![PROTECT - A COVID-19 National Core Study]

Perceptions of transmission and mitigation of SARS-CoV-2: public transport

Theme 3 WP1 Deep dives

Views of experts, organisational leaders, workers and passengers between

January – May 2021

Prepared for

The PROTECT COVID-19 National Core Study on transmission and environment

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National Core Study Report

The PROTECT COVID-19 National Core Study on transmission and environment is a UK-wide research programme improving our understanding of how SARS-CoV-2 (the virus that causes COVID-19) is transmitted from person to person, and how this varies in different settings and environments. This improved understanding is enabling more effective measures to reduce transmission – saving lives and getting society back towards 'normal'.

Public transport is one of a number of occupational and industrial sectors being specifically examined as part of Theme 3 of the PROTECT study. This report describes qualitative research carried out between January and May 2021 on perceptions of the risk of transmission of SARS-CoV-2 and of the effectiveness of controls implemented on public transport in the UK. The research team will also carry out a limited follow-up study in early 2022 to see if the perceptions detailed in this report have changed following the lifting of restrictions and rise in passenger numbers in the UK.

Based on thematic analysis of interviews with sector experts (public transport researchers, policymakers, industry and regulators), organisational leaders, workers and passengers, the research found that the interviewees generally perceived the risk of SARS-CoV-2 transmission on public transport to be low, and the controls in place to be effective. However, public transport users' perceptions of safety and risk were found to be dependent on the compliance of fellow passengers and staff with behavioural measures, such as the wearing of face coverings. Confidence in using public transport was also impacted by transmission rates in society at the time, vaccine uptake, and the emergence of new virus variants. The authors make a number of scientific recommendations on the basis of their findings that may help inform future pandemic preparedness in the sector.

Perceptions of transmission and mitigation of SARS-CoV-2: public transport

Theme 3 WP1 Deep dives

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Abstract

A qualitative study was carried out to determine the **perceptions of the risk of SARS-CoV-2 transmission** and of the **effectiveness of mitigation measures** that were introduced in the Public Transport sector in the UK. The study focussed on **ground transport in UK** - rail (including light rail / tram), bus and taxi. To inform the study design we carried out a literature review and had extensive engagement with relevant stakeholders in the sector.

We carried out 47 **interviews** comprising 17 experts (policy / research / industry / regulators) and 13 organisational leaders (including unions) between January – March 2021, and with 5 workers and 12 passengers between April – May 2021. Interview data were **analysed thematically** using NVivo.

The perceived risk of transmission of SARS-CoV-2 was generally **low** but **risk not constant.** However, this was within the context of low passenger numbers and relatively good adherence to guidance. Feelings of safety were reliant on observations of **compliance** with mitigation measures by the transport operators, transport staff, and other passengers, alongside **policing** of these measures. Confidence to use public transport was seen as a **balance** between transmission rates, vaccines, mitigations, new variants, and compliance with behaviour.

Most respondents perceived mitigations to be **appropriate and effective** but relative effectiveness was **difficult** to determine**,** as they were **all used together**. Effectiveness was also perceived as dependent on the relative importance of **transmission routes. In addition,** effectiveness of **behavioural** mitigations was seen as being dependent on the compliance by individuals.

Monitoring / policing of mitigations for workers and passengers was challenging. Clear **messaging** about the effectiveness of the mitigations on public transport was seen to be essential for the return of many passengers.

Different rules in place in **devolved nations** / **different geographical areas** could cause confusion.

Company representatives reported that initially, it was **difficult to source consistent** and **timely information** to help facilitate decision-making. There was a **lack** of clear scientific evidence / objective data for the public transport sector. In particular, there is currently still a lack of **objective data** about the effectiveness of different mitigations, in isolation and together, and it is important that effectiveness of mitigation measures is evaluated. There is also a need to improve our understanding of the impact of messaging and communication on **behaviour of staff and passengers.**

In conclusion, the **perceived individual risk** of using public transport was considered to be low, and the **mitigation measures** were perceived to be effective, but this may be due to the low passenger numbers at the time. It is unclear if the lifting of restrictions in the UK and rise in passenger numbers, since July 2021, will have affected these views. Hence, in order to investigate this, we will be carrying out a limited follow up study, interviewing some of the sample participants again.

Executive Summary

Introduction

The PROTECT ('Partnership for Research in Occupational, Transport and Environmental COVID Transmission') National Core Study (https://sites.manchester.ac.uk/covid19-national-project/) conducted a series of 'deep dives' into specific [industrial] sectors to gain understanding of the issues that promote or reduce transmission of 'SARS-CoV-2' (the virus that causes COVID-19) in selected occupational settings (Theme 3, work package 1).

This report presents the findings of the qualitative element of the 'deep dive' looking at ground public transport (rail, bus, tram and taxi) in the UK, conducted between January and May 2021. The deep dive had two main components. First, a literature review of pertinent published global literature (published elsewhere; Gartland *et al.*, 2021) and second a qualitative assessment of the perceptions of a number of professionals and public transport users.

Methods

After an initial stakeholder engagement exercise with the public transport sector (consulting with experts, organisational leaders, regulators), semi-structured interviews were carried out with experts (research, policy, industry, regulators, N=17) organisational representatives (including unions, N=13), workers (N=5) and passengers (N=12). Forty-seven 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).

The qualitative interviews were carried out by two skilled researchers using videoconferencing platforms (Zoom / TEAMS) lasting an average of 60 minutes. Interviews were professionally transcribed and analysed thematically. Global, organising, and basic themes were identified, and helped the research team describe the perceptions of risk and risk mitigation effectiveness, experience of changes introduced to the public transport sector to reduce transmission of SARS-CoV-2, and considerations for how the sector will move forward in the future. This was then used to help answer the 3 overarching research questions:

1. *What are **the perceptions of risk** of transmission by the various stakeholders (experts (research / policy), organisational leaders, unions, workers (middle management / front line), and general public) within public transport?*

2. *What are the **mitigations** being put in place and the **perceived effectiveness** of these risk mitigation strategies? Are these perceptions different between the stakeholders?*

3. *What are the **major knowledge gaps** that will need to be addressed in the short and longer term?*

Results

Context and Information Sources

◊ Findings are within the context of low passenger numbers which persisted throughout the research period.

◊ COVID-19 had a marked impact on working practices within the sector, introducing many changes and challenges for those working in the sector and passengers.

◊ Experts and organisational leaders relied on information from Government departments (DfT and HSE, as well as Public Health England and Local Authorities), ongoing research projects, academic papers, sector partnerships (Unions, regulators etc.), and feedback from passengers and workers.

Perceptions of Transmission Risks

◊ SARS-CoV-2 transmission on public transport was perceived as possible, but of variable risk – in general, the individual risk was viewed to be low, but thought to be affected by time of day, what locations travelling to and from, journey duration, rural vs urban settings, type of vehicle travelling in and with whom.

◊ Opinions varied as to which transport modes/activities were associated with the highest/lowest risk for transmissions. However, all groups generally considered similar factors in estimating risk: crowding and ability to social distance, perceived cleanliness, behaviour of (other) passengers and transport workers, level of ventilation.

◊ Inequity in the likelihood of public transport-related exposure to SARS-CoV-2 was noted, as certain groups have less choice about their need to travel and choice of transport mode.

◊ Workers and passengers generally reported feeling safe/comfortable in public transport settings, but identified particular situations in which they felt at greater risk - usually, in response to seeing others not complying with behavioural mitigations.

Processing of Information

◊ Experts and organisational leaders detailed the large body of work that informed the sector's response to the pandemic. Industry wide forums were established early in the pandemic and met regularly to filter information and knowledge, facilitate decision making, and coordinate a standard industry response.

◊ There were some challenges in interpreting messages from Government; messages changed quickly and some guidance required significant translation into operational practice which at times resulted in unintended consequences and disruption.

◊ The Government's initial message to avoid public transport had a strong and continued impact on passenger numbers.

◊ Passengers were generally supportive of well-publicised guidance (e.g. face coverings, hand hygiene, social distancing), but expressed some concern about the practicality of public transport specific guidance to use quieter stations / stops and wait for the next service if the current one was busy.

Implementation of Risk Mitigations

◊ A wide range of mitigation strategies were employed by the public transport sector to minimise transmission risks. Broadly, these included: social distancing/capacity, enhanced cleaning regimes, face coverings, hand hygiene, ventilation, reducing contact (e.g. screens, contactless tickets, working in bubbles), restrictions to reduce touch points, keeping staff at home.

◊ Relative effectiveness of mitigations was not well understood, but most suggested if all mitigations were in place the risk of transmission was well-managed.

◊ Perceptions of behavioural mitigation effectiveness were impacted by acceptability and levels of compliance.

Management of and Compliance with Risk Mitigations

◊ Monitoring of mitigations was a challenge within public transport settings.
◊ Social distancing for passengers was facilitated by transport company's calculations of capacity and demand, and was monitored in some settings by proxy measures (e.g. seat reservations). For workers in the sector, observational checks were made but largely employees were trusted to comply.
◊ Organisational leaders explained that by far the highest number of complaints received from passengers related to non-compliance of wearing face coverings by fellow passengers and occasionally workers.
◊ Complex cleaning regimes were implemented at time and financial cost. Some challenges were faced where employees were expected to carry out cleaning between shifts.
◊ A significant challenge related to the responsibility for policing and challenging of non-compliance with behavioural mitigations, and divergent views were held by those working in the sector in comparison to passengers. This was an emotive issue as both passengers and workers spoke of their safety being reliant on the behaviour of others.

The Future

◊ The key short term issue to be resolved was the need to increase passenger numbers safely.
◊ In the longer-term, capacity, reliability and viability of public transport needs to be balanced with wider transport programmes, including the green and sustainability agendas.
◊ Many lessons can be learned from the response of the public transport sector to the pandemic, and positives can also be taken forward to improve ongoing working practices.

Discussion

Summary of conclusions

RQ1: What are the perceptions of risk of transmission by the various stakeholders?

At the time of the research (January – May 2021) the general view of all stakeholders was that the (personal) risk of infection was considered to be low. Workers and passengers felt the mitigations implemented on public transport were generally effective and appropriate. Contraventions of mitigation measures undermined perceptions in the safety of public transport. The general perception of all stakeholders was that the mitigations were important for controlling transmission at times of low passenger numbers, and that they would increase in importance as passenger numbers increased. Confidence to use public transport was seen as a balance between transmission rates, vaccines, mitigations, new variants, and compliance with behaviour.

RQ2: What are the mitigations being put in place and the perceived effectiveness of these risk mitigation strategies?

A range of mitigations was introduced in the public transport sector in order to reduce the risk of transmission in this setting (in place at time of interviews). Some of these changes were instigated by transport companies themselves, however others were mandated by the Government. All changes were introduced at pace and around the same time. Effectiveness of risk mitigation strategies was dependent on the relative importance of transmission routes, but effectiveness of behavioural mitigations was also seen as being dependent on the compliance of individuals with these measures. Passengers were generally keen to see more policing of these measures on public transport; however, workers and organisations felt this was not their responsibility. Clear

messaging about the effectiveness of the mitigations on public transport was seen as essential for the return of many passengers.

RQ3: What are the major knowledge gaps and things to consider that will need to be addressed in the short and longer term in each sector?
At the outset, transport organisational leaders and experts found it difficult to source consistent and timely information to help facilitate their decision-making. There was a call for an evaluation of the mitigation measures introduced, to determine how effective and sustainable they were for the future. Respondents were concerned about how to build up capacity on services safely while the requirement for social distancing remained. Another major knowledge gap was what the future demand for public transport would look like. This relates to helping people regain confidence in using public transport and patterns of transport use for the future. Concerns were raised around linking public transport to wider agendas e.g. Green and carbon neutral while funding an effective transport system and keeping workers and passengers safe.

Other issues
At all levels, a clear reduction of usage of public transport was seen and passengers reported changes of mode and reasons for using public transport, since the start of the pandemic. Sharing of good practice and knowledge as quickly as possible across the transport sector was found to be very useful to help facilitate consistent interpretation of guidance and decision-making.

A number of areas of consideration which present opportunities for learning from the experiences of the COVID-19 pandemic have been identified. However, these arose at the time of research (January – May 2021) and will need to be considered in the context of changes since that date. We will carry out a limited follow up survey, re-interviewing some of the participants to update the views and perceptions and identify any other issues that may have arisen since July 2021.

Recommendations

We suggest that evidence and knowledge gained during the pandemic should be used to develop clear and effective strategies to allow for coherent and rapid response to any future pandemics. Recommendations include*:

- Consider maintaining / establishing industry fora to respond quickly to appropriate issues in the future;
- Consideration should be proactively given to collaboratively (between Government, regulators, companies, Unions and passenger groups) developing messages and communications that are clear;
- Encouragement of leading by example from those working within the public transport industry in adhering to guidance about risk mitigation;
- Consideration should be given to the complex dynamics in workplaces when developing messages to worker groups that will interact in many ways;
- Consider developing clear lines of accountability for compliance with current guidance, particularly for passengers and workers;
- Longer term planning of public transport services should consider wider agendas and greater cross agency co-ordination.

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Abbreviations

CMA	Competition and Markets Authority
CPT	Confederation for Passenger Transport
DfT	Department for Transport
EX	Expert
HSE	Health and Safety Executive
LA	Local Authority
NHS	National Health Service
OL	Organisational leader
ONS	Office for National Statistics
ORR	Office for Rail and Road
P	Passenger
PCR	Polymerase chain reaction
PHE	Public Health England
PPE	personal protective equipment
PROTECT	Partnership for Research in Occupational, Transport, Environmental COVID Transmission
RDG	Rail Delivery Group
REACT	Real-time Assessment of Community Transmission
RMT	National Union of Rail, Maritime and Transport Workers
RQ	Research Question
RSSB	Rail Safety and Standards Board
RR	Response Rate
SAGE	Scientific Advisory Group for Emergencies
TfL	Transport for London
TRACK	Transport Risk Assessment for Covid Knowledge
UCL	University College London
UK	United Kingdom
UKRI	UK Research and Innovation
VIRAL	Reducing the Risk of Virus Transmission on London's Public Transport Vehicles
W	Worker
WHO	World Health Organisation
WP	Work Package

Introduction

Public transport was identified as a potential high risk for both workers and travellers when COVID-19 was first identified in the UK (March 2020; Nafilyan *et al.*, 2021), although relatively little was known about the risk of transmission and the effectiveness of measures in reducing infection on various types of transport. Public transport in the UK was an essential service that operated throughout extended lockdowns, but with Government and transport operator messaging to try to reduce numbers of people using services where possible. It therefore provided a unique opportunity to examine the experiences and perceptions of people involved in/with the sector as the pandemic unfolded.

Bus and train drivers, those manning stations / depots, signal boxes etc. continued working on site with advised mitigations. Guidance for Operators, workers and passengers was released by Government (see Appendix A). As a consequence of the pandemic and associated guidance, use of public transport has considerably reduced and varied since March 2020 (Department for Transport (DfT), 2021) (see Table 1).

Table 1: Selected usage of Rail and bus services (2020/21) in UK to illustrate changes resulting from COVID-19 lockdown (Department for Transport, 2021).

Date (Mondays)	National rail	Bus (excluding London)
9/3/20	100%	101%
23/3/20	25%	27%
20/4/20	6%	12%
24/8/20*	40%	45%
14/12/20	33%	57%
4/1/21	**13%**	**29%**
8/3/21	**22%**	**38%**
26/4/21	**35%**	**61%**
14/6/21	54%	63%
19/7/21**	54%	55%
23/8/21*	68%	58%
6/9/21	65%	69%
11/10/21	69%	80%

Figures are percentages of an equivalent day or week, **bold figures** were valid at the time of interviews.
*During school holidays (England), **Day most remaining restrictions lifted in England.

As part of the current research, we conducted a narrative literature review to determine what evidence there was for transmission of COVID-19 on public transport. The review included 28 papers (up to 10 May 2021), from international sources. A detailed write up of the review can be found in Gartland *et al.* (2021). Broadly, this review found that:

- Current published literature was sparse in relation to COVID-19 and public transport.
- Empirical studies provided some evidence for the transmission of SARS-CoV-2 transmission on public transportation and highlighted important factors that moderate transmission such as proximity and duration of co-travel.

- There was mixed evidence for the contamination of air and surfaces in the existing literature.
- Modelling approaches, such as agent-based modelling, needed real world data to best inform their utility.

According to Marsden *et al.* (2021), by the end of 2020, £5.4bn of additional funding support was identified by the National Audit Office for public transport which had been provided or committed by government. This enabled bus and rail operators to continue providing a service, when service use had fallen dramatically (see Table 1), and social distancing rules were in place.

