

ROUTES OF INFECTION / ROUTES TO SAFETY

Understanding microbial landscapes
of the bus during the COVID-19 pandemic

Interim Report
December 2021

Routes of Infection / Routes to Safety

UNDERSTANDING MICROBIAL LANDSCAPES OF THE BUS DURING THE COVID-19 PANDEMIC

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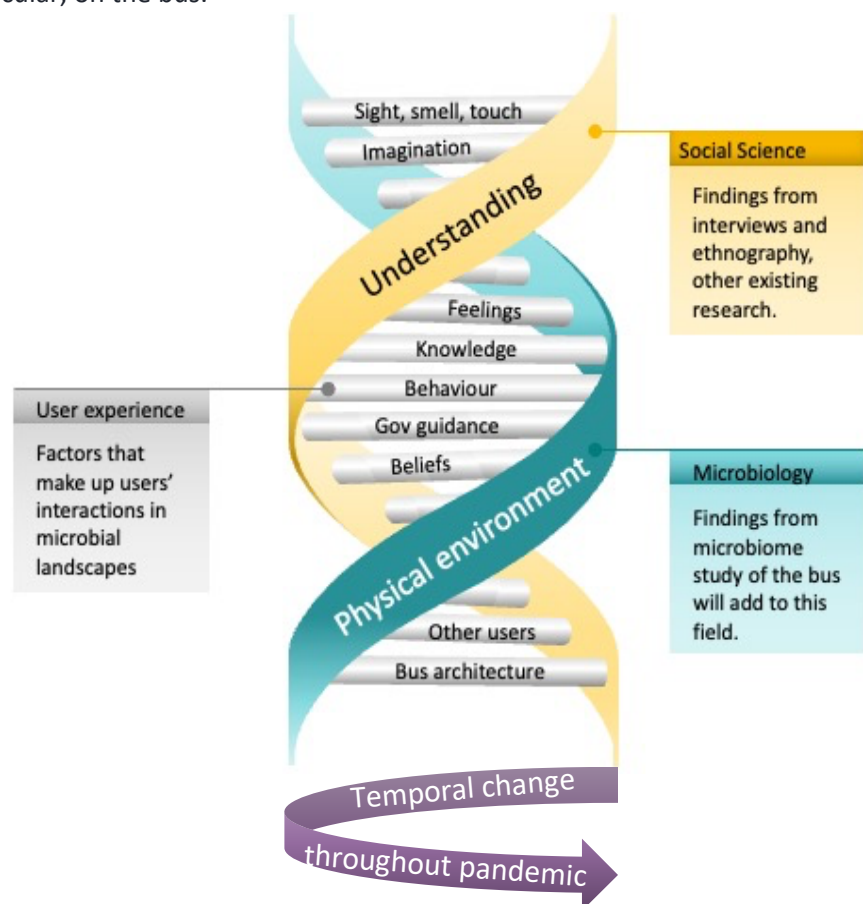
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EXECUTIVE SUMMARY

This report is provided for stakeholders involved in the provision and management of public transport services where there is a risk of community transmission of COVID-19 and other infections such as seasonal colds, flu, and noroviruses. It provides analysis of everyday bus user experiences within the changing conditions of the COVID-19 public health crisis, March 2020 onwards.

Central to our thinking is the concept of ‘**microbial landscapes**’. This is a new term we are introducing to help describe and explain what is going on all around us, but in particular, on the bus.



Microbial landscapes describes the intertwining BETWEEN the various ways different bus passengers visualise and sense the bus environment, AND the physical, material elements like other passenger bodies, bus architecture, viral particles and microbes. These microbial landscapes are dynamic across the temporalities of day, different seasons, different passengers, and the local dominance of evolving viral strains (alpha, delta, omicron of COVID-19 virus) and cleaning regimes, hand-sanitising, mask-wearing, and windows opening.

This report explains:

PUBLIC TRANSPORT CHALLENGES AND COVID-19

1. **DISTORTED NORMAL BUS ENVIRONMENT:** Changes to the bus environment under Pandemic conditions has distorted the bus passenger experience. a) The interior of the bus was re/organised and redesigned. This in turn b) changed how those on the bus imagined the space, leading to c) altered passenger behaviours, and of those former passengers who have not returned to taking the bus.
2. **INVISIBILITY:** The COVID-19 Pandemic has brought attention to the bus's microbial landscape on surfaces or in the atmosphere/air and yet the microbial world's invisibility creates problems about how bus-users know how to respond and feel about it.
3. **BEHAVIOURS / FEELINGS IN MICROBIAL LANDSCAPES:** Not only have there been obvious changes to what passengers see inside and outside the bus to remind them of Pandemic times (heightened cleaning, signage), but passengers have been mandated or requested to behave in unusual ways. Collectively, there are new feelings that can be felt on the bus - caution, alarm, reassurance, confidence, relief, are just a few that this study has identified.
4. **BUS STIGMATISATION AND CLEANING:** The bus is often stigmatised for being dirty. This is unfair, rather the bus is repeatedly having a changing line-up of human passengers through the day who bring 'stuff' on with them from the 'microbial' (viruses, bacteria, fungi) through to macro-scale litter (tissue, bus ticket, drink can). In light of the pandemic, bus operators have responded with much stricter cleaning protocols to reduce bus surfaces as potential sites of COVID-19 transmission. For economic and environmental reasons, it is necessary to better cultivate the collective interest of bus-users about their personal role in keeping the bus clean of not only macro but micro 'stuff', to build confidence in returning to/using public transport.
5. **SURFACE CLEANING:** Early findings from the bus microbiome study shows that bus operator's surface cleaning works to reduce the scale of microbial populations on surfaces immediately after a clean. The microbial communities build up as passengers get on and off the bus, but there is no evidence that these increase any likelihood of catching something if basic infection prevention measures are adopted. Personal well-being – such as an open-cut that could become infected or having a compromised immune system – can reduce or increase ones' risk levels. There is a research gap about how much, when and what types of microbial life, commonly thought of as the mostly invisible microbiome, pose a risk to humans.

