule-breakers, isn't it, that's what it is.' (W4, public-facing)

> 'But they'll always harp back to the half a dozen that are taking the Michael. Half a dozen people that you know don't need to come out, can make other arrangements, are flaunting the rules or don't give a monkey's.' (W6, public-facing)

Passengers not wearing face coverings was an issue that was discussed by all participant groups. However, organizational leaders were clear that the guidance for workers was not to challenge passengers on this issue, as this would increase their risk of viral infection. This was an industry wide approach, designed to protect workers.

> 'They keep taking their masks off, despite being told several times over the PA that they need to keep them on, they will just put them under their chin or just put them on the table, you know. And that has been a constant. And it was a big worry for us at first because, you know, sometimes it felt like they weren't being made to adhere to the rules strongly enough and the company would say, you know, we can only advise people, they can't enforce it…So that's been sort of like a bit of a worry of the risk for people working on the trains. [It made me feel]

quite anxious because I've got underlying health conditions. […] So I think, you know, I did everything I could to keep myself safe but always being aware that other people were not keeping me safe.' (W4, public-facing)

> 'I'm not saying that we should be policing, you know, wearing of masks, you know, we have, all along, said that that puts our members into too much potential conflict, for them to be involved in policing. It's bad enough being railway worker with public transport users, you know, we've had increasing levels of violence shown towards railway staff.' (OL2)

A particular problem reported related to social distancing not being observed between colleagues that felt comfortable with each other and formed an 'in group'. This was often explained by the suggestion that colleagues forget to adhere to the mitigations.

> 'The thing that we find most difficult is people tend to come together. Particularly colleagues tend to not respect two meter distancing between each other. 'Cause it's unnatural. So they tend to drift together.' (OL4)

> 'We've had instances where, they just forget, so they've bought in sharing food and, you know, sat in a socially distanced manner but all pouring over the same cheese platter or whatever.' (OL1)

However, it was also suggested by some organizational leaders that this was the result of a more fundamental lack of understanding about the risk of transmission, and misplaced trust in familiar people.

> 'So this was a nonsense, and just people feeling they were above it, and crucially not realising that their danger was catching it from their colleagues, rather than from the public. And I think that's a theme, whenever you have a discussion about these things, there's still this perception, well it's alright, because these nice people I know won't have it, it's all the people I don't know who've got it […] because they were just simply not getting that they were most at risk from their colleagues.' (OL15)

v. Role of leadership and messaging

The importance of strong leadership and clear messaging was discussed by many employees. This included the introduction of new communication methods (e.g. apps, company intranet) to deliver information about new working practices, as well as a focus on two-way communication and engagement between managers and staff.

> 'Each time there's been a new variant the company have acted on it straightaway. They've spoke about it, they've said what they are going to do, so they've always got contingency plans put in place…so loads of reassurance.' (W1, office-based)

> 'Actually, overwhelmingly the message from employees is our managers have looked after us and kept

us informed and all the rest of it…I think the other thing about employee engagement is we've kept in contact with each other, so where we had staff working at home or they were off train and we told them just stay at home, we made sure that there was very regular contact with those members of staff.' (OL5)

While leadership and communication between the public transport providers appeared to be clear and well communicated, as reported by employees, leaders reported the messages and information provided by Government could have been improved. It was also suggested that further engagement with the sector to discuss solutions would be beneficial.

'Certainly, for rail, we have got to be given as much accurate information and knowledge as early as possible, to enable us to work with the employers to continue to protect our members and their employees from the risk of the disease. And that means, sitting down and having honest discussions with workplace representatives.' (OL2)

'It [Government messaging] was also very unclear and inconsistent, and still is inconsistent. So, the message currently is, the official message is social distancing at two metres should be encouraged, if you can't achieve two metres it's okay to distance on social at one metre plus, and the plus can mean additional measures such as sanitisers, or wear a mask, or whatever.' (OL17)

The idea of 'COVID secure' workplaces was discussed by many in relation to the effectiveness of mitigation measures. Some were in support of the confidence of identifying as 'COVID secure', while others were concerned that this may be misleading.

'And it's just a nonsense to think that you can create COVID secure workplaces. But they're using that as a way of saying to workers, you must get back to work and you must turn up for work and you must do your duties.' (OL2)

B. Long-term impacts of COVID-19 on working practices and effects on health and wellbeing

Looking to the future, several subthemes were discussed relating to long-term concerns about health and wellbeing as a consequence of COVID-19. This included both continuing risk of infection from the virus, and how this might change with time and government policies, as well as the impact of altered business structures, necessary for long-term sustainability, on workers. Four subthemes are shown in Table 2.

i. Continuing COVID-19 mitigations

Participants discussed their thoughts on what challenges lay ahead for public transport. Many participants (at the time of interviews) reported that they expected mitigation strategies

to stay in place, and were accepting and supportive of this. Some participants reported that they would feel safe, as long as the mitigation measures remained in place:

'But I would like to think that we would keep a lot of the procedures that we have in place now, for the foreseeable future, I would certainly envisage until later this year, the end of this year maybe. I mean, certainly the vaccination seems to be having a positive effect in the number of transmissions, and I think, at work, the procedures are there in place to make sure that we don't [catch COVID-19]. And as long as we're able to continue to do those, then I will certainly feel comfortable working there.' (W5, public-facing)

'I think all we can do is literally carry on as we are now, emphasise face coverings because, you know, let's be honest about it, the medical industry still don't know how it's transmitted so easily, airborne/touch, they've gone through the whole raft of it all. So I think we just need to, sort of, cover all bases at the moment. So, yeah, you just need to sanitise, keep distance from strangers. Minimise your contacts with people at the moment.' (W6, public-facing)

ii. Impact of increasing passenger numbers

Employees also expressed concern for the level of risk once passenger numbers increased. It was expected that workers' risk would be further assessed in this situation, and recommendations would be made according to individual circumstances (e.g. job role, health concerns, etc.), implying that they felt the current mitigations were potentially insufficient with higher passenger numbers.

'But it's just going to be a big change when the trains come back full and hopefully all this doesn't spark another wave because that could be the danger of it. […] I don't know how things are going to change for me when it does get very busy in terms of my risk. But the company will assess me again and decide how to go forward, so we'll just have to see.' (W4, public-facing)

'It's going to be an enormous challenge, because I mean at the moment it's easy because there's nobody travelling on the network, so it's very easy to keep it clean, for people to socially distance themselves and so on.' (OL1)

iii. Impact of vaccination programme

Vaccines were also seen as a positive step for reducing risk. However, *all* workers expressed concern about reductions in mitigation behaviours as a result of a, potentially overstated, sense of security gained through vaccination; some organizational leaders also reported this. Therefore, this was seen by many as a potential *increase* to the risk of contracting COVID-19.

'I think some people's attitude to it's just like, well it's not there anymore. Like I've had my vaccination, I can

go out. [...] A couple of drivers have said, I've had my two jabs, do I still need to wear a mask, so it's just a case of explaining to them, well you can still be a carrier, even though you've had your vaccination.' (W7, office-based)

'The bigger worry is that people feel that they're invincible because of the vaccination, so their behaviours change, and we know that behaviours mustn't change after vaccination.' (OL6)

iv. Impact of changes to business structure

More broadly, organizational leaders recognized the impact of the wider business on workers wellbeing at work. The change in the model of the business, from being funded by passengers to being funded primarily by government grants (during the time of the research), was seen to impact on the working environment. Organizational leaders expressed concern for the future viability of the businesses, given uncertainties over the return of passengers to public transport and changes in commuting behaviours. Therefore, this uncertainty and the impact on workers within this sector could be long term.

'The other thing is that of course the biggest change for us has been that we were a thriving organisation that was starting to turn a corner and make its own money, but we are now totally beholden on government grants and, sort of, limping from one to the other which doesn't do anybody's kind of mental wellbeing any good really.' (OL1)

One organizational leader illustrated that the changes to the approach to employee engagement and wellbeing as a result of the pandemic had been positive for the business as a whole.

'We were getting involved in areas that you wouldn't ordinarily get involved with, but you know what, it taught us that for the wellbeing of your staff you're really blinking not to get involved in stuff like that. You really ought to get involved in their life if they're happy for you to do so for their wellbeing because you've got a better employee, you've got a better business if they're getting their whole life sorted out, you know? But ordinarily you don't see any of that.' (OL12)

Discussion

This study identified two themes and nine subthemes relating to the public transport sector after detailed analysis of in-depth semi-structured interviews with workers and organizational leaders. In terms of the balance of risk and mitigation of SARS-CoV-2 transmission (RQ1), public transport operators put in substantial effort to make workplaces safe for workers: introducing new working patterns, cleaning regimes, conducting risk assessments for

individuals based on personal circumstance, implementing social distancing, work bubbles where distancing was not viable, staff testing and face covering mandates for passengers, etc. These appeared to have been effective in making workers feel safe in the workplace, although in the context of low passenger numbers. This is in line with research in the USA (Rice *et al.*, 2021) which showed significant associations between knowledge of employer safety responses and lower COVID-19 risk perceptions. However, despite this the potential for contextual changes to negatively impact risk perceptions is evident, with our research also reporting employees expressing concern about what the impact increasing passenger numbers would have on their risk from SARS-CoV-2.

Workers perceived greater risk when mitigating procedures were not followed; this was exclusively reported for the behavioural mitigations in place—particularly, social distancing and face covering wearing. Therefore, where safety was seen as being reliant on the behaviour of self and others, it was more precarious. Between colleagues, this 'in group' behaviour has been described in the literature (Cruwys *et al.*, 2020; Tunçgenç *et al.*, 2021). However, Neville *et al.* (2021) outlined how communications can harness social norms to increase adherence; organizations could use this strong sense of in-group to promote adherence by emphasizing compliance for the good of the group. Research into non-adherence has also highlighted the roles of policy decisions and policy makers in the creation of conditions that produce non-adherence (Williams *et al.*, 2021).