Messages from Government throughout the pandemic had been to avoid public transport where possible and, while bus use recovered to around 60% of 2019 levels in the autumn 2020, rail did not get above 43% at best (Marsden *et al.*, 2021 p5). By mid-June (2021) figures were increasing again but in a context of people being asked to work from home where possible and social distancing still in place. Since most remaining restrictions became non-mandatory on 19 July 2021, the figures for trains have slightly risen, while for buses fallen – this may reflect schools being closed and people travelling for holidays / leisure. Levels of usage may be predicted to rise again during autumn 2021 as more people return to offices and educational institutions.

Since March 2021, Transport Focus (2021a), have run a weekly survey of over 2,000 people each week ('Travel during COVID-19 survey'). Respondents cannot participate in future rounds of the survey, so the results are a snapshot of opinion. The work is helpful for comparing attitudes of bus and rail users and regularly reports on differences between user categories and suggests that the pandemic has had a negative impact on people's attitudes to public transport. They have also been looking deeper into the data using segmentation analysis, breaking the population down into five groups (Cautious Car Choosers, Anxious and Affected, Rethinking Reducers, Spring-back Socialisers, and Carefree and Carrying on) according to key behaviours and attitudes. Their conclusions (for the period 16 July – 1 August 2021) suggested that these negative attitudes are persisting: '*Overall, there are few obvious signs of this change in the segments. As we expected, their attitudes and behaviours will take much longer to change*' and '*face coverings remain the clearest dividing issue*'. In June 2021 (Transport Focus, 2021b), nearly half of train passengers suggested that "*it was busier than expected on board*". And nearly one in five questioned in that survey said it was 'a lot' busier than expected on public transport.

They have also looked at understanding attitudes to social distancing (Transport Focus, 2021c) and between March and April 2021 carried out an online survey exploring the views and experiences of over 10,000 current, fully lapsed and non-users of bus services in the UK. This looked at using buses during COVID-19, expected bus use once things go back to normal, satisfaction with services and priorities for increased use. At that point, before restrictions were eased in July 2021, *"half of people said they won't use public transport unless social distancing is in place. Almost two in five people that used public transport in the last week say they won't use it unless social distancing is in place".* In the same survey three in five people suggested they won't use public transport unless passengers are required to wear face coverings.

In October 2021, Transport Focus (2021d) updated figures on feelings of safety when using public transport. This showed that current passengers felt safer using public transport (89% rail, 86% bus) than non-users (65% train, 59% bus) would feel if they had to make a journey on these transport modes.

The TRACK (Transport Risk Assessment for Covid Knowledge; https://tracksurveys.info/) project is a major UK Research and Innovation (UKRI) funded multidisciplinary project designed to address knowledge gaps around COVID-19 transmission on public transport. TRACK aims to understand the residual risks of COVID-19 transmission on different modes of public transport

(bus, trains and metro) and consider the best control measures. It involves surveying the travel and behaviour of people on transport systems: where they go, which routes they use, which stops they get on and get off at. Using this information the research will try to measure how travel behaviour changes in different situations, over time, and with crowding. During September 2021 they were carrying out a behaviour survey to look at travel behaviour, COVID-19 and attitudes towards public transport.

In addition, researchers at University College London (UCL) on the VIRAL project (Reducing the Risk of Virus Transmission on London's Public Transport Vehicles; https://www.ucl.ac.uk/civil-environmental-geomatic-engineering/research/groups-centres-and-sections/hirg/ucl-viral-reducing-risk-virus-transmission-londons-public) have been working together with Transport for London (TfL), across scientific disciplines to minimise the risk of exposure to pathogens on London's public transport. They are looking to integrate data collected using microbiological sampling, air quality measurements, air flow computer simulations and passenger crowding models to devise a risk assessment framework for viral transmission on tube carriages and buses. To date they have published on surface spread of COVID-19, modifications of driver's cabs and air cleaning devices (Rawlinson *et al.*, 2020, Malki-Epshtein *et al.*, 2020).

Work carried out by Marsden and Docherty (2021) funded by COVID-19 emergency response (UKRI) on lessons from the mobility sector in response to the COVID-19 pandemic in the UK suggest that the response to the pandemic has accelerated already planned policies but generated few new policies; long-term impacts on the future structure of cities, use of public transport and uptake of active travel could still emerge and leading strategic thinkers on transport policy are still unsure what kinds of future demand to plan for.

To compliment this range of work within the public transport sector, the PROTECT (Partnership for Research in Occupational, Transport, Environmental COVID Transmission) team carried out a qualitative 'deep-dive' in the public transport sector to develop a comprehensive overview of the perceptions of risk of transmission and effectiveness of risk mitigation measures to control transmission, from the perspective of the main stakeholders (e.g. employers, unions, regulators, employees, experts, passengers). Alongside the quantitative measurement of attitudes and behaviour, microbiological risk, and long-term policy impact, our work was positioned to provide an in-depth investigation of risk perceptions, effectiveness of risk mitigation and knowledge gaps among the key stakeholders, in order to develop an improved understanding of any barriers / facilitators for effective control of transmission risk of SARS-CoV-2 on public transport. Specifically, we aimed to address the following three research questions:

1. *What are **the perceptions of risk** of transmission by the various stakeholders (experts (research / policy), organisational leaders, unions, workers (middle management / front line), and general public) within public transport?*

2. *What are the **mitigations** being put in place and the **perceived effectiveness** of these risk mitigation strategies? Are these perceptions different between the stakeholders?*

3. *What are the **major knowledge gaps** that will need to be addressed in the short and longer term?*

Deep Dive 1: The Public Transport Sector in the UK

Methods – what we did

As part of this qualitative deep-dive in the public transport sector we initially carried out a significant informal engagement exercise with people working in and with the public transport sector. These took place concurrently to inform the design of the study.

This report is focussed on the findings of the **qualitative element** of the first 'deep dive' looking at **ground public transport** (rail, bus, tram and taxi) **in the UK**, conducted between **January and May 2021,** but will briefly describe the co-production with experts as context.

1. Developing relationships and gaining knowledge

To make the research feasible and due to their common usage (Department for Transport, 2018), we chose to focus initially on two modes of surface public transport in the UK – bus and rail; although we did recruit stakeholders from the taxi / tram sectors in later stages of data collection. A partnership with a wide group of stakeholders was established; this had to be established as a remote network relying on co-operation from industry experts, including people from policy, research, regulation and industry backgrounds.

The prerequisite for co-creation was building relationships quickly, including engaging informally at the outset to identify the relevant issues from the sector, and scheduling regular meetings/communications throughout the development and implementation of the study. Stakeholders were initially identified using existing contacts within the Health and Safety Executive and the Department for Transport (DfT). A process of snowballing was then used to build up a wider network of sector leads, academics, regulators, Trade Union officers and user representatives. We established the key questions for the industry and identified existing work programmes to ensure the study complemented existing research (for greater detail see: Davies *et al.*, in preparation).

Due to rapid changes in COVID-19 rates and associated regulations, at the time we carried out the research (October 2020 to May 2021), we constantly monitored developments in COVID-19 transmission, changes in UK public transport guidance for operators and/or passengers, changes in local and national lockdowns and the COVID-19 tier system, initiation of vaccine programmes, and identification of new SARS-CoV-2 variants.

Recruitment to the study was staged, with interviews initially held with experts and organisational leaders who could then provide a route into passenger and employee groups. The majority of the experts (65% Response Rate (RR)) and organisational leaders (76% RR) invited to participate agreed to speak to us. However, recruitment of workers was challenging. We tried to do this via the companies where we had already spoken to organisational leads and via Trades Unions. However, given our short timescale and the timing of the pandemic (public transport opening back up) many workers were unable to find time to speak to us despite us offering out of hours' time slots – many were working long shifts, and some may have been put off thinking their employer would be able to identify them despite us promising anonymity. We recruited 12 passengers via invites on social media and through company passenger panels resulting in a mix of current and lapsed users for the different modes of transport. We ensured a diversity of ages, locations and reasons for use of public transport.

Ethical Review

Once we had identified the broad questions to be answered (see Appendix B), developed interview schedules and topic guides and other associated ethics documentation, ethical approval was applied for via the University of Manchester proportional review committee. This was granted in mid-January 2021 (Ref: 2021-10535-17496).

2. Qualitative interviews

Interviews with participants were carried out by two qualitative researchers using videoconferencing platforms (Zoom / Teams). All interviews were recorded with permission of the respondents and transcribed verbatim. Comprehensive field notes were written up immediately following each interview to enable first reflections in advance of transcripts being analysed systematically using NVivo software.

For this report, a thematic analysis was conducted to generate the high-level themes and subthemes. These included context (individuals, changes to practices/ travel), Government roles (responsibilities, sources of information and oversight), processing risk information, perception of risk, implementation of risk mitigation, managing transmission, personal experiences and longer-term changes (see page 16). Quotes have been used to illustrate findings where appropriate, keeping respondent and organisational identity confidential by providing each with an identification code prefixed EX (experts), OL (organisational leaders) W (workers) or P (passengers).

Results – what we found

Between January and May 2021 we recruited and interviewed 30 participants representing experts and organisational leads across the UK; 17 experts (policy, research and industry) and 13 organisational leaders (bus, rail and tram / light rail) – see Table 2. Some respondents represented the devolved countries of Wales and Scotland in addition to England to help us understand the devolved nature of responsibilities and related implications for COVID-19 guidance and mitigations for transport policy across the UK. We also spoke to 5 workers and 12 passengers between April and May 2021.

Table 2: Overview of Interviewees in the Public Transport qualitative 'deep dive'

Type of respondent	Number	Total	ID Number Prefix
Expert – Research	5		
Expert - Government / policy	7	17	EX
Expert - Industry / regulator	5		
Org leader / union - bus	5		
Org leader / union - Rail	7	13	OL
Org leader / union – tram / light rail	1		
Workers - rail	4		
Workers - bus	1	5	W
Passengers	12 Mix of current and lapsed users for train, bus, taxi	12	P
Total	**47**	**47**	

To assist with the interpretation of the results, the following sections have been grouped according to the themes from the analysis as follows:

A: Context and information sources, including sources of information.

B: Perceptions of transmission risks, including understanding risks – expert and organisation leader perceptions, different transport modes, comparing public transport with other situations, inequity in society, understanding risks – workers and passenger perceptions.

C: Processing of information including responding quickly and flexibly, interpreting guidance, communications about the pandemic, implications of the vaccine programme and new variants of COVID-19.

D: Implementation of risk mitigations including mitigations applicable to workers and passengers and effectiveness of mitigations.

E: Management of and compliance with risk mitigations including perceptions of facilitators and barriers of mitigations, monitoring mitigations, specific mitigations (social distancing, face coverings, cleaning, capacity and crowding measures, policing and challenge, observations of transmission, wilful non-compliance, reliance on the behaviours of others, COVID-19 security and relationships and individuals.

F: The future including short and longer term challenges for example testing and compliance, subsidies and ownership, industry co-operation, capacity reliability and viability of public transport, links to wider agendas (green, accessibility), learning from the pandemic including some positives.

A. Context and Information Sources

All experts and organisational leaders described their work in the last 12 months having changed significantly, whether it be tailoring their research to take into account COVID-19 or researching COVID-19 directly, developing very rapid policy / guidance associated with COVID-19 or taking the guidance and operationalising and implementing it in a public transport context. All described the rapidly changing environment and the challenges of gaining the right knowledge to inform decisions being made in an accurate and timely way.

> *"…one is to help our train operators […] understand what technical mitigations at stations and on trains are available to them, which they should implement, why they should implement them, how they should implement them […]the other area I've been leading on […] is what research is being done […] that are relevant to rail." (EX4)*

> *"I suppose directly the role hasn't changed, in that in a role like this I think you have to be ready for anything […] So you just adapt and inevitably the focus of myself and others in the business is you switch to business continuity, in terms of, right what do we need to do this week, next week, for the next few weeks et cetera, in terms of getting through the different phases of the pandemic and adapting the operation of the business accordingly?" (OL5)*

Workers also described significant changes to their working practices, characterising the impacts that policies had on their roles and responsibilities. Frontline staff often had periods at home or periods of furlough, particularly if they had medical conditions which might have put them at additional risk. While these changes were generally seen as acceptable and necessary, there was an impact on morale.

"Well, obviously the nature of my job involved a lot of customer contact or very close contact, if not actual physical contact. […] when the lockdown started, my job role was actually stood down from the business. And that went through from mid-March almost a year ago, until early July at which point they decided they wanted to try and offer some kind of service. I mean, since then the role has changed, in that although we are offering a service, it's very much the customer needs to come to us, we're certainly not offering a trolley service, we're not going through the train to minimise the contact with the general public. The café bar has opened, we have a very limited range of food, people have to socially distance to queue. We're obviously now, wearing a lot of PPE [personal protective equipment], we've got aprons, we've got gloves, we obviously have to wear our masks and some people are also wearing visors. We're wiping down the surfaces a lot more within the area that we're working, we've got a lot of sanitiser wipes. We're constantly cleaning now, I feel that's part of the job that we perhaps didn't do to the extent that we do now, previously." (W5)

"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 because…and not really in a good way either because, you know, you're just alone all day and you don't have that camaraderie that you have and the support from your colleagues, you don't see them." (W4)

Almost all organisation leaders and many of the experts (industry) pointed to the transport sector working together through the pandemic period. This facilitated information and knowledge sharing but also helped to develop a consistent message for workers and passengers that could be more easily understood. It was most common for companies to group together by mode of transport, so rail or bus but there was some cross interaction with light rail / trams. However, certain travel modes were more isolated. For example, the taxi sector, where the majority of taxi drivers are self-employed and licenced through Local Authorities.

All passengers reported a reduction in their use of public transport, many in change of mode (e.g. long distance to local, train to bus or taxi) and reasons for using public transport (e.g. less commuting and leisure destinations, more only when need to travel e.g. medical appointment, food shopping) since the start of the pandemic.

Sources of information
There was some confusion at the outset as to who was responsible for what during the pandemic between the different levels of actors in the public transport sector – Government, industry, company, employee and passenger. Experts and organisational leaders working in / with public transport were asked about sources of information that were available and accessible to them to help with their decision making in relation to research, interpreting guidance, developing policies and introducing mitigations against the spread of COVID-19. The following are a list of commonly mentioned sources by our respondents:

- Department for Transport (DfT), devolved Governments and Health and Safety Executive (HSE) for official safety guidance advice and information;
- Public Health England (PHE) and local authorities (LAs) for data on infection rates, different variants etc.

"As far as the external world is concerned, we spent a lot of time and effort in the first, sort of, three months or so trying to work with the industry and the Health and Safety Executive, PHE, Department for Transport and others, to write some guidance for the industry. So, there was a fair amount of running around trying to understand what the issues were and get stuff drafted and written." (EX18)

- Ongoing research – for example, the Real-time Assessment of Community Transmission (REACT) and TRACK studies, Office for National Statistics (ONS), ZOE app, Rail Safety and Standards board (RSSB) work;

  "We discovered in June because of the ONS data […] that there were certain occupations that had higher mortality than other occupations compared to the national average and that included taxi and private hire, but also include bus drivers." (EX25)

- Academic papers; on the effectiveness of face coverings, cleaning, ventilation and latterly on the role of vaccines and transmissibility of new variants;

  "I've been using the Imperial College's REACT data, the ONS's Infection Survey. I've been using the information coming out of the COVID-19 Symptom Study, the ZOE app. So, I've been using all of that to look at infection rates, and then just all the academic papers essentially, so all the things they have to say about mask effectiveness, about ventilation, about the new variants." (EX6)

- Sector partnerships (formal and informal), regulators, industry bodies, Unions;

  "There's multiple teleconferences every week, […] I think this is good practice, so that's happened several, many times since. So within the railway family, I would say very open." (EX4)

- Feedback from passengers and workers directly (organisational / regional or national scale, discussions, surveys, social media etc.) or from other sources (e.g. Transport Focus surveys).

  "We monitor things like customer satisfaction all the time anyway, so things like are our social distancing arrangements adequate? What is the impact of the reservation only policy on customer satisfaction, things like that?" (OL5)

Experts and organisational leaders were also asked about oversight and regulation during the pandemic. They had formal links with DfT (generally) who were providing information and guidance, PHE and LAs (in relation to public health), as well as the HSE, mode specific regulators (e.g. Office of Rail and Road (ORR)) and transport representative bodies (e.g. Confederation for Passenger transport (CPT)). Many respondents said it was complicated when different statutory / advisory bodies and potentially individuals within these provided different information, advice and interpretations of rules. This was a particular problem at the start of the pandemic. They explained that this made it difficult at the organisational level to devise effective policy and operationalise guidance for workers and passengers:

"There were two particular points of conflict between us. The first was, we were presented with, what we were told, as evidence that if you worked with an individual in close proximity for a short amount of time, there was no risk of disease transmission. And because we complained so much about it, that lead to a series of meetings that were organised by the [named union] and the Department of Transport with Public Health England. And, with Public Health England continuing to push the line that working for a short time, 15 minutes or less in close proximity, was perfectly safe. And we challenged that, and we've never had a formal response from Public Health England on that, despite asking for it on repeated occasions. And we now understand that, actually, the 15 minutes came from WHO guidance that said, for track and trace, the definition of contact is, in close proximity with someone for 15 minutes. And somewhere in the mix, someone, and it must have been someone at a fairly high level, I don't know, either within HSE or PHE or within Government, took that to mean completely the opposite." (OL2)

Experts and organisational leaders spoke about the importance of trust and confidence in the various sources of information and many of the organisational leaders described how they themselves had had to become 'experts' in COVID-19 very quickly, assimilating the available information at that time and from that translating information into practical responses to try to keep workers and passengers safe while delivering an effective transport service. They also spoke of the challenges in balancing and responding to the many and diverse range of opinions coming into organisations (experts, industry, workers and passengers).