CULTURES OF PANDEMIC (MIS)INFORMATION

6. **CONFUSION ABOUT THE SCIENCE:** Science is not the sole authority on microbial landscapes. Indeed, a lack of scientific clarity on COVID-19 infection risks, and subsequent misunderstanding (about spread, vaccine, and spaces of perceived 'high' risk like the bus etc) and circulation of misinformation, particularly at the start of the pandemic, requires broader interdisciplinary approaches that recognise the important role social and cultural dimensions play in public health adherence. The concept of a 'novel virus' was simply not grasped by all, along with other scientific terminology like 'strains', R-rates and microbial loads.
7. **SIMPLICITY OF GOVERNMENT GUIDANCE:** In contrast, Government guidelines about how to behave (if not the reasoning for it) was initially widely understood and adhered to as the way to stay safe, by bus-users. Cautionary guidelines were welcomed and resonated largely with bus-users' fears about the virus and shock about the changes to everyday life as people experienced Lockdown.
8. **DIMINISHING EFFECTIVENESS OF COVID-19 MESSAGING:** Yet as the Pandemic has continued, the Government's simple messaging has become less effective. The scientific communications have become more confusing because of microbial evolution, the stated success of the vaccine roll-out alongside political shifts to Government public health guidance and rules which have sought to be attentive to the negative economic and social impact of the Pandemic. Different types of bus-users or potential bus-users have increasingly made their own decisions and rationale about how to behave in and around taking the bus.

CREATIVE INTERVENTION IN INFECTION PREVENTION MATERIALS

9. **NOVEL PUBLIC ENGAGEMENT:** The *Never Alone on the Bus* films build on these insights from our studies to experiment with a creative medium of communicating about the changing microbial landscape and infection prevention on the bus.
10. **INTERDISCIPLINARITY APPLICATION:** An interdisciplinary approach that combines social scientific and microbial studies (hereon socio-microbial) of buses and other public spaces – pubs, supermarkets, cafes, hair salons, libraries – can articulate how the microbial landscape imagined, felt, believed can achieve two things. Socio-microbiology of the bus can address cautious passenger behaviours by providing some clarity on the bus microbiome. These insights could improve infection prevention guidance and recommendations through supporting bus-user's interventions to manage potential risks within these invisible, dynamic microbial landscape.

The report gives substantial examples, drawn from 10 months of empirical social and microbial study of the points raised above, and makes specific recommendations for stakeholders in the public transport sector.

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1. INTRODUCTION

1.1 CONTEXT OF THE RESEARCH

Bus services are vital to healthy societies and provide accessible, affordable travel for a diverse community of users. They serve a critical role in transporting commuters to work, students to school and college, shoppers to supermarkets and shopping centres, and enable people to meet with friends and family or to socialise by day or night. But Transport Focus weekly reports in 2021ⁱ continue to indicate some former users feel unsafe returning to the bus as COVID-19 infection prevention measures have been watered-down with the ongoing roll-out of the UK COVID-19 vaccination programme. As well as being an essential social and economic resource, buses also play a role in reducing car use and congestion and associated air pollution and greenhouse gas emissions. The UK Government's 10-point plan for a post-pandemic Green Industrial Revolutionⁱⁱ aims to get people back using public transport, but also, to increase pre-pandemic usage levels.

This report begins by detailing what is currently known about the epidemiology of the novel coronavirus and specifically how characteristics of the bus-travelling experience and lifestyles of bus users could potentially increase the risk of transmission. This helps to explain how COVID-19 has disrupted the microbial landscapes of ordinary bus use behaviour and its impact on operators, users, and their staff (drivers and cleaners).

1.2 WHAT IS KNOWN ABOUT COVID-19 VIRUS

COVID-19 is an infectious disease caused by the SARS-CoV-2 coronavirus. Coronaviruses were first discovered in humans in the 1960s, and while some coronaviruses (e.g. those causing common colds) pose lower risks to most humans, others can lead to more serious illness including SARS, MERS and COVID-19.

The outbreak of a novel coronavirus was reported in Wuhan China in December 2019 and spread rapidly across the world in spring 2020, with the first reported cases in the UK on the 29th January 2020. This virus, SARS-CoV-2 can be transmitted through direct, indirect, or close contact with an infected person, through infected secretions such as saliva and respiratory secretion, or repository droplets expelled when an infected person sneezes, coughs, or talks^{iii iv v}.

As scientific understanding about the routes of COVID-19 transmission have developed, so too have discussions about the risk of infection in indoor public spaces, including public transport. These have focused on issues that include:

- overcrowding (reduced opportunities for social distancing),
- inhalation of shared air in indoor spaces (if insufficient fresh air circulating or poor ventilation),
- sharing touch surfaces like grab-rails, stop-button, steering-wheel (reliance on good hand-hygiene by bus users), and
- the effectiveness of face coverings (for self- or community-protection).

Causal links between COVID-19 illness and having contracted the virus on a bus are impossible to prove, especially when it comes to tracking passengers' lives. However, from what is known about the behaviour of existing COVID-19 strains, there can be risks for bus users if spending time close to, or in an enclosed space, with an infected person. Significant reductions to the risk of catching the virus from an infected passenger can be achieved by a combination of preventive actions:

- bus users wearing face-coverings,
- ensuring fresh air ventilation by