The issue of reliance on the behaviour of others was also relevant for participants' views of future risk (RQ2), particularly where passenger numbers might increase and vaccination could reduce compliance with behavioural mitigations. Observing behaviours appeared to be a strong signal of safety for workers themselves. The vaccination programme appeared on balance to increase the perception of risk through people's potential relaxation of mitigation behaviours. Research by Ozbilen *et al.* (2021) presented recommendations for future transport policy, which included 'formulating viable solutions to address high-risk perceptions associated with transit'; future research should focus on the inter-relatedness of passenger and worker perceptions of risk and associated behaviour.

A number of factors were reported to impact on worker health and wellbeing (RQ3), including viral transmission from failure to follow behavioural mitigations by colleagues and passengers, feelings of isolation because of mitigation measures, and a reduced sense of job satisfaction and reward with lower passenger numbers. These findings support previous literature, which demonstrate an impact of the pandemic

on feelings of isolation, mental health, and productivity (Williams *et al.*, 2020; Senerat *et al.*, 2021), as well as findings that the majority of the general UK population experienced challenges (including to mental health) in adhering to COVID-19-related instructions (Keyworth *et al.*, 2021). These issues were seen to potentially impact long-term health and wellbeing, but the nature of these longer-term effects was dependent on the progression of the pandemic and the recovery of the sector. Impacts on the wider business and wellbeing of staff were identified to be important in the context of changing funding approaches in the sector, and concerns over the longer-term viability of the sector negatively impacted on employees.

Understanding these issues, and the practical tools that have proved successful, can help to inform future strategy. There were several examples of good practice; for example, online engagement with employees (one-on-one and in groups) was positively received and could tackle feelings of isolation. The importance of leadership and clear communication was also stressed by many participants, recognizing the reassurance that this can provide during uncertain times. This finding is consistent with research with the general public that highlighted the impact of communication on trust and clarity of guidelines (Williams *et al.*, 2020). The importance of leaders in creating workplace cultures/climates that promote COVID-19 measures should not be underestimated (Wright *et al.*, 2021). Clear leadership and communication could be utilized to attempt to increase compliance with behavioural mitigations, as this is a key issue for many employees.

This study has a number of strengths, including stakeholder breadth, comprising companies, unions, and workers from a range of transport modes (bus, rail, and tram) that permitted capture of a range of views and experiences within the public transport sector. Also, the timing of the study was well placed to capture real-time perceptions of risk and safety, as the pandemic was ongoing.

There are also study weaknesses to note. First, we acknowledge that the sample size for workers and organizational leaders is small and not representative of the sociodemographic range of this population. Additionally, we were not able to collect detailed personal and demographic data relating to participants. The short timescale of the study, work schedules, and the demands of the pandemic meant many workers were unable to participate despite offering out-of-hours' slots. Some may have been deterred by thinking employers would be able to identify them despite promised anonymity. Specifically again, as we did not adopt a case study framework, our data may not be representative of all the themes that may exist in such populations. We recognize that further work is necessary to fully understand the impact of the pandemic on work in this sector, to build on the findings

of this research. However, smaller samples have been used for qualitative work in this field (Malagón-Rojas *et al.*, 2020). Second, consideration of additional topics was not feasible in this phase of the research. Notably, long COVID is an important consideration for workers' health and wellbeing. This was not formally raised, and it was not mentioned spontaneously by participants.

The context of this work is important, and provides a snapshot of the pandemic where lockdowns and restrictions were in place. A follow-up qualitative investigation is planned to explore how the situation in the public transport industry changed after 19 July 2021, when most restrictions were lifted in England, and later when the Omicron variant was identified. It will be of particular interest to record perceptions of risk and safety amongst employees who anticipated that behavioural mitigations (particularly face coverings) would have been maintained through this period.

Conclusions

Most public transport workers reported feeling safe, but public-facing workers were reported to be at higher risk. Generally, mitigation measures were thought to be effective in reducing the risk of viral transmission, although new procedures and work practices were reported sometimes to have a detrimental effect on worker morale and wellbeing, particularly where they reduced contact between colleagues. Organizations could counteract loneliness and isolation by creating new/alternative ways for employees to have contact. Non-adherence to guidance was felt to be an ongoing source of increased risk although no clear solutions were identified. Therefore, it is imperative to understand non-adherence and address this within the workforce, potentially through organizational messaging to tackle colleague interactions, as well as interactions with the public, and reducing in-group behaviours that can increase risk. Future research is required to monitor the changing situation regarding the prevention and control of infectious diseases on public transport.

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Conflict of interest

D.F. is the Chief Medical Adviser for the Health and Safety Executive (HSE), GB and also HSE NI. The publication contains the views of the authors, and not necessarily those of HSE or NIHR policy.

Data availability

Data cannot be shared for ethical/privacy reasons: The data underlying this article cannot be shared publicly because respondents did not give permission for their data to be shared beyond the research team as part of the consent process.

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