Once information has been sourced respondents told us that a lot of time was spent digesting and interpreting the information in order that accurate guidance could be written. This has been an ongoing process throughout the pandemic, each time new evidence is published and / or the context change e.g. ventilation being more important or new variants of COVID-19 being identified. Both experts and organisational leaders suggested that there was often a lag between new official information being issued and its translation into practical guidance within companies for workers and passengers:

> *"We made a decision last summer based on the various levels of risk […] and it was right to review whether that was still acceptable in the light of changed circumstances, including the new variants." (EX22)*

> *"Some of these things have been really complicated, and have taken a little while to resolve. And sometimes the guidance has appeared well after the verbal instructions, I'm sure there have been things that have gone wrong, but generally the guidance has ended up being consistent with the steer we've been given, we've been able to do the right thing, and then been supported." (OL15)*

However, workers were generally very happy with the communications from their employers about the pandemic and implementation of mitigation strategies, which shows that this difficult task was generally handled well by the companies they worked for.

> *"…they send regular updates via email, so any changes to any restrictions, any policies, and any ways of working they are clearly detailed in an email to everyone across the business. We have an intranet site, which one of our pages is dedicated to Coronavirus. […] But the company are really, really good, they are very detailed in any changes that do happen." (W1)*

Current passengers we spoke to suggested messages coming from individual public transport companies varied in mechanism (emails, texts, online, apps, at stations / stops or on vehicles), frequency and amount of information. Most agreed they had enough information and generally knew where to find it but that sometimes it was confusing, especially if different to guidance more generally (e.g. social distancing, face coverings). In contrast, lapsed passengers we spoke to tended to stress the message of only using public transport if you have to:

> *"So, I think for individual operators, they have on their websites, they will tell you what they are doing and what they are hoping you to do as well. But I don't necessarily go…to just actually go on that website and then check it separately, because I think a lot of the time, they have quite similar guidelines across different companies. It's sort of like an industry standard […] I do see adverts on like billboards, or posters or those BT [British Telecoms] advertising." (P9, current passenger)*

> *"I guess from a public transport perspective, the message that I've picked up, and it may be the wrong message but it's just the one about, you know, don't use it unless you really have to or try to avoid it, you know, that message hasn't really changed in my mind since." (P12, lapsed passenger)*

Differences in guidelines across countries, varieties of sources of guidance, and different interpretations of guidance was challenging and made the situation hard to follow at times.

Respondents from the devolved countries (Wales and Scotland) were more likely to say this was harder initially and used their contacts in England to get information.

> *"We were coordinating UK wide to make sure that if there was anyone falling behind, like Public Health Scotland or Wales for example, you know, we could say, well hold on, Public Health England have got this, they've made this decision, they've given us advice, let's make sure that, you know, the devolved nations have got this information and keep us all together, you know, with the best practice information." (OL12)*

However, as time went on organisational leaders from Wales and Scotland suggested the devolved Governments (responsible for public transport) were more accessible to them than their English counterparts.

Companies that had services crossing country boundaries (trains, buses / coaches, taxi) found it complicated at times due to different advice being issued by the devolved Governments. However, in the longer term some respondents saw interactions within the industry and with Government improving and hoped this would be a legacy of the pandemic.

> *"One of the principles that we have stuck to is to follow the government guidance. Which for us is slightly complicated by the fact that we operate in both England and Scotland, so we have to keep track of both sets of government guidance. Of course, the government guidance in itself, there's many different sources of it and you could argue a few different interpretations in some cases." (OL5)*

> *"Communication, both internally in our business and with other operators through CPT and government is the best it has ever been by a mile, you know, right down to minutia of detail." (OL14)*

B. Perceptions of Transmission Risks (processing, understanding, responding and communicating)

Understanding risks – expert and organisation leader perceptions

At the time of the interviews (January-May 2021; 10-15 months into the pandemic) experts/leaders generally considered the risk of COVID-19 transmission on public transport as low. However, this was in the context of low passenger numbers and mitigations having been introduced during the previous months.

> *"Interviewer: So if I said to you, what level of COVID-19 transmission risk do you think there is generally on public transport, what would you say?*
> *Respondent: Low. So, the railway has done a fair amount of work on this, if you go and look at RSSB has done some work, London Underground has commissioned work from Imperial College. There was an interesting piece of work they did recently where they went around London Tube carriages doing air sampling and touch sampling and all the rest of it, they found zero. So, transmission does not come from the trains, it comes from the people you meet on them." (EX18)*

Some experts were less certain and highlighted the lack of data around transmission and particularly the routes of transmission, wanted to see more evidence and described how they were not always confident in mechanisms being used to measure transmission in particular contexts:

> *"I guess the professional answer is that we don't have good data to indicate either way, but there are some of the same risk factors in place for transport which we'd expect to be in place for a high risk environment, which would be a number of people in close proximity potentially without the ability to physically distance in an enclosed space for an extended period of time." (EX3)*

> *"I think there is a measurable but very small COVID-19 transmission risk associated with public transport. People are trying to measure it at the moment, I'm not comfortable or confident that they are…there's any degree of credibility or any degree of accuracy around those figures, but I think there is a consensus that it's a small but measurable risk. Also it's clear that the risk is different according to what mode of public transport we're thinking about and what the local situations and circumstances are." (EX4)*

> *"As a person who works in the rail industry I'm not meant to say this, but not using public transport is the best measure, particularly as I said, if you're using public transport, you go in somewhere else where you could get it (the illness) or if you've already got it you're taking it somewhere else to give it to people." (EX6)*

Some respondents also recognised that the level of risk was not constant. It is affected by factors such as the time of day, where you are travelling to and from, journey duration, rural vs urban settings, type of vehicle travelling in and with whom. Interviewees expressed the view that transmission occurred between people and was dependant on how they used public transport (workers / passengers). However, public transport is used to take people to places, and we note that at these places, risk of transmission may be equal to or higher than in Public Transport.

Different transport modes
Experts suggested different modes of transport have different risks and components that influence risk (proximity, duration of contact, ventilation, cleaning regimes, numbers of people, demographics, community rates of COVID-19 infection etc.). Passengers also had differing perceptions of risk for different modes, and current passengers tended to report their most frequently used mode of transport as the safest. However, both groups generally considered similar factors in calculating risk: crowding and opportunities to social distance, perceived cleanliness, ventilation.

> *"So, I would, I think the highest risk for an individual would be when you're in a smaller space, so in a taxi or a shared car or a minibus I think are probably highest modes for an individual. From a population level, it's…again, it's hard to say, it's possibly the possible buses, actually are currently…the most, the biggest contributor… and this is just my view on it…but I think that will be because they are the most widely used form of transport for the highest number of people and they also are the mode of transport that people tend to have to use if they have nothing else." (EX8)*

> *"…it might vary depending on which public transport, like I know you're not really looking at Tubes, but certainly if I was going on an Underground, that might feel higher risk than getting on a bus with windows or a train with windows, you know. Or a taxi where it's just me and the driver who's got a screen between us and I know that they've been cleaning the taxi or whatever, that seems lower risk." (P1, lapsed passenger)*

> *"They're not very well ventilated [buses] and they tend to be a bit more cramped, and people need to pass next to you more than they do on the train." (P5, current passenger)*

Comparing public transport with other situations
Respondents were asked to compare risk (of contracting COVID-19) on public transport to other situations – most highlighted issues of being in a confined place (and the inability to walk away), for an amount of time with other travellers or workers (who may or may not be complying with guidance on face coverings/social distancing), with variable ventilation. Many suggested that passengers and workers were reliant of others' behaviour and compliance with the rules.

> *"Shopping, very similar, because they're both indoors, they've both got people who are unpredictable around…Probably about the same. No, maybe, a tiny bit more, because in supermarkets you can move…Whereas on buses, if you get somebody strange who isn't wearing a mask or coughing, there isn't a lot of places to go to get away from them." (P2, current passenger)*

Inequity in society

Respondents (especially experts) were also concerned about the inequality of risk from public transport across society, highlighting that certain groups have less choice about the types of transport they use and are therefore disproportionately affected by any risk. In addition, it was recognised by many that the demographics of the workers within the sector included groups / individuals who may be at elevated risks for infection or may be more vulnerable in relation to COVID-19, and work was done within the industry to carry out individual risk assessments to manage that.

> *"Another really important part of this which we haven't touched on is the, sort of, equality issue as well, because for some people if they want to do those things, or they would just simply want to go to work, they […] have no choice. They have to get on a bus, they have to get on a train, or whatever, or they have to get on the tube, because that's the only way they're going to get to work." (EX9)*

> *"The bus driver population does tend to be a bit older and we have a bigger BAME [black, Asian and Minority Ethnic] community in some parts of our business, like London. So, there are some risk factors in there for our people, and we are trying to manage that." (EX1)*

Understanding risks – Worker perceptions

Workers within the transport industry presented mixed assessments of the risk they felt at work. Most reported feeling safe generally, but also highlighted particular circumstances where they felt at risk. Usually, this was in response to passenger or colleague non-compliance with behavioural mitigations.

> *"So, I think difficulties would have been mainly from my point of view, people, colleagues and customers not adhering to the rules. I mean, you can walk through a train, and the amount of people that don't have face masks on is quite high, we're constantly having announcements that they should wear them. And they know they're doing wrong, because they see you walking through the train, and they suddenly pull their mask up, and you turn round after you've walked past, and they've pulled them down again. That's frustrating." (W5)*

Understanding risks – Passenger perceptions

Most current passengers told us they felt relatively safe in the context of much lower passenger numbers and the mitigations they could see public transport companies implementing. Like workers, they began to feel less safe when they could see others (workers / passengers) not complying with the rules.

> *"Now, I would say I feel that it's one of the safest forms of transport [bus], and I think that's probably because I'm very used to it. Also probably because I've had my first vaccine, waiting for the second. And I think you just then get used to…so you still have to wear the face mask to get on, I still have the sanitiser in my bag, but they feel very normal, so I'm quite comfortable with it now." (P11, current passenger)*

> *"I think generally, if they're all applied as probably envisaged by the scientists, I think that they will all aid the avoidance of COVID, they're not going to stop it completely but as a package of activity, I think if they're all applied, it'd be really good. The problem, as I've said before, is: is it possible to do all of that with crowds of people and the behaviour of everybody? You end up to the lowest denominator, in reality. Some people aren't abiding by the rules, you're putting yourselves at more risk." (P12, lapsed passenger)*

In particular, a common theme was a desire to see that an environment was 'controlled' or that the passenger had some autonomy in the environment, and that this sense of control made people feel safer.

"I think the fear factor and, you know, that whole socially distance and the surface touching, all those things, I just felt at that time that I just didn't feel comfortable with that [taxi], whereas I just felt getting on the bus, it was slightly more controlled." (P11, current passenger)

"Depending on what bus it is, sometimes you can feel like there's not as much space to have more freedom of being able to move around 'cause you're situated in one place whereas in a metro you can move around a little bit if you feel like you're in an unsafe bit whereas in a bus you can't exactly do that. […] Our metros have two carriages. It could even be if you don't feel right in one you can just go to the other one." (P10, current passenger)

"I think it's probably higher [risk] on a bus than it is a train to be honest even though they are limiting numbers on buses. Simply because I don't think that the rules are being enforced as rigidly shall we say." (P15, current passenger)

C. Processing of Information

Responding quickly and flexibly

Experts and organisational leaders across the train, bus and tram sectors were keen to tell us that they had acted quickly and decisively working to the information they were provided. They highlighted the benefits of a cross sector response to the pandemic. We were told about industry wide forums being established early in the pandemic which could help to filter information and knowledge and co-ordinate a standard industry response. Different fora were formed for the different modes of travel but all were aware of their existence across the sector. For example, the CPT facilitated this for the bus sector, while a new Rail industry COVID forum was established via the Rail Delivery Group (RDG) and others referred to various public transport authorities.

These groups had been established quickly, met regularly and were described as facilitating bold decision making and helped by providing a consistent message to workers and passengers. These groups helped develop trust between the diverse participants (industry, organisations, unions, regulators etc.) and allowed quick sharing of information and decision making to take place due to the seniority and roles of individuals sitting on the groups.

"So, we are a member of the Railway Industry's Corona Virus Forum, it's got a group that meets, I think it meets on a weekly basis, that talks through every and any issue relating to Corona Virus. It's chaired by a trade operating company director, but there are safety directors, managing directors. But also, there are representatives from the trade unions on that meeting. […] So, there is quite a lot of information exchange." (EX18)

"During COVID, even though we are not personally really responsible for the health and wellbeing of say the bus operators, employees or the taxi and private hire, we'd really work closely to make sure that they are getting the sort of same level of advice and support and input that our own employees have been getting." (OL1)

Respondents talked about flexibility at a time of crises and having regulators and Government allow companies to carefully flex rules and systems to allow services to continue while keeping workers and passengers safe:

"And you think to yourself, what actually goes into that, you know, first of all legislation, 'cause we've to give 56 days' notice to change a bus service, but that was out straightaway. So, we've been talking through CPT [Confederation of Passenger Transport] to DfT [Department for Transport] about emergency powers to suspend the registration period, and so it was dropped to 24 hours… So, that was industry talking to government at high level about the things we would need to do from a regulatory point of view to be able to restructure the business." (OL14)

Interpreting guidance

Interpreting messages from Government and advisory bodies wasn't always simple. The messages changed quickly and sometimes were not practically focussed or detailed enough, which according to some of the responders resulted in unintended consequences and disruption. Issues discussed by respondents included: i) leaving guidance open to interpretation, ii) inducing fear in both employees and customers, iii) inconsistencies between interpretations of guidelines between different government departments leading to requests to change risk assessments, iv) some lack of clarity on details (e.g. exemptions from face masks, requirements for face masks vs face coverings, definition of 'essential worker', when is it okay to move from 2m social distancing to 1m+mitigation), and v) lack of information regarding payment during self-isolation which could promote presenteeism (workers). There was also discussion about ambiguity in the guidance and the need for clarification from Government, especially at the outset or when circumstances change with respondents explaining how moving from guidance to operational practice could be complex and time consuming.

> *"For lots of the people who are more operational and in the businesses, just as soon as you've got on top of one thing, then something else comes up. […] I mean, there's a real feeling of disorganisation and chaos at central government and that they really don't know what they're doing and that they're just winging it, totally winging it and they've got no sense as I said before of what these changes mean on the ground." (EX2)*

> *"Then you get a new variant, and, initially, the governments are very good at chucking numbers, aren't they, and going, this is 30 percent more transmissible than…But what comes with that isn't any kind of updated guidance that goes, well, actually, because it is 30 percent transmissible because of this…does it last longer on surfaces or is it more transmissible because it's through the air? What is the route of that?" (EX1)*

> *"This is about the physical partition, and they've worded it in such a way as it gives them carte blanche to interpret things differently. And we have had this out with them, and they're devils for doing this, to make sure that they don't leave themselves in a difficult position. And you could interpret that on school vehicles each seat has to be encased in Perspex floor to ceiling." (OL14)*

For workers and passengers the majority (both current and lapsed passengers) believed guidance for travel in the pandemic was fairly easy to understand. The complications emerged where guidance and rules for transport was different to the general pandemic guidance (e.g. face coverings on public transport vs in shops).

> *"I think there was no confusion for me, it was very easy to follow and made sense." (P11, current passenger)*

> *"I think now it's a lot easier to understand. I think when it first came in to place, like, the masks weren't an issue with the buses, but it was more people that were exempt, were you allowed to refuse travel if they never had a mask on but they just told you they're exempt. I think right at the start there was the grey area. It wasn't just the travel industry." (W7)*

Particularly among passengers with more experience of using public transport during the pandemic, there was some concern about the practicality of some guidance, for example the instruction to use quieter stations or to wait for the next service if current one is busy. This was perceived as unhelpful if your journey time mattered e.g. travel to work, or the instruction not to eat/drink on public transport which was seen as impractical on long journeys. While for workers it was the challenge of making the guidance part of everyday work:

"I mean, you can't [wait for the next service], 'cause that's in conflict with some of the major train companies, where you have to have booked a seat. And it's impractical if you live in an area where there's only an hourly service. […] And I think to say don't eat or drink on a journey that might last for three hours, is a bit unrealistic frankly, I mean most people want at least a drink of water in that time. […] And also, not touching a surface, I mean, it's unrealistic, you can't walk around with your hands in the air on a train, or getting on a bus, because you'd fall over." (P8, current passenger)

"Just initially lockdown. It was…as I said, some of the drivers in here have been driving buses for 40 years and now you're telling them, you know, this is now part of your day-to-day routine" (W7).

Communicating about the pandemic

Some (experts and organisational leaders) believed Government messaging and publicity in the media had perpetuated a message of high(er) risk on public transport which was not supported by evidence:

"They specifically said, avoid public transport. And this was really, really unhelpful because it was not based on any scientific evidence, there hasn't been and still to this day hasn't been any evidence that public transport is a transmitter or a particularly virulent environment for the virus. But they sort of based it anecdotally off the idea that…and it's very London-centric idea, […], people catch colds if they catch the Tube a lot, so they sort of did it off this anecdotal, well, it's very crowded, it's very busy, and everyone knows that it's quite dirty […] so therefore there will be a hotbed, so they said, avoid public transport." (EX2)

Communicating messages on to workers and passengers was a challenge in terms of the correct message and the form of communication which needed to go out consistently and quickly, as explained by an industry expert. A one size fits all guidance and communication mechanism did not always fit all modes of transport as one expert explained regarding taxi drivers:

"The guidance that was issued and spoke very much about the employer's duty to employees and that may work when you are a very large multi-national that has health and safety experts coming out of their ears, and they can do these assessments and look at all the processes they can put in place. Taxi and private hire they are basically all self-employed there's 360,000 of them. So trying to get a message out to them was difficult." (EX26)

Implications of the vaccine programme

During the research period the vaccine programme was being rolled out and many respondents commented on the implications. These included some believing it made little difference (until the majority of adults had had 2 vaccinations) to managing the risks, some thought it was giving both workers and passengers a false sense of security with corresponding alterations to their behaviour which was difficult to manage and there was some concern around implications for vaccine passports and 'no jab no work' schemes.

"We know that the bigger worries 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. So…and until you've had the second dose, and it's been a sufficient period of time, and if we know whether it works against the new strains, so whether there's any resistance. Until we know whether or not it actually prevents you from getting it, as well as preventing you from spreading it. Whether or not eventually you need a passport with…a COVID passport to be able to travel, or you need a COVID passport to be able to go into football stadiums, I just…I don't think we're there yet, and I don't think we know." (OL6)

"It's [vaccine passports] unlikely to come into policy for public transport just because… the enforcement or the logistics around that, but is there going to be demand for that, is there going to be drive for that?" (EX3)

A current passenger described the relief of having the vaccine but suggested they wouldn't change behaviour, at least initially, as mitigations for travel had now become the norm. Most passengers talked about the vaccine increasing their feelings of safety and confidence in using public transport, particularly after having both doses. Increased feelings of safety also came from knowing vaccination rates in the wider population were also increasing.

"I think, definitely being fully vaccinated will help with some of that anxiety, in terms of travelling." (P17, lapsed passenger)

"I probably feel a little bit safer. I don't feel invincible, but I feel...and it hasn't changed my behaviour, but probably, in the back of my mind I feel a little bit safer […] Yeah, I suppose it's made me feel a little bit more confident […] because I feel that I have a degree more of protection and that...especially the age group of the demographic that uses the bus that I get on, that most of them will have had theirs, as well." (P6, current passenger)

New variants

During the time we conducted the interviews, the Alpha variant was firstly most prevalent, but concerns then grew about the Delta variant. Both experts and organisational leaders expressed concern about this new variant, but were unsure about what, if any, changes to make. Even some of the experts were not certain of the implications:

"So, quite a lot of our union reps have said to me at the start of the new variant, what do we need, what's different? Do we need to review our risk assessment? And I was like, well, we can, but we don't know what we're risk assessing, so, you know, it becomes a really difficult task to conflate that into policy and operationalise it in the business into something that is different from what we already do. […] There is always this lag between that…that knowledge surfacing and the actual kind of, the nuts and bolts behind it. Because the devil is in the detail." (EX1)

At this time more workplace testing was being implemented but with associated concerns over logistics of testing on site, the reliability of tests and supporting staff that had to isolate. The new variants issue also prompted several organisational leaders and unions to make enquiries about public transport staff getting vaccines earlier than their age group suggested due to increased perceived risk.

Passengers were also concerned about the issue of new variants (generally, not specifically in relation to public transport), made links to the ongoing vaccination programme and suggested since the new variants had been discussed they were more cautious generally.

"Yeah, I'm worried about that and I know they're talking about a booster in September for some people, yes, obviously that always is a worry, and also be worried going back into another lockdown as well, that's always kind of in the back of my mind." (P14, current passenger)

"They're very unsettling. I think any new variant is unknown, potentially in terms of risk and impact. In your mind you go, what does this mean risk wise, is it more deadly, all of those kinds of things. But I suppose, where I am at the moment, any variant is an unsettling variant, because of no immunisation at this point in time." (P17, lapsed passenger)

D. Implementation of Risk Mitigations

We asked respondents what mitigation strategies were being utilised (January – May 2021) in the public transport context to help protect passengers and workers from the transmission of COVID-19. All experts and organisational leads made comment without prompt on social distancing, face coverings and transport capacity and the majority mentioned hand sanitisers, enhanced cleaning and ventilation. One expert stated:

> *"The most effective measure that you could do is to keep all the windows open and to have people cleaning their hands on the way in and on the way out, and to wear a mask. Those are the absolutely the best things you can do." (EX16)*

The following table shows mitigation measures mentioned by the organisational leaders, Union representatives and experts (see Table 3). The majority of workers and passengers were well aware of most of these mitigation measures.

Table 3: Mitigation measures (Experts and organisational leaders)

Mitigation (Listed alphabetically)	Detail
For passengers / workers	
Capacity on transport	Numbers of services, numbers of seats accessible etc. to avoid overcrowding, reservation only services
Enhanced cleaning regimes	More regular, focus on touch points, different cleaners, antiviral surface treatments, fogging machines
Face coverings (often referred to by respondents as masks)	Face coverings were mandatory* on public transport for passengers and workers in specified contexts
Hand sanitiser provision	Provision by organisations for workers / passengers
Social distancing	1m+ and 2m, seats closed off, in places where staff gather, limiting worker and passenger interaction, signage, one way systems.
Stations / bus stops adaptations	Social distanced queues, one way systems, new signage / posters
Technology	Contactless tickets / payments, apps, virtual training
Temperature screening	Passengers / workers
Ventilation	Increased air circulation, keeping windows open (signage)
Additional for passengers	
No eating / drinking / free papers on public transport	Less touch points / litter
Additional for workers	
Adaptions in vehicle	Screens, money shoots, one way systems
Campaigning for early vaccinations	Campaigning as key workers (by unions and employers)
Clinically vulnerable staff - shielding	Shielding if worker or family needs, pregnant workers
PPE / gloves	Visors, masks (grade higher than face covering) and gloves
Staff testing and isolation	Lateral flow / PCR**, pilot testing, private testing
Staff working from home / furlough	Taking staff away from risk
Training (staff)	Keeping safe, keeping passengers safe, challenging behaviour
Work bubbles	Close proximity, shift pattern staggering, in-person training

* Except for those 'exempt' (or claiming to be exempt), which is a point of difficulty for implementation
**PCR polymerase chain reaction,

Mitigations applicable for workers and passengers

For mitigating risks for both workers and passengers the introduction of enhanced cleaning regimes, face coverings, use of hand sanitiser, social distancing, use of technology (apps, online ticket purchases/seat reservations etc.), improvements to ventilation, station and stop adaptations and in some cases temperature screening were mentioned by experts and organisational leaders, and reiterated by workers.

In the context of managing capacity and passenger numbers on transport, measures included number and frequency of services running, number of carriages (trains, trams, light rail), number of available seats (to comply with distancing regulations) and pre-booking travel on certain modes of transport (trains, taxi). As the interviews progressed evidence about better ventilation began to filter through and by the April - May 2021 interviews all respondents made reference to the importance of good ventilation.

> *"A lot of it mirrors the government messaging, which, you know, to a large extent has been supported by the science behind it. It's about social distancing. It's about is it clean. It's about are people wearing their face coverings, but combined with that it's the behaviour of other passengers as well, and more recently ventilation as well." (EX9)*

Most respondents, especially organisational leaders, believed that if workers and passengers followed the guidance as set out they would be at relatively little risk. However, some cautioned about the completeness of the protection afforded by safety measures generally, and others over compliance and behaviour as circumstances change.

> *"You know, I think the staff, if they adhere to the measures that have been recommended, should be fairly well protected. I think the passengers as well, if they adhere to the measures, like wearing a mask, keep the windows open if they are openable, clean their hands; I think if those measures are adhered to, on the whole, you know, everyone should be pretty well protected." (EX7)*

> *"I heard that, in one of their secure workplaces, [named and geography described] has had a COVID outbreak in the last week, with seven people being diagnosed with COVID and taken off work. 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. And you must hang around needlessly, in a lot of cases." (OL2)*

Mitigations for passengers (only) and workers (only)
Additional mitigations brought in specifically relating to passengers were designed to reduce contact with surfaces (no free papers, no food or drink, less litter) or avoid aerosol release (shouting, singing). See Table 3.

In relation to keeping workers safer many companies took measures to protect their more vulnerable staff. This included updating company policies, adapting the work environment (home, office, vehicles, depots, stations etc.), performing personal risk assessments with staff to identify pre-existing health issues and providing support in relation to bereavement, furlough, parenting etc.

> *"We updated our policies, like flexible working policies, family friendly policies, parental employee benefits, diversity and inclusion work, a big wellbeing questionnaire to all of our staff." (OL5)*

In addition to face coverings, some of the respondents also mentioned the use of visors, medical grade face masks, gloves, etc. These were provided by companies, and the industry worked together to commission supplies:

> *"So, quite early on, Network Rail because of its sheer size and buying capacity took on the job of supplying the industry, for example, with PPE or masks. It diverted one of its depots over so it acted as a central store, so it ended up with millions and millions of items of PPE that it had bought in." (EX18)*

The bus and taxi sector, where drivers come into greater direct contact with passengers than trains /trams, made adaptations to the vehicle environment at an early stage. This included screens between the driver and passengers, encouragement of contactless payments, and one way systems for boarding vehicles. On some buses, these screens were initially a curtain of flexible plastic because Perspex was in short supply; however, these were eventually replaced with rigid Perspex screens. However, some unintended consequences resulted such as some buses losing air circulation if the driver's door wasn't opened at each stop and fitting screens in taxis was often costly, complicated and guidance on this was still uncertain (May 2021).

"The protocols that we put in place in terms of checkerboard seating, blocking off, distancing, fresh air. We had [named University] do trials. They started in London because they closed the front doors on the buses in London so that people weren't going near the driver. Well the way the airflow works in the bus that actually is counterintuitive to do that because that was actually worse because the air at the front was remaining still and circulating with the driver rather than it being purged when the front door opened. So, we learned a lot about air movement." (OL12)

"We needed technical guidance on screens […] we went to our technical engineering specialists who regulate the technology of motor vehicles and they worked through it very thoroughly, bringing in external engineering know how to come up with a very workman-like set of guidance's to help the taxi drivers themselves, but then also to help the licensing authorities, who are the local level, the regulator, the local council of this trade. We are still working on screens." (EX25, early May 2021)

In many of the companies work bubbles had been instigated to try and protect both staff and continuity of the business. Some work (e.g. engineering, signallers, training in cab etc.) is not compatible with social distancing but for safety needs to continue. Organisations have therefore split workers into 'bubbles' so that if a breakout happens not all staff have to go off sick / isolating.

"They are sort of rota'd onto shifts in bubbles, so that if, you know, one of them tests positive, then that bubble of staff would then self-isolate. So it kind of mitigates risks of other…the broader sort of team." (EX24)

Transport companies were beginning to put into place staff testing for COVID-19, some of this was via National Health Service (NHS) piloting and some was instigated by the company themselves. This enables workers to get tested several times a week but in terms of logistics was very complex for many companies. Public Transport companies could be spread across many sites so identifying locations suitable for testing (access, space etc.) was a challenge and involved asking workers to travel to other locations, arrive earlier than shifts began etc. There was also concern about additional testing and the accuracy of the lateral flow tests being used in terms of more staff having to isolate for periods of time. Many of the organisational leaders suggested they were trying to work with NHS testing pilots or setting up a company testing regime but there were many barriers to overcome before this could happen.

"It's all very well for [the Government] to say workplace testing is available for all employers of over 50 people. But there's a 243 page slide presentation that has to be complied with, to the letter, in order to set up your own testing site. Then you have to find volunteers to actually operate it, as well as finding somewhere to do it in, and then you have to get people there. And experience in the industry is nobody really wants to volunteer to operate a COVID testing side. And people don't really want to travel to it either and they don't want to attend it outside of their working hours. So it hasn't proved that universally popular in the pilots that have been done thus far." (OL4)

Effectiveness of mitigations
Most in the industry suggested it was difficult to tell which mitigation strategies were working as the relative risk of each transmission route was unknown. Thus, highlighting that industry leaders were making decisions at a time of little certainty about which strategies were essential / desirable / effective. However, it was also suggested, in response to this, that face coverings provide effective mitigation because they work across all transmission routes and were a sensible public health mitigation wider than COVID-19.

"I don't think we really know, that's the issue we keep hitting in the rail industry, is we don't know how good any mitigation is. We don't know, like the fundamental, first of all we haven't got any Test and Trace data, so we don't know how many transmissions have happened on rail. […] And then we don't know what kind of proportion of infections are caused by the aerosol route, the large droplet route, or the surface contact, people touching infected surfaces. So, we don't know how that splits down, and then that impacts all the different mitigations." (EX6)

"So, I think masks I think are very effective because you are…or a face covering because they will mitigate just about all of the transmission routes, so they will stop the virus being omitted which means there's less of it on surfaces, there's less of it in large droplets, there's less of it in aerosols and they also provide a certain amount of protection to inhalation and to stopping people touching their faces." (EX8)

Interpretations of effectiveness were also hampered by practical considerations. Many respondents mentioned that relative effectiveness of risk mitigation strategies was hard to determine because they were all introduced at pace at the same sort of time. Therefore, because the mitigation strategies have not been used in isolation, their effectiveness comes as a bundle: face coverings, social distancing, cleaning. Other respondents indicated that mitigations were layered on top of each other, with little evaluation, so it was difficult to tell which measures were most effective or if all measures were necessary, as one OL explained in relation to cleaning regimes:

"Well, we've done a massive amount on cleaning and hygiene […]So we, what we tended to do is we've overlaid a lot of cleaning on our normal cleaning regime, and we're actually now get to the point of thinking, actually we've layered stuff on top and it won't and it's not always necessarily the most effective way of doing it." (OL4)

It was also recognised by some experts that effectiveness of mitigations was linked to their acceptability and levels of compliance with behavioural mitigations. Where mitigations are challenging in terms of acceptability (e.g. windows being open in the winter) or behaviours are hard to enact (e.g. developing skin conditions from hand sanitizer use), the effectiveness of these mitigations will be compromised.

"So, okay…well, there's a kind of a difference between what would be most effective and what would be most tolerated by people. So, you could put in very effective measures, but they wouldn't…people would, maybe, stop using the bus or stop abiding by them. So, there is a sort of, effectiveness equals, you know, the measure of compliance, if you like." (EX16)

However, workers and leaders spoke about some of the challenges of applying the new rules, especially in a confined space and with people you have worked with for a long time. It was suggested by some that part of this challenge was because colleagues trusted one another, and this was hard to reconcile with the mitigation measures.

"So in terms of on train crew, because they're in a smaller environment, they sometimes forget that social distancing still needs to be adhered to. And I think because they are really good friends and it's like sometimes going to work is like a day out for them really." (W1)

"It was almost an expression of distrust. Remember how difficult it was back in February [2020], to stop people shaking hands and things like that? So, I think they felt they were insulting the person they were taking over from." (OL15)

It should also be noted that many respondents foresaw the continued use of many of the mitigations (e.g. social distancing, capacity control, face coverings etc.) at that time, even when the economy opened up further:

> *"I think it'll just remain the same as what it is just now. […] Perspex screen, I think they'll always be there now. […] The sanitiser stations will always be there now. I think the only thing in the future that will go away will be the masks. I think everything else will still be day-to-day routine." (W7)*

E. Management of and compliance with risk mitigations

Perceptions of facilitation of / barriers to mitigations

Experts, organisational leaders and union representatives were asked about the factors that had facilitated or hindered operationalising and implementing the suggested mitigations against the spread of COVID-19. For detailed tables of facilitating factors and barriers to implementation refer to Appendix C.

Many of the barriers identified by respondents (experts, organisational leaders and union representatives) had been exacerbated by the rapidly changing context (policy / guidance, knowledge, community COVID-19 rates etc.). It had therefore been a challenge for undertaking research, formulating policy, operationalising and implementing changes required to help keep workers and passengers safe as well as maintaining a functioning service.

Examples were provided of changes to legislation and guidance coming in so quickly, experts found it hard to advise and organisational leaders to convert the messages into sensible guidance for workers and passengers in timescales required:

> *"The face covering legislation was introduced at very short notice really. We were told it was coming and we had discussions with the department around what was going to be in it. But ultimately, the final version I think was…the legislation was made at the weekend and it was supposed to be effective from the Monday. So in terms of the industry communicating all of that to its staff, that was pretty difficult." (EX22)*

> *"And the message from DfT about lateral flow testing was that sort of thing, it was, we need your feedback in five days to go live with this in a month or something, so it was quite difficult for rail employers to actually operationalise some of these ideas." (EX19)*

Some respondents spoke about confusion due to the timing of advice and implementation of some mitigations such as face coverings or social distancing. Whilst many agreed with the advice, it was difficult to communicate to workers and passengers when in other environments they did not need to follow the same rules:

> *"…think we saw a lot of confusion last year, sort of last summer when public transport introduced face coverings before other settings. So we went first and mandated face coverings on public transport ahead of supermarkets and shops and things. And I think we did the right thing but what I…the surveys and things that we've done, I understand that people found it quite confusing. […]And I think it caused…I think the inconsistencies caused confusion." (EX24)*

Some organisational leaders put in place their own guidance for staff / passengers before things were mandated by Government guidance and others were responsible for multiple operating companies so moved quickly to establish new ways of working across the business. This was not their usual way of working but vital to keeping the whole business functioning.

"But we took a decision that the wearing of face masks would give reassurance to other workers that if you, the individual...it wouldn't stop you getting COVID, but it might stop you transmitting the virus. And that was the line that we had to pursue quite vigorously, to get it taken on board…We then developed that in our guidance that we issued just at the beginning of the summer." (OL2)

"So, we put in place a response team in the business before the first lockdown because of the way that it was developing. So, I think that has helped us a great deal to be, as a company, quite fleet of foot in our response to things. We have a lot of operating companies, and it allowed us to quickly take policy decisions and operationalise them for our whole business. That's not our normal mode of operation. We're quite, you know, we allow operating companies to manage their businesses, but on this subject we've gone into crisis mode and it's allowed us to respond as quickly as we can really." (EX1)

Respondents explained that most mitigations to COVID-19 transmission had challenges on public transport. If it is cold, having windows open for ventilation is a challenge, for example. While if you have committed to using public transport as a passenger, predicting capacity is a challenge and can lead to tightly packed vehicles. There was also the issue of increased costs in putting in the recommended mitigations, particularly at a time of decreased revenue.

Organisational leads explained the reasons they had heard from passengers for not travelling on public transport. This included practicalities and reasons to travel as well as emotional reactions:

"But the top three are, government guidelines, not travelling for leisure and I'm working from home […] And then emotional reasons, the top one is, I don't want to put myself or others at risk, I'm anxious about using the train […] I don't trust other people." (OL4)

Monitoring mitigations
As the majority of mitigations implemented in public transport settings were at least to some extent behavioural, continued adherence with these behaviours from relevant parties has been essential. All respondents spoke about compliance with behaviours and many discussed ways in which they monitored this. While compliance was generally seen as high across the different behaviours, it was noted that even small numbers of incidents can have a large impact on the perceptions of risk. For other respondents there were concerns about complacency over time, especially as lock down restrictions were to be lifted.

"It doesn't take a lot and we've seen, sort of, stubborn significant minorities on some of those measures, like the other passenger behaviour, you know, coming through from some of the satisfaction scores. It's like...you know, and that doesn't take a lot of that to, sort of, percolate through and, you know, create a situation where people don't think it's a safe environment." (EX9)

Passengers held a generally positive view of the public transport companies, the mitigations implemented, and workers' adherence to mitigations. Most suggested that there were no further mitigations that could be put in place. Instead, it was compliance with the existing mitigations that they felt should be the focus of improvements. They reported many incidents of other passengers not following guidelines; while passengers observed that *most* people were adhering to guidelines, it appeared that the notable occasions where they had observed non-compliance had stuck with them.

"No, the public transport people themselves are wearing masks, they're keeping distance from you. I mean, when I was getting on the train, the guard walked right back into the seats, so that I could get past and keep distanced. No, they are doing what they should be doing." (P8, current passenger)

Social Distancing

Some organisational leaders noted procedures for the monitoring of social distancing between staff, usually through managers observing the behaviour of others, but within other organisations employees were trusted to adhere to behavioural mitigations. Most organisational leaders reported that they felt compliance with this measure was high among their employees, though there was also recognition that colleagues can feel safe with each other and drift together. There was also some uncertainty around what happened when workers had left work premises.

> *"I still think there are occasions where people don't do it, but it's one of the things we routinely check. And we have a checklist which all the depots do every day, the supervisor's charged with going round and checking that all the measures are still in place and reporting on any laxity or things that need to be done." (OL15)*

> *"That's one of the things we've jumped on a bit, is people being fine at work and then climbing in a car together to go home or and come to work, or offering somebody lift and said, come on, that's daft isn't it." (OL4)*

Some organisational leaders who ran short distance rail services / buses / trams explained that there can be no seat booking like on longer distance journeys and this could cause issues with social distancing compliance:

> *"We haven't taken specific seats out of use and all that kind of stuff, though. We've done that on stations. And we don't have a reservation system, like the long-distance operator, so you can't kind of reserve, because we're essentially a commuter railway. So there's obviously signage and everything inside the trains, but clearly if you take some seats out of use and you've got a family group of four people, then they end up spreading over quite large piece of the train or else they just rip the stuff off or ignore it. So we didn't think that really works." (OL4)*

Some operators had to make compromises having assessed risk vs service provision. For example, school services and keeping the wider public safe:

> *"Within our local authority areas, there are quite a lot of local bus services, and this is not unique to us, where although they're public local bus services, at peak times, probably on a double decker, you will have 65 children and four adults. That's fairly common in rural areas. And the approach we took was to say, well those 65 children all travelling to one school can go at the back downstairs, and upstairs, and we'll reserve a portion of the bus at the front, to allow adults to be socially distanced, away from the children. And that approach was supported by the local transport authorities." (OL15)*

The monitoring of social distancing for passengers on trains was generally through proxy measures (e.g. seat reservations, monitoring the load on a vehicle) due to workers limiting their time walking up and down trains in contact with passengers. Frequently, bus companies had implemented new counting equipment on their buses which counted the number of people getting off at each stop in order to constantly monitor how close the vehicle was to capacity. However, one organisational leader suggested that these mechanisms were not always reliable.

Most passengers have reported that social distancing has been easy to maintain due to the low numbers of passengers on public transport. However, as lockdowns eased, passengers noticed more contravention of this rule. There is also concern among passengers, especially lapsed users, about maintaining distancing in the face of disruption to services.

"I've also noticed – not all of them do it, but…so really there should be only people sat on every other seat, so you're never sat directly in front or behind anyone. If the bus then becomes full, they actually do put, sorry, full, and drive past, even though there are available seats. There's been I think only two occasions where I've been on and they've not done that and the bus has been full like it would be normally, I find that quite…yeah, I didn't enjoy that, not comfortable at all." (P11, current passenger)

"What happens when trains get delayed, when trains get cancelled and as a regular commuter for many years, I know the knock-on effect of that is everyone just pushes and shoves, 'cause you want to get home, you want to get to work, we're all very busy. How would that be handled, and how would that be controlled going forward within the parameters of COVID, and social distancing and those things?" (P17, lapsed passenger)

Face Coverings

Organisational leaders explained that by far the highest number of complaints received from passengers related to non-compliance of wearing face coverings by fellow passengers and occasionally workers.

"The biggest series of complaints that we saw coming through were passengers complaining about other passengers not wearing face coverings, so it was the whole public debate about who is exempt and who was not?" (OL17)

Some passengers and workers, at the time of the research, saw wearing face coverings (referred to by many as masks) on public transport as more of a longer-term public health issue to help reduce the spread of many diseases, especially during the colder months. However, workers spoke about compliancy in wearing face coverings and that as soon as permission was granted for mitigations to go they believed most people would choose not to wear face coverings.

"So yeah, definitely still think I'd want the regulations, definitely mask wearing because my concern as a passenger is actually, as we open up again and we go into this winter, we've not done a winter with flu and COVID where people have actually been properly mixing. And I think, so it's in some ways beyond COVID, it's bigger than that." (P17, lapsed passenger)

"I haven't had a cold for over a year, and I think, wow, I wonder if this is because we've been wearing masks, and we've been washing our hands a lot more? Particularly when you work with the public, you are more prone to catching the common cold and things like that, so it's been interesting not having had one for over a year, and would we be allowed to wear masks afterwards?" (W5)

Cleaning

Experts and Organisational leaders stressed the extra time and cost of putting in the new cleaning regimes required, but many thought that this new regime would potentially stay after COVID-19 restrictions ended. Within many organisations, employees were trusted to adhere to personal cleaning mitigations, but one organisational leader noted that this had led to low-compliance rates. Others asked workers to clean as they arrived e.g. next shift in a bus cab, so that they were happy it had been cleaned to their satisfaction. This highlights the complexity of implementing new behaviours in existing organisational structures, where they may alter the interpersonal dynamics between colleagues.

"We trust them to do it because obviously the instructions say that, actually, you're doing it for your own benefit. We have, I suppose you could say, like most urban bus operations, we have a workforce which are…the workforce is probably slightly more skewed towards being a at risk group than the population as a whole, given its mix of age and ethnic make-up. So I don't think there's any…there's no reticence of people to do it. They're very keen to do it." (OL10)

"So, I think they felt they were insulting the person they were taking over from. […] But it was a little bit of laziness as well. But these are country bus drivers who just saw COVID as a London thing that had spread out to the provinces, and nothing ever happens here, sort of approach, as well. But the good news of that particular little story, is that fortunately no one was seriously ill." (OL15)

For passengers issues around cleaning centred on the fact that most of the time they did not see this being carried out, so for them proxy measures such as a lack of litter or a smell of cleaning fluid helped give a sense of security. Nevertheless, some doubts remained about how levels of cleanliness could be maintained throughout the day, especially on buses.

"You always notice first thing in the morning there's always a really strong smell of some kind of sanitiser, which is good. Because I get on…it's about 6:20 when I get on, so it's one of the first buses, so you can tell that they have been cleaned quite thoroughly […] I don't know what they do in the day, and I would be very surprised…there's no indication that anything's been wiped down." (P11, current passenger)

"Well, on trains probably yes, they probably clean after every journey, but on buses you can't do that. I don't know what they do about cleaning on buses, I've never seen anyone doing any cleaning on a bus. […] And I imagine those handles get enormous amount of people holding onto them. And then, maybe, when it gets to the end of the journey, they clean the buses. I assume so, but by then so many hands have…have held onto them. So, they probably don't do enough. But there is a limit, I think, to what can be done." (P2, current passenger)

Capacity and crowding measures

Issues around predicting capacity and demand through the pandemic was difficult when the public had been encouraged to only travel if their journeys were essential and were beginning to return as society began to unlock. Related to this were issues around crowding, affected by factors such as the weather, lock down announcements, school travel, changes to peak travel times, etc. This was difficult for organisational leaders to plan for in terms of staffing levels and transport capacity. An organisational lead explained the methods used for monitoring capacity:

"So, in effect by using whatever data we can get off the train or off that ticket gate exits. And then we collate that and use that to interpolate effectively what we're getting on the train […] We're not physically monitoring that people are separating themselves because they might be, you wouldn't be able to anyway because people are from the same household or bubble. But what we do is we aim to provide enough capacity to enable social distancing throughout the whole train." (OL4)

Passengers (especially those not currently travelling) raised the issue of pinch points in journeys such as platforms, doors to vehicles, barriers where pre-pandemic crowds could form.

"If lots of people are back using the train or particularly at a train station when you are all, historically, seven or eight trains would arrive at the same time and you're all heading to the barriers to get to the ticket gate and therefore social distancing will be very difficult. I perceive the pinch points to be more risky on those kind of journeys than anything else that I would do." (P12, lapsed passenger)

Policing and challenge

Initially, many frontline staff who had previously worked on trains, at stations, revenue collectors etc. had been removed from face to face interaction with the public so policing in many cases was left to the transport police or in some cases the regular police. As time went on however, companies brought back some of these workers and in many cases they were expected to challenge non-compliance. From an organisational leader perspective, enforcement was often

seen as a role for transport police (trains) or the police. Public transport companies were only able to 'advise and encourage'. Workers found the rules around challenging fellow workers and / or passengers about non-compliance difficult. They spoke about being able to challenge passengers but having no way of enforcing the rules and found policing their own colleagues especially difficult:

> *"The biggest bane in our lives is we can't enforce, and not to be confrontational. So a driver could turn round and say to someone, have you got a face covering/a mask? And if they say no, that's it, there's nothing they can do. So they almost feel like it's…they're actually wasting their breath." (W6)*

> *"They were people who were in positions senior to me, occasionally were not wearing masks. Well, I can't really question them not doing it. […] When I'm the only one wearing one, and there's three of them not, it's difficult to say anything. You don't want to appear to be policing the situation. I mean, had I been in a more senior role, I certainly would have done. But, when, perhaps a more senior person was one of the ones that was temporarily lowering their mask, it's not for me to question to the person responsible for the train, i.e. the train manager, would you mind pulling your mask up? It's difficult." (W5)*

Passengers did not always see/perceive that mitigations introduced on vehicles and/or at stations were being policed. This was an interesting contrast of perspective, because passengers were largely keen to see more enforcement of rules by public transport workers; however, workers did not see this as their responsibility, especially as confronting individuals was considered to be putting themselves at even greater risk. However there was also a general acknowledgement by passengers that this would be a hard thing for workers to do (challenge passengers).

> *"And controlling people's behaviour and being challenging is a really difficult thing to ask people to do. Because people are unpredictable and, you know, you could say to me, where's your mask, and I go oh my God I'm so sorry, and put my mask on. You could say exactly the same thing to someone else and it would not be as well received. So, I think it's a really difficult thing and we've all seen examples of people not sticking to the guidance or not doing things. So, I think it probably would potentially become something that they regularly have to do, which is not an easy ask at all." (P17, lapsed passenger)*

> *"Well, as I said, I think the bus company management need to give their staff more back up, and make it clear that there will be enforcement taken. I think the train guards need to, again, the few people who aren't wearing masks, make it clear that they will be turfed off at the next station if they don't comply." (P8, current passenger)*

Observations of transmission

Organisation leaders spoke of low levels of staff sickness and absence in general, but almost all organisational leaders had seen some form of outbreak (which had generally not been publicised), but with most instances traced to factors external to work or being on public transport. Others struggled when staff had to self-isolate due to being 'pinged' by the NHS App:

> *"We've had a couple of control room incidences where we've nearly had to close part of the network because we haven't had enough control room staff because they've all been pinged by the app […] It really sort of started peaking in December/January, we were losing a lot of staff, either due to positive tests or due to being pinged." (OL1)*

When there has been an outbreak many suggested it was difficult to tell if it was work related, travel to and from work related or home related, with a few well publicised exceptions. A regulator described one such occurrence:

> *"We've had all sorts of nonsense. My favourite was one particular station where the station staff wanted to do a baby shower [named station]. That ended up on my desk. I just gave it to my inspectorate […] you just have to go around to the local station management, bl**dy hell. You just think, I'm sorry, but engage your brain. Engage brain, I'm sorry but this is not acceptable behaviour." (EX18)*

Respondents said that the highest levels of COVID-19 rates seen in workers was at the beginning of the pandemic (March 2020) and over Christmas / New Year 2020/21 when community rates were high.

Many of our respondents (especially organisational leaders) appeared to assume that as there had been relatively few observed outbreaks that the mitigations in place were effective and that public transport companies had done everything they could to keep workers and passengers safe.

> *"Yeah, so I think since June or July when we brought the safe systems of work in, generally the indications are that they've been working very satisfactorily. […] I am satisfied that our safe systems of work are really doing their job in terms of limiting transmission, both customers and employees." (OL5)*

> *"In terms of public health, the virus, all of that kind of stuff, completely comfortable with all of the threats and risks around about that to staff and customers, et cetera. All of that we are now aux fait with and comfortable that we can deal with that in a normal and ongoing basis." (OL12)*

Wilful non-compliance

Behaviour and discipline fatigue was mentioned by many organisational leaders. Some spoke of having to remind workers and passengers of their responsibilities when working / travelling on public transport. They appeared to indicate that in the majority of cases this wasn't wilful non-compliance but struggles at the outset to get used to new ways of working especially for those not working from home.

> *"We haven't had evidence of lots of clusters at work. I mean we have had; we had a cluster where I think it was sort of in the out of lockdown period where we had a group of work colleagues all went to play five a side football together. And, you know, we've had instances where, you know, people have just, 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)*

> *"It was usually on stations [the non-compliance], so our station teams. Because they're technically outside, there was this doubt in their mind, I suppose, I don't have to because I'm outside." (W1)*

Passengers took a strong negative view of other passengers who did not comply with guidelines, particularly wearing face coverings. Workers also mostly reported that colleague and passenger non-compliance was wilful and that despite being reminded, non-compliance (social distancing, face coverings) would continue; this was a source of frustration and anxiety for many workers who were concerned that this increased their risk

> *"Yeah, I mean, you know, the people that wear their masks wrongly, yeah the people that eat and drink. Yeah, the people that don't abide by the rules, so... […] No. I would say, on the whole, no, people do understand, you'd have to be pretty daft to not understand you should wear a mask and this is the way you should wear it, I think they just choose not to." (P6, current passenger)*

"And I think probably one of our most controversial areas is mask wear, so, you know, employees being really upset by customers not wearing masks, customers being really upset by employees not wearing masks. A lot of employees who think they should be exempt from wearing masks, us batting back and saying you are mild asthma really doesn't mean that you can't wear a mask. That's probably like our most controversial area." (OL1)

Reliance on the behaviour of others

Related to passengers' sense of a controlled environment, was passenger and workers' awareness of their reliance on the behaviour of others; their risk of contracting COVID-19 was dependent on the actions of the other passengers. This was a source of anxiety and frustration for some. In addition, where the responsibility for carrying out a behaviour was on an individual, it was reported to reduce the effectiveness of the measures in reducing transmission.

"And I think the only concern, in terms of other forms of transport, maybe, with taxis, because of the amount of people in confined spaces…and I don't know if, you know, people are wiping down surfaces and all of those kinds of things which, you know, we were originally advised to do. And have, you know, could even be doing that on food produce and things coming into the house. So, I think, if you've been quite meticulous in that sense at home, they are my concerns, maybe, going forward because I've not no control over those things." (P17, lapsed passenger)

"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)

One lapsed passenger highlighted the issue of trusting the other people present, they explained that they would first feel comfortable returning to activities where they knew the others and would have confidence that they would be following guidelines:

"I do Pilates classes in a school hall that a teacher I know runs, I wouldn't…I still wouldn't feel comfortable doing that, but it probably would feel less riskier than getting on public transport, because again it's fewer people, I know that my teacher and everybody there will have done everything they can to make sure that they're not passing anything on or anything like that. Then again, I wouldn't necessarily go to…I mean, I don't go to the gym, but I wouldn't necessarily go to a gym for the first time because I wouldn't necessarily know or be as reassured that everything was being done to sort of mitigate any risks." (P1, lapsed passenger)

Covid-security

Workers reported mixed ideas about the security of their workplace mitigations against COVID-19. Almost all workers reported that nothing further could be done to reduce the risk of transmission in their workplace, and most felt positive about the management of changes implemented by their public transport companies. However, many also reported incidents where mitigations were not fully adhered to all of the time (above).

"I think there's nothing more they could do, there's nothing more we can do. It's just, you know, being super-careful and just abiding by everything that we're meant to be doing in terms of safety. […] There's nothing more they can do apart from put you in a hazmat suit, you know, really." (W4)

"I think if we put anything else in place, it'd feel like jail. There's not much more you can do I don't think." (W7)

"But, some of my colleagues, when I hadn't seen them for a while, they were coming up and wanting to hug you, and people perhaps not always wearing their masks, colleagues of mine not always wearing their masks, they'd pull them down in certain situations." (W5)

Some felt so confident that the mitigations would stop all transmission that colleagues who had contracted COVID-19 were assumed to have broken the rules, and were viewed negatively as a result.

> *"I've followed the rules from the beginning. They haven't really changed. I mean, going back a year now, it was social distancing, face coverings, and although they were not all compulsory at all times, I have chosen to do that. And in a way, I'm almost amazed that so many people have caught it, because I'm thinking, well, if you'd been doing what you were supposed to do, and maybe this is a bit unfair, but I think if people had done what they were supposed to have done, they might have been at a lesser risk. I mean, I didn't see my family at Christmas, because I wasn't prepared to take the risk. But some people did, and some of those then went on to catch something. So, I think if we'd done what we were supposed to go, I struggle to see how I could have caught it really, because I was always washing my hands, I was wiping surfaces, I was wearing masks. I think if I had caught it, and touch wood I won't, well I've had my vaccination now, so hopefully not, but I think I would have been very surprised had I caught it, because I did everything I was supposed to do, in all parts of my life." (W5)*

In one workplace, a worker reported that they felt they had been COVID secure, but then had experienced an outbreak of multiple staff where transmission had occurred within the workplace; this caused confusion and distress, as their understanding of the safety with mitigations in place was undermined.

> *"I do feel safe. But I think that's what was 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, you just…you just don't know." (W7)*

Relationships and individuals

Respondents told us about the importance of clear and consistent leadership and individuals going above and beyond to keep things running and safe for workers and passengers during the pandemic. Many in senior positions in companies were working much longer hours, working in very different ways and in some cases it was indicated that if these individuals were to leave or be sick then the whole system could easily start to break down.

> *"The only fundamental way that it's changed is that I'm working twice as hard as I ever worked before, because it is just, it's ceaseless. And, I suppose, in the role I do, I'm doing everything from providing, you know, one to one support over the phone to individual members and reps, and advising them of the best steps, up to meetings with government ministers, and doing everything in between, as well." (OL2)*

F. The Future

We asked organisational leaders, union representatives and experts what the short term (next 6-12 months from the date of the interview) challenges were to keeping a safe (for workers and passengers) and effective transport service running and what they foresaw the longer term challenges (next 5 years) to be.

Almost all respondents were concerned about getting footfall back onto public transport quickly, whilst keeping passengers and workers safe, to enable the system to become financially viable again. They were worried about balancing current risks and predicting future trends for travel. Most respondents acknowledged that there was a need to balance increasing passenger numbers and perceptions of safety:

"Having our customers feel confident presumably, and that will grow over time as we move out of this. But we've got to keep that balance, don't we? We don't want people to feel uncomfortable on our vehicles, we want them to feel safe, and that's really important. And to do that we might need to keep social distancing in place longer, you know, that's…and we're all trying to work that through." (EX1)

Short term challenges

Increasing passenger numbers vs safety

Getting footfall back in a safe way in order to pay their way and keep companies operating (wages and fuel costs etc.) was the most mentioned short term challenge. Both experts and organisational leaders stressed the need to get passengers back on public transport to make it financially viable both in the short and longer term, but most were clear this would take time and the Government would need to continue to support the sector. The issue of predicting future patterns of demand was also raised - flexible working will mean changes to travel patterns e.g. peak times, flexible season tickets. It is a challenge to balance the upfront monthly costs (e.g. Hire Purchase finance) with a loss of income due to uncertainty over passenger numbers.

"I think the main thing is on the financial recovery side I would say. […] it's a fine balance between encouraging people to use public transport so that, you know, operators and the economy can be sort of propped up to help that there are. But I think sort of longer term, you know, if people have bought cars and they're scared of public transport and things like that, it's going to be difficult to get people back on." (EX24)

"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)

Many respondents spoke of the messaging throughout the pandemic in relation to public transport and the challenge of turning this around, making passengers (especially lapsed users) feel safe enough to use public transport again and this linked into wider agendas (green, clean air) as well as safety and risk.

"…They [Government] don't think through the long-term consequences of anything, so their sort of avoid public transport and coronavirus takes the bus, nobody has said, okay, you do realise what's going to happen coming out of this, people are going to be genuinely scared about public transport and that's going to leapfrog us very quickly into massive traffic congestion, climate change, air quality problem […] there's no medium to long-term thinking, and that's clear from all government action, there's no sense of the role public transport has within the country in terms of its health, in terms of its climate change, in terms of economy." (EX2)

"The other key issue is, given all the negative publicity and the othering of people you don't know, is there going to be a long term impact of that where people don't want to share public transport and see it as dirty? The sad thing there's no evidence of this at all, and if we're to build back greener, then sharing transport is going to be crucial." (OL15)

Passengers had interpreted advice not to use public transport except for 'essential journeys' variably, with some continuing to use it throughout the pandemic. However, this was sometimes met with surprise by their peers. There was also a subset of passengers (particularly lapsed passengers) that had readily taken this message on board and stated that they required messaging from government in order to reverse this avoidance:

> *"We were told not to get on public transport unless we absolutely had to, and as I said, I haven't had to, so I've tried to stick…I have stuck with that. […] so it's really discouraged me from doing any travel for the moment." (P1, lapsed passenger)*

> *"...when I did go into [named town], to meet a very depressed friend, the bus driver did ask me if my journey was essential, and that rather put me off. I said, yes, I was going for compassionate reasons, but he was quite aggressive about it." (P8, current passenger)*

> *"Very few people I know who used to use public transport, are still using it. They think I'm, not mad, but they're amazed that I'm doing public transport, when I have a car." (P8, current passenger)*

Respondents were aware that getting the right balance between community COVID-19 infection rates and increasing travel capacity was important. They stressed that if social distancing remained, public transport could only cope with a more limited capacity with continued Government subsidy.

> *"We have moved into an interesting phase now [May 2021] where we haven't actually started promoting ourselves yet. […] they haven't properly released the social distancing constraints, but the bus operators have taken it upon themselves to sort of increase their capacity by saying, you can sit next to each other on a bus now. Which is fine, that is catering for demand as it's growing […] But actually, we are noticing that we can't actually…on our busiest lines you can't social distance at one meter in the morning peak or evening peak, you just can't do it". (OL17)*

There is an ongoing debate in wider society around vaccinations, variants, living with the virus, keeping some mitigations in place (or in reserve if conditions worsen again) and what level of risk we, as a society, are willing to take.

> *"You only have to look at the SAGE [Scientific Advisory Group for Emergencies] modelling, opening schools in England the R goes to one point six, the posed reopening in June the R could be three, you know. Now then, you're into a debate as to whether that matters anymore […] And I'll let epidemiologists work that out, but it is…this is the big debate of our times and its coming. Once people have been vaccinated to what degree do we unlock and go back to some form of normal and accept that in the background people will get very sick and die from this virus. And that's the big question and no one is politically wanting to even go near that at the minute." (OL16)*

> *"If you're told you don't have to wear a mask in public anymore, maybe people would relax. That would be an interesting thing to know, is I suspect some people would be like, phew, no masks anymore, and go and do anything, but other people that may be off-putting for them, everyone has now stopped wearing masks. So, what the overall net effect of removing the mask mitigation, I don't know what that would be." (EX6)*

The vast majority of passengers described feelings of confidence / safety in using public transport in the future as a balance between risks (including current rates of transmission and development of new variants), mitigations (and perceived adherence to these mitigations) and vaccination programme progress as well as personal vaccination status.

> *"I think if we know that the rates are heading down, we know that most people, even if not all people, are getting the vaccination, if everything is being done to keep public transport clean and people to be wearing masks, I think…and hopefully that none of the variants are particularly bad, I'm hoping that things will get better and I'll feel more comfortable getting on public transport again." (P1, lapsed passenger)*

> *"I don't think there is very much risk now at all. The only way that would change, if there would be a new variant that was either incredibly infectious or incredibly virulent and caused a high-level infection or high level of death." (P15, current passenger)*

At the time of the interviews (April - May 2021) all but one passenger spoke about expecting the mitigations on public transport to stay in place for the foreseeable future, and many reported that this increased their confidence in using public transport. Workers also generally thought the mitigations were working and if they stayed in place, they would feel comfortable with their work even if things opened up more.

> *"Definitely throughout the winter is important and I would feel more comfort in that, as well as sanitising in general. I don't know in some ways it's become a little bit like a way of life, hasn't it, in terms of we wear masks…and I don't like wearing a mask, I don't find it enjoyable at all, but I know I have to do it, so I do. So, I think those kinds of things, if they kept them going that would definitely provide me with some more confidence." (P17, lapsed passenger)*

> *"R: I think it's definitely till the end of this year, think they'll stay, and possibly into most of next year. Can't see anything changing really at the moment". (P14, current passenger)*

> *"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 think we need to see how things pan out. I mean, certainly the vaccination seems to be having a positive effect in the number of transmissions, and I think, again, at work, the procedures are there in place to make sure that we don't. And as long as we're able to continue to do those, then I will certainly feel comfortable working there." (W5)*

Testing and compliance

Some respondents suggested better workplace testing would be important in the short term, alongside promoting vaccinations:

> *"Vigorous health promotion of vaccination. Targeting occupations that are more risk. Regular testing, I think, is part of the story. So I think that regular testing, even how relatively painless and easy is to do, is part of it. And we've got unfinished business, I think, to do those two things, but we can't influence the vaccination, but we perhaps make testing, to some extent, mandatory every week." (EX25)*

Maintaining compliance with mitigation strategies with a changing proportion of the population vaccinated was seen as a tricky prospect for which respondents wanted more information and guidance. Most operators were planning to keep social distancing and wearing face coverings in place over the following months.

> *"Probably the biggest challenge the complacency and the degree of compliance when you get to that point where, you've been vaccinated but I haven't type of situation. Which is clearly a situation we're going to experience over the next six or nine months, I can see a situation in the summer months where people will think that…people will have been vaccinated or think that others have been, so there will be a breakdown of social distancing. So we're planning to maintain the social distancing system on our trains over the summer, try and maintain it through the reservation system, and we'll clearly be doing or be maintaining the messaging and the communication to our staff and things like that as much as possible." (OL5)*

> *"Even though vaccinations are absolutely brilliant, on the flip side there's also that other side of the coin that people think, well I've had a vaccination now so I don't have to be as careful so maybe that potentially. But I think the government has to be really careful – the roadmap was great but sometimes it can all be too positive and not do what our business does in terms of, right it's great that on the 12 April we can go and do x but we still must remember to do y. And I think the government does sometimes forget that." (W1)*

Challenges in next 5 years (longer term)

Subsidies, ownership and industry co-operation

Respondents identified many challenges for the longer term, some of which had existed prior to the pandemic and some that were new. These included: Government subsidies needing to be maintained at suitable level or public ownership with suitable policy; new vehicles / fleet design incorporating infection safety measures (ventilation, seat spacing etc.), in order to reduce general viral infection and to be better prepared for the next pandemic; and policies need to prioritise public transport and join up the different modes with a less competitive focus.

> *"Personally speaking, I think that's good because there was far too much silo working beforehand, and that was not because people, you know, were incapable of talking, I think it was just because of the way things were done within the industry. Everyone ran scared of the CMA [Competition and Markets Authority]. So, yes, I think there will be more cooperation but in a good way, and that's something that's probably going to be crucial to get the maximum out of the industry so that there's a maximum delivery of, you know, service coverage for the footfall that's available."* (OL12)

Capacity / reliability / viability of public transport and wider agendas

Prior to the pandemic, footfall was decreasing year on year for public transport, especially bus (issues of road congestion and cars as alternative) thus, the pandemic has exacerbated an existing problem for public transport. Reliability, crowding and punctuality of service were perceived to be at the top of customer priorities, with cost further down list (but prices have to increase if covering costs and footfall reducing). The majority of experts and organisational leaders (as well as some passengers) discussed their concerns of the pandemic's impact on public transport in terms of the green and sustainability agendas including alternative modes of transport e.g. e-scooters, cycling, and active travel.

> *"I think that is very sad, given the priorities that we should all have about a green future, about recovery, about including, you know, being inclusive of vulnerable people in society. And, in fact, clean air and congestion. We are a small island. So, all of those things are…it feels a bit like we, you know, this is causing us to discount the future in terms of that."* (EX1)

> *"The perception of the risk [on public transport] is very high, and I think that's going to take government messaging to say it's safe, I think explicitly say public transport is safe, it's going to take a lot more confidence and reduction in fear of the general population. It's going to take incentives to get people to actually go to do all these things, and it's going to take some push and pull from the government around policy to get people to move away from cars, which are going to be in the long-term much more damaging than COVID."* (EX2)

Learning from the pandemic and parity in research in public transport

Some of the experts and organisational leaders reflected about the importance of learning lessons from this pandemic and planning ahead for the next major issue. Some suggested they would have done things differently and others suggested longer term planning needs to look wider than this pandemic and incorporate wider thinking for a more effective future service.

> *"I think our thinking was entirely wrong initially, which was, oh dear, we have lost all our passengers, let's try and reduce our costs and cut our service to meet that, which put a lot of burden on the organisation and we had to rewind out of that pretty quickly again, straight away. So, I wouldn't touch the service. We would put the procedures in wraparound to look after staff first, straight away, you know, and I think we have got a lot in terms of risk assessment to processes now, move the shifts like to bubble type working, you know, that sort of thing, think we could be almost ready for that kind of thing immediately."* (OL17)

> *"We can't just look at the single sort of COVID questions in isolation, because I think there's a real risk if we do that we focus on the only problem at the moment and, you know, there's people's exposure to air pollution, people's exposure to other diseases. What about the next pandemic and you know, will that be transmitted in exactly the same way or will it be transmitted slightly differently? And so, we need to use this to keep a bit of an open mind about how we can identify how to make things as resilient as we can." (EX8)*

Many respondents (at the time of the interviews) of all types were predicting some forms of mitigation measures in place until after winter 2021/22 and stressed the need to learn lessons from other countries and other similar diseases.

> *"We think some form of mitigations against COVID will need to be in place until Easter next year. We're conscious that those countries that have been through SARS and MERS 10-15 years ago were much better in a public and much quicker in a public transport response than we were. So we need to take our learnings from COVID and have them written into our playbook and have things ready to deploy much quicker, much faster, much more effectively […] so it's basically having procedures, mitigations, train designs, station design, chemicals, PPE, all of that much more stockpiled, self-testing, all that kind of stuff ready to run much, much more quickly." (EX4)*

Respondents in the bus sector called for parity across sectors for funded research and development. There was a desire for government funded research across public transport modes (bus, tram / light rail, taxi) to match that for rail in order to coordinate and organise efforts for potential future pandemics, population health and wellbeing and green recovery.

Positives from the pandemic

As well as the pandemic having very negative impacts to the public transport industry, it is important to note that respondents were also able to highlight some positive consequences. There included: re-evaluating long standing working practices and the creation of cross-industry links and collaboration (less competition and more co-operation across public transport e.g. keeping the established sector forums which brought together operators, regulators, unions etc. to aid quick joint decision making); creating innovative solutions that can be taken forward as part of the wider agendas (e.g. carbon neutral); and re-focussing on staff engagement and mental health issues in the workplace. Respondents said they wouldn't want to lose these gains in the future. There was also a sense of pride in maintaining the service and supporting key workers during this period.

> *"Elements of the kind of, longer term thinking around customer. So, accessibility improvements, innovation, and kind of, what we want the future customer experience to look like, on like new trains." (OL16)*

> *"We're a self-help kind of sector [public transport]. We do that. We self-help, but this is, you know, this is something where we…if we are really fighting a battle, we should be working together to do that […] So, it's been very good for us as an industry, we have pulled together and done this work together in a way that I think the bus industry haven't done so much before." (EX1)*

> *"There's the benefits, what are the opportunities it's brought, because there are opportunities that have come out of COVID, in how we work and how we treat people and how we…and, I think, I'd be curious and has it changed our mind-set in treating like health like safety. You know, 'cause we're always very good at doing the safety risk assessments, but we've never really had to truly do proper health risk management." (EX20)*

Discussion

Using a 'deep dive' approach with qualitative research methods, gave researchers a process for capturing insights from the sector at a time of uncertainty. This could not have been achieved at the necessary speed and assure relevance to a quickly changing context without adopting a co-creation model with stakeholders closely involved in delivering, working for and using services.

Involving stakeholders as partners and engaging together in candid interchange of ideas was challenging. However, the urgency and uncertainty of managing the risk of transmission promoted a mutually beneficial exchange in understanding the issues. Building a rapport with these informants enabled us to be as up to date as we could be with the rapidly changing situation, recruit respondents quickly to participate in the research (via stakeholder introductions) and interpret the emerging findings.

The following observations are based on analysis of the perspectives of different stakeholders from within the public transport sector, including experts, organisational leads, employees and passengers. The findings have been grouped under the 3 main research questions, plus further learning.

RQ1: What are the perceptions of risk of transmission by the various stakeholders?
At the time of the research (January – May 2021) the general view of all stakeholders was that while public transport was a place where COVID-19 transmission could take place, the combination of low passenger numbers and the implementation of mitigation measures meant that the (personal) risk of infection was considered to be low. Workers and passengers felt the mitigations implemented on public transport were effective and appropriate. However, the sense of safety was reliant on compliance with mitigation measures (e.g. cleaning, social distancing, and face coverings) by the transport operators, transport staff, and other passengers, alongside policing of these measures. Contraventions of mitigation measures undermined perceptions in the safety of public transport. While most respondents reported that measures were generally complied with, exceptions were notable and caused upset and an increased sense of risk. Indeed, the general perception of all stakeholders was that the mitigations were important for controlling transmission at times of low passenger numbers, and that they would increase in importance as passenger numbers increased. At the time of interviews, there had been no discussion of the removal of mitigations from public transport, and most expected the mitigations to remain in place for the foreseeable future.

Looking forward, the progress of the vaccination programme increased confidence in the safety of public transport for passengers but new variants of COVID-19 counterbalanced this view, and experts raised concerns that vaccine may lead to over-confidence and reduced compliance with mitigation measures. Confidence to use public transport was seen as a balance between transmission rates, vaccines, mitigations, new variants, and compliance with behaviour.

RQ2: What are the mitigations being put in place and the perceived effectiveness of these risk mitigation strategies?
A range of mitigations were introduced in the public transport sector in order to reduce the risk of transmission in this setting and were in place during the time of the interviews. These mitigations broadly fell into 6 categories:

1. Cleaning
2. Face masks/coverings
3. Social Distancing
4. Ventilation

5. Reducing contact – home working, bubbles, payment of fares, restrictions on talking/shouting and eating/drinking
6. Prioritising employee health – identifying vulnerable staff, implementing appropriate working policies, providing support for staff

Some of these changes were instigated and introduced by the transport companies themselves, however others were mandated by the Government. While all changes were introduced at pace, those imposed by Government were required with very little notice or consultation with the industry. The reasons for this were understood, but it was suggested that better forward planning would be valuable for the future (COVID-19 or other potential diseases).

Respondents reported that effectiveness of risk mitigation strategies was dependent on the relative importance of transmission routes. Many respondents talked about evidence that suggests surface contamination (fomite route) is not the primary source of transmission, with more emphasis on the role of airborne transmission; this impacted their view of effective mitigations, with cleaning being less important (with the exception of some passengers) and social distancing and face coverings being more important. The potential importance of airborne transmission over larger distances became increasing accepted over the timeframe of our interviews (January – May 2021). This led to an improved understanding among non-experts of the need for good ventilation. As we spoke to many of the experts / organisational leaders earlier on in the research period, this was less likely to be mentioned by these groups.

The effectiveness of behavioural mitigations was seen as being dependent on the compliance of individuals with these measures. The fact that the responsibility was at the individual level caused some issues, as social distancing for workers was unnatural and was sometimes forgotten, and some workers and passengers were wilfully non-compliant with the mitigations. Passengers were generally keen to see more policing of these measures on public transport in order to maintain high levels of compliance; however, workers and organisations felt that this increased their risk of contracting COVID-19 and believed enforcement was the responsibility of the police.

Clear messaging about the effectiveness of the mitigations on public transport was seen to be essential for the return of many passengers. It was felt that this communication would need to come from Government in order to overcome the previous Government messaging to avoid public transport. In addition to this, the first experience of lapsed users' return to public transport was seen to be a very important opportunity to demonstrate the mitigations put in place and make people feel confident that appropriate measures are being taken to reduce risk. Particularly, space and capacity on public transport, along with better ventilation are key concerns and will be especially salient when passenger numbers rise and/or community infection rates increase (e.g. winter season).

RQ3: What are the major knowledge gaps and things to consider that will need to be addressed in the short and longer term in each sector?

At the outset, transport organisational leaders and experts found it difficult to source consistent and timely information to help facilitate their decision-making. Respondents talked about what information would be valuable for informing decision making as the sector moves forward while continuing to reduce transmission risks for workers and passengers. One of the main calls was for an evaluation of the mitigation measures introduced, to determine how effective and sustainable they are for the future. At the time of interviewing, respondents were concerned about how to build up capacity on services safely while the requirement for social distancing remained. Related to this, there were questions about what the acceptable levels of risk in different/changing circumstances would be for workers and passengers, and how to adapt services and mitigations to reflect this.

Another major knowledge gap was about what the demand for public transport would look like. This relates to two questions. Firstly, how to help people regain confidence in using public transport to increase the ridership. Secondly, what will be the patterns of transport for the future, as these are shifting and may mean few commuters (as people move away from the traditional 5 day commuting week) and may lead to a greater focus on leisure travel. These questions regarding who will be using public transport and when raised further concerns from the respondents regarding the funding of public transport in the future, as well as the industry's ability to continue working on the green agenda (while keeping workers and passengers safe).

Other learning points
In addition to the primary research questions, additional information was raised in the interviews that represent further learning points that are relevant for the public transport sector.

At all levels, a clear reduction of usage of public transport was seen and passengers reported changes of mode and reasons for using public transport, since the start of the pandemic. Other researchers in this area have tracked these changes across much broader samples (Institute for Transport Studies, Transport Focus), but these changes in behaviour and decision-making strategy are very relevant for the future patterns of public transport use. Drawing on national data sources and a panel survey of over 6000 people (July- December 2020) Marsden *et al.* (2021) call for a major realignment of investment and policy to ensure that following changes due to the COVID-19 pandemic, there is 'not a return to the overcrowded, congested, polluting and unhealthy transport system that people had come to accept as inevitable'. The research suggests several factors that are likely to lower the impetus to travel, including: increased home working and online shopping and leisure, concerns about exposure risk amongst some parts of the population, and reductions business travel due to remote working and virtual meetings. Another round of the panel survey results (carried out in May 2021) is due.

It also relates to the funding of public transport; dramatic falls were observed in passenger footfall and revenues during each lockdown, due to messaging not to use public transport unless it was essential. By the end of 2020, it was estimated that £5.4Bn of additional funding (Marsden *et al.,* 2021) support for public transport had been provided or committed by government (during the pandemic period). This enabled bus operators and the rail industry to provide services that complied with social distancing rules, but the scale of fall in usage of public transport patronage of up to 95 percent has meant that no public transport services were commercially viable. It remains to be seen if the easing of restrictions and new guidance will help / hinder public transport regaining pre-pandemic levels of usage of services over the short and longer term. The message to not use public transport may need to be turned around to get passenger numbers back using public transport with confidence and to support the independent commercial viability of the sector.

In terms of workers and operations within public transport companies, sharing of good practice and knowledge as quickly as possible was found to be very useful; both the rail and bus sectors have established groups who meet regularly to share knowledge, best practice (Rail Covid Forum, Bus operational groups), which have been vital. Most hope these will continue operating in some form in the longer term. Part of the need for such cross-sector collaboration was because transport organisational leaders and experts found it difficult to source consistent and timely information to help facilitate consistent interpretation of guidance and decision-making. In addition, significant changes have occurred to workers daily routines, this has generally been accepted but has had impact on morale of the workforce.

Thoughts on changes since the research period

Since our research was undertaken, the Government announced that as of 19 July 2021, almost all legal restrictions on social contact would be removed, but with encouragement to make 'sensible decisions' in England. The other devolved countries followed suit but have kept the requirement to use some mitigations e.g. face coverings in crowded indoor spaces including on public transport. The Association of Directors of Public Health (De Gruchy, 2021) suggested the continuation of some of the public health mitigations already in use *'handwashing, testing, contact tracing, economic support for isolation and quarantine, physical distancing, wearing a face covering and strict border controls'.* They added that *'We believe it is right for the Government to promote working from home, insist on face coverings in crowded and high-risk situations such as on public transport and in health settings and encourage outdoor socialising'.*

It should be noted that although many controls became voluntary after July 2021, employers were still responsible for controlling the risk and carrying out risk assessments. Ventilation controls, cleaning and hand hygiene were still applicable as well as considering limiting the number of people workers came into contact with (Health and Safety Executive 2022).

The Government announcement caused some disquiet with the different rules and regulations across the devolved nations, confusion over messaging for public transport workers and passengers with transport companies having to make their own choices about keeping mitigations in place and how to police them. These are issues already discussed in this report (see p17 'Sources of Information').

This has resulted in unions and travel industry bodies raising concerns that many operators were finding it difficult to plan for the coming months. For example, a spokesperson for the Confederation of Passenger Transport (CPT), representing bus operators outside London, said (14/7/21) they would not require passengers to wear masks (face coverings), but added: "*We think it's a confused message. The government said they would publish further guidance which hasn't come out yet which is making it harder for operators to plan. There's been a stark change in tone. […] They should not be introducing guidance that puts the onus on operators and millions of individuals to make a decision"* (Topham, 2021). The National Union of Rail, Maritime and Transport Workers (RMT, 2021) also issued a statement on 14 July 2021 warning of the threat of violence to staff due to the '*confused approach to face coverings on public transport'.*

Transport for London (Topham, 2021) announced that mask / face coverings would remain compulsory on their network when the restrictions were relaxed, as did Metrolink (the tram service in Greater Manchester), both of which are overseen by the Mayors in the Region. Other City Region Mayors (e.g. Liverpool, West Midlands) had less direct influence, due to deregulation, and success in trying to convince transport companies to retain some mitigations. However, this left concern again within the public transport industry that there may once again become a perception that public transport is a less safe environment as compared to other settings (e.g. night clubs, theatres) as they open with no formal requirement for face coverings.

A spokesperson for the RDG, quoted in the Guardian (Topham, 2021) said "Passengers should follow the government guidance and, out of respect for others, wear face coverings if an indoor setting is busy. Train travel is low risk, with the majority of carriages well ventilated by air conditioning systems or by doors and windows".

The Government (Cabinet Office, 2021) set out its winter plans for 'living with the virus' on 14th September 2021. This includes a Plan A as well as a Plan B, the latter would come into effect as a last resort to prevent unsustainable pressure on the NHS. Plan A primarily involves vaccination: a single vaccination for 12-15 years olds, booster jabs for the over 50 and those with underlying health conditions, continuing to encourage unvaccinated people to receive the vaccine, and

extended offering of the flu vaccine to over-50s and secondary school pupils. It also includes continuing NHS test and trace along with free PCR tests and promoting ventilation and face coverings in certain settings. Plan B would see face coverings becoming compulsory in some settings again (including public transport), home-working where possible, and the introduction of vaccine passports.

More recently there have been suggestions (McTaggart, 2021) that in England since the rules relaxed, wearing a face covering on public transport has become less common place – figures cited from Network Rail in September 2021 report only one in five rail passengers in England, while Transport for London and the devolved countries have kept the requirement to wear face coverings. By the 21 October 2021, The Unite Union (Kemp, 2021), was calling for the government to reintroduce mandatory face covering wearing on public transport. They suggested that "*By reintroducing mask [face covering] wearing the danger of infection to both bus workers and passengers is significantly reduced",* against the background of rising COVID-19 infections. The challenges around enforcement of rules and mitigation measures were also raised again. Another report (Cox, 2021) suggested that the latest figures on face mask compliance (quoting Greater Manchester Transport), showed that just 45% of Metrolink passengers were wearing masks at the end of August 2021, compared to 60% at the start of that month. On the railways since face coverings became 'advisory' only, the compliance figure is quoted as 30%, with usage higher on morning trips into the city centre and on longer distance routes.

In October 2021, the Government again urged the public to comply with voluntary COVID-19 measures, including wearing masks in indoor spaces. The secretary of state for health and social care warned that failure to do so would "hit us all". However, the Government were criticised for not following this advice in Parliament. Reicher *et al.* (2021) outlined a number of ways in which this could negatively impact on public behaviour. One particularly relevant process identified was the effect of the explicit suggestion (made by some leaders / role models) that masks are not necessary when you are with people you know (in-groups); the assumption that people you are familiar with are "safe" is widespread but false and should be actively challenged by the Government. Indeed, this issue has been highlighted as a potential problem in the present study, with public transport workers finding it difficult to maintain behavioural mitigations with co-workers in 'in-group' spaces such as common rooms / canteens. This challenge to effective behavioural mitigations should be approached actively in guidance and policy.

It may be challenging to revert to widespread use of face coverings and adherence to other risk mitigation measures in public transport if this is deemed necessary in the future. If this is needed then it will be extremely important for Government, public transport companies and unions to work closely together to develop clear messaging, and clarity over any enforcement etc. This chimes with a more general advisory made at a recent SAGE meeting (meeting 96, 2021): *"policy work on the potential reintroduction of measures should be undertaken now so that it can be ready for rapid deployment if required, stressing the importance of reintroducing measures in combination, supported by clear communication; consistent implementation that avoids creating barriers to adherence; and clear triggers for deployment".*

Note: This report was written before Plan B Winter COVID measures were introduced on 8th December 2021 and these remained in place until 19th January 2022. At this time mitigations such as wearing face coverings and instructions to 'work from home if you can' were re-introduced. Our ongoing work looks at perceptions during this time and will be reported separately once available.

Recommendations

Through the analysis of the data collected from a range of stakeholders in public transport, we have identified a number of areas of consideration which present opportunities for learning from the experiences of the COVID-19 pandemic. It should be noted that these arose at the time of research (January – May 2021) and will need to be considered in the context of subsequent changes outlined above. We will be conducting further research, longitudinally (revisiting the same respondents) to understand if these issues are still accurate in the current context and what other issues have arisen in the last 4 months.

Evidence and knowledge gained during the pandemic should be used to develop clear and effective strategies to allow for coherent and rapid response to any future pandemics. This will need to be kept up to date, as our knowledge on the risk of transmission of SARS-CoV-2 viruses and effective mitigation increases. Dissemination and communication of this knowledge to the public transport sector is important and will help with developing clear and timely messaging throughout the public transport sector.

The following are recommendations to consider by those working in and with the sector to help enable this to happen effectively:

- **Consider maintaining (rail / bus) / establishing (taxi) industry fora to respond quickly to appropriate issues in the future**

  Trying to act quickly in response to a crisis is always a challenge. The industry found some of the decision making and quick implementation of changes challenging. The industry links and fora established during the pandemic now present a quick contact point for joint decision making both with and across the industry (operators, regulators, unions etc.). The trust built over time from working together, can help facilitate consultation with the industry as a whole as well as promote collaborative effort to make decisions and implement change. This could be usefully extended to include stakeholder engagement such as workers and passengers.

- **Consideration should be proactively given to collaboratively developing messages and communications that are clear**

  The Government's message to avoid public transport at the beginning of the pandemic has had a lasting impact on the public's attitude towards the safety of public transport. While this was effective in achieving the necessary aim of reducing numbers of passengers in the short term (which all accept was necessary), the long-term implications of messages regarding public transport should be considered in the full context of future viability and sustainability as well as the green agenda. Consider having messages with an explicit time frame or actively revoking at an appropriate time, and the fora above could be utilised to allow co-design of suitable messages in the future to minimise any unintended consequences. Avoiding mixed messaging and where possible different messages and rules between devolved countries and across different modes of transport would help with clarity as well as compliance and enforcement for both workers and passengers.

- **Encouragement of leading by example from those working within the public transport industry in adhering to guidance about risk mitigation**

  The importance of leaders in creating workplace COVID-19 secure cultures / climate should not be underestimated. Managers at all levels, and especially immediate line

managers need to be aware of the impact of their behaviours on likely compliance in their teams. The organisational culture should encourage compliance by workers and passengers, in order to protect those working in and travelling on the public transport sector.

- **Consideration should be given to the complex interpersonal dynamics in workplaces**

  General Government guidance about avoiding contact with people outside your immediate household was successful in relation to public transport, particularly with strangers or passengers. However, the guidance was less frequently followed with co-workers. The guidance did not take into account the complexity of different working relationships, where co-workers have a very different relationship to fleeting worker-passenger interactions. The level of familiarity and trust that some co-workers had with their colleagues made the implementation of social distancing, cleaning and face coverings challenging in a way that was not mirrored in their contact with the general public. This is applicable to any work environment where workers have a dual public and worker facing role. Consider additional messaging for in work circumstances such as breaks, work at depots / stations and travel to work and involving behavioural scientists to help word messaging to raise compliance in all circumstances.

- **Consider developing clear lines of accountability for compliance with current guidance, particularly for passengers and workers**

  There was a difference in understanding between passengers and all other stakeholders over the responsibility for encouraging adherence to COVID-19 guidance and enforcement of any regulations on public transport, which caused frustration on both sides. Further consideration could be given to where accountability for compliance lies, its implementation and clarity on enforcement across different mitigations.

- **Longer term planning of public transport services should consider wider agendas and greater cross agency co-ordination.**

  While trying to solve the immediate short term issues arising from getting passengers and workers safely back onto public transport, longer term issues around the green and carbon neutral agendas (as well as issues around increasing accessibility to public transport) should be recognised and accommodated in future planning. As public transport is inexorably linked to other developments under the responsibility of other agencies (e.g. housing, planning etc.) careful cross-coordination should be considered.

Rapid developments of the pandemic and continuing research.
All the interviews for this report were carried out between January and May 2021. Clearly a lot has changed over this period and since the completion of the last interview, due to the changes in the pandemic, vaccination role out, appearance of new variants or modified variants, level of government restrictions, and evolving understanding of COVID-19 transmission. Although, we believe that many of the observations are still very relevant, it will be very valuable to review the current situation and ascertain whether the risk perceptions and perceptions of the effectiveness of risk mitigation measures have changed. We have therefore extended the data collection, in order to re-interview a selection of the original participants between December 2021 and February 2022.

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Appendix A: Guidance for Public Transport operators and passengers

Safer Transport Guidance for **Operators** is available at [Coronavirus (COVID-19): safer transport guidance for operators - GOV.UK (www.gov.uk)](). It was first published on 12th May 2020 and has been updated periodically with the last update being 17th May 2021 (at the time of the research). It stated that

> "Each organisation will need to translate the principles and examples in this guidance into specific actions. Transport providers should remain mindful of their obligations under health and safety, equalities and employment legislation. Transport providers should try to coordinate their planning and actions with other providers".

Some transport workers will be able to work from home and the guidance states:

> "Employers and employees should discuss their working arrangements, and employers should take every possible step to facilitate their employees working from home, including providing suitable IT and equipment to enable remote working".

For others who can't work from home:

> "Where people cannot work from home – including, but not limited to, people who work in critical national infrastructure, construction, or manufacturing – they should continue to travel to their workplace".

This has resulted in keeping public transport services operational throughout the pandemic for essential workers during 'lock downs' with messaging to try and reduce the numbers of people using services where possible. However, bus and train drivers, those manning stations, signal boxes etc. cannot do this from home and have had to continue working with advised mitigations.

Guidance was also issued for **passengers** ([Coronavirus (COVID-19): safer travel guidance for passengers - GOV.UK (www.gov.uk)]() first published in May 2020 and last updated on 15th June 2021. Guidance states that

'You should work from home if you can. If you're going to travel, plan ahead and travel safely'.

'You can help control COVID-19 and travel safely by walking and cycling, if you can. Where this is not possible, use public transport or drive. You can also help control COVID-19 by:

* working from home where possible,
* observing social contact rules,
* keeping your distance when you travel, where possible,
* washing or sanitising your hands regularly,
* planning ahead and avoiding the busiest routes, as well as busy times like the rush hour,
* downloading the NHS COVID-19 app before you travel.'

'Help keep yourself, other passengers and transport staff safe by taking the following precautions' including:

- maintain social distancing
- wash or sanitise your hands regularly
- avoid touching your face
- cover your mouth and nose with a tissue or the inside of your elbow when coughing or sneezing
- travel side by side or behind other people, rather than facing them, where seating arrangements allow
- only touch surfaces where required for safe travel

You must wear a [face covering](#) on public transport and in substantially enclosed areas of transport hubs in England, unless you are exempt.

*Note Guidance changed from 19/7/21 in England and the Government removed most mitigations (face coverings, social distancing etc.) from law. It became up to individual public transport firms / Taxi drivers / Mayors (in some regions) to decide whether to recommend continuation of mitigations under their rights to carriage and how to enforce / police these.

Appendix B: Categories of questions

Interview topics industry experts (Note: PT = public transport)	
	Topics
1.	**About you** • Your role and responsibilities • Changes in role and responsibilities since COVID-19 • How has your experience shaped your contribution to managing COVID-19? How has this been applied to PT?
2.	**Your views of COVID-19 transmission and PT** • How safe do you regard PT and are there any areas of particular concern and why? • How successful is the guidance and measures in place to keep people safe on PT and reducing transmission? • What do you think are the barriers to improving safety on PT? • What sources of evidence have you been using in your COVID-19 work? How have these contributed to guidance/policy (national / local) etc. • How have you responded to the uncertainty and rapidly evolving situation of COVID-19? • What are the challenges of implementing COVID-19 guidance in PT? • How would you sum up the key issues for PT in terms of research and policy
3.	**Your views about keeping everyone safe who uses /works on PT in the longer term** • What are the key areas where we need a better understanding of COVID-19 and PT? • What are the key challenges in the short and medium term for PT in keeping passengers and employees safe? • How long do you think we will PT need to maintain COVID-19 measures? • What are the future challenges for tackling COVID-19 transmission on public transport?
4.	**Your own experience of COVID-19** • How concerned are you about on PT? How do you keep safe at home? What personal experiences of COVID-19 have you had? • How do you think the vaccine will help improve safety on PT?
5.	Anything else you think would be useful for us to consider in investigating COVID-19 and PT?

	Interview topics Organisational leaders (Manager / Union rep) (PT = public transport)
	Topics
1.	**About you** • Your role and responsibilities • Changes in role and responsibilities since March '20
2.	**Changes in what you and your organisation do in response to COVID-19** • What has your organisation done differently to keep people safe on bus/train? • How has this affected the way you and your staff work? What impact has it had on the relationships between staff and managers? • What do you think about the safety measures and how are you monitoring their impact in your service? How do you use feedback from staff and passengers? • How did the easing of lockdown affect you (July/September/Christmas)? • What do you think has been driving these changes in your organisation?
3.	**Your views about keeping everyone safe who uses / works for PT** • What kind of difficulties have there been in keeping people safe (staff and passengers)? • How have your services been affected by COVID-19 related sickness absence? • How much have passengers changed what they do when they travel on PT? • How effective have the measures been and what interferes with people following the measures? • How easy has your organisation found it to follow the guidance (national / local)? • What other changes would you like to see? • What support have you received from external agencies? (e.g. HSE / PHE) • What role does your organisation have in protecting passengers from catching COVID-19? What role do you think your organisation has? • What are the main challenges in maintaining a functional and Covid-safe service in the medium term (next 6 months), for your organisation?
4.	**Your own experience of COVID-19** • How concerned are you about COVID-19 in work? • How concerned are you about COVID-19 outside work? How do you keep safe at home? What personal experiences of have you had? • How do you think the vaccine will help improve safety on PT?
5.	Anything else you think would be useful for us to consider in investigating COVID-19 and PT?

	Interview topics employees (PT = public transport)
	Topics
1.	About you • Your role and responsibilities • Changes in role and responsibilities since COVID-19 • Type of contract and how this influences your response to COVID-19
2.	Changes in what you do at work since COVID-19 • What have you done differently to keep people safe on bus/train? • How has this affected the way you work? • What do you think about the safety measures and how they were introduced? • How did the easing of lockdown affect you (July/September/Christmas)?
3.	Your views about keeping everyone safe who uses PT • How much have passengers changed what they do when they travel on PT? • What kind of difficulties have there been in keeping people safe? • How effective have the measures been and what interferes with people following the measures? • How easy have you found it to follow the guidance? (national / local) What helped you implement the guidance? • What other changes would you like to see? • What role does your organisation have in protecting passengers from catching COVID-19? What role do you think you have? • What are the challenges in keeping PT Covid-safe over the next few months?
4.	Your own experience of COVID-19 • Have any of your colleagues tested positive, and how do you think they caught C19? • How concerned are you about COVID-19 outside work? How do you keep safe at home? What personal experiences of C19 have you had? • How do you think the vaccine will help improve safety on PT?
5.	Anything else you think would be useful for us to consider in investigating C19 and PT?

Interview topics passenger (PT = public transport)	
	Topics
1.	About you • Your role and responsibilities/job • Your use of PT • Principal reasons for using PT
2.	Changes since COVID-19 • Changes in use of PT and why • What have you done differently to stay safe on bus/train/taxi? • How has this affected your daily life? • What do you think about the safety measures and how they were introduced?
3.	Your views about keeping everyone safe who uses PT • How much have you and other passengers changed what they do when they travel on PT? • What kind of difficulties have there been in keeping people safe? • How effective do you think the measures have been and what interferes with people following the measures? • How easy have you found it to follow the guidance? • What other changes would you like to see? • What are the challenges in keeping safe over the next few months on bus/train/taxi? How could your confidence in travelling safely be built?
4.	Your own experience of COVID-19 • How concerned are you about COVID-19 outside work? How do you keep safe at home? What personal experiences of COVID-19 have you had? • How do you think the vaccine will help improve safety on PT?
5.	Anything else you think would be useful for us to consider in investigating C19 and PT?

Appendix C: Facilitators and barriers to implementation of mitigations

(Listed alphabetically)

Facilitators

Facilitators	Detail
Co-operation between providers of services	Less competition, more co-operation
Company support to workers	Information, sick pay, HR policies
Effective communications (often making use of technology)	With workers (intranet, apps, magazines, newsletters etc.) and passengers (online, posters, apps etc.), visible cleaning activities (hygiene theatre)
Government financial support	All normal costs ongoing while passenger numbers dropped significantly
Feedback from staff and passengers	Lots of companies asking staff / passengers for feedback, social media, Research and consumer research (e.g. Transport focus)
Information and knowledge	Gaining timely and good quality information to inform decision making
Lower passenger demand / less people	Stay / work at home , essential travel only, uncertainty
Messaging	'Hands Face Space' message from Government Use public transport only where necessary / stay at home
Monitoring	Effectiveness of mitigations, how easy to implement, other options, passenger numbers, face covering compliance, community infection rates, staff sickness / isolation, etc.
Sector working together	Joint industry (virtual) Boards (bus and rail), sharing information and best practice across countries / organisations, support from industry experts/ research
Technology	Purchasing tickets, timetables, capacity of buses / trains, communication with workers / passengers
Testing	In community, by companies. PCR vs lateral flow, test and isolate
Trust	Leaders trusting employees to 'do the right thing'
Vaccines	Depends on ability to save lives and reduce transmission, drivers prioritised for vaccine in some areas

Barriers

Barriers	Detail
Behaviour / discipline fatigue	Difficult to predict individual's behaviour, risk and reward different for everyone.
Capacity on Public Transport	People don't have choices about when and where they need to travel much of the time e.g. work, hospital etc. Not finite numbers, as households can travel without social distancing
Communication	To and from Government, with workers, with passengers, with research community. Needs to be accurate, consistent and timely.
Difficulty of monitoring/ Need for trust	Invisibility of some behaviours (e.g. drivers wiping down their cabs between shifts)
Enforcement with passengers	Very difficult for staff to police passenger compliance, anyone can say they are exempt from wearing face coverings. Challenging people puts staff at more risk through extended contact/conversation
Extra costs	Putting in mitigations e.g. cleaning, hand sanitisers, face coverings for staff, low passenger fare collection
Gaps in knowledge and misinformation	Finding reliable timely sources of information. Individuals having to become experts in areas no previous knowledge of. Sensible operationalisation of guidance

Government decisions made too close to implementation requirements	Too short notice e.g. introduction of face coverings, timetables
Government guidance and messaging	Chaotic and difficult to work with, ambiguity in the guidance from the government, and points of contradiction within documents. Poor notification of new guidance. HR policies and procedures challenged by the differences in the guidance across the 3 nations.
Misunderstanding of guidance / rules	Clarity of guidance / rules, speed of change in rules / guidance, Inconsistencies in messaging
Oversight / regulation	At times a focus on enforcement rather than collaboration and supporting learning
Passengers compliance	Variable compliance among passengers in terms of social distancing, face coverings, groups wishing to travel together, making unnecessary journeys
Pressure on key individuals (Organisational leaders and workers)	If these people go off sick / stressed business will not operate in same way. Everyone has been in crisis mode for 12 months.
Risk of offending colleagues	Difficult for staff to enforce compliance with peers; it can seem insulting as it suggests they don't trust them.
Sector (modes of travel / job roles) differences	Different travellers on bus / train, different reasons for travel, so need for different solutions / support. Workers roles – drivers, construction, signals, revenue collection, platform, catering etc.
School transport (buses)	Doesn't have same socially distance rules, double running services – normal and school
Silo working of Government Depts. / industry modes (bus / rail) / organisations	Better joined up working required for guidance to make sense and keep whole of public transport sector operational, fit for purpose and safe
Social media	Fast reaction to complaints required, take up a lot of time, firefighting, quick solutions to communicate to staff.
Some jobs cannot use all mitigations	In cab training, signal boxes, bus drivers
Speed of changes	Situation evolving so rapidly, not possible to evaluate changes introduced
Staff compliance	Staff can forget and feel safe with their 'mates'. Workers following guidance in work but not outside of workplace (Living arrangements, travel to work, socialising etc.)
Test and isolate	Some object to testing, some can't afford to isolate, accuracy of testing, at-work testing difficult to set up/manage
Transmission between passengers or between workers – how to measure	Data not being collected / not available. Factors external to travelling / working on public transport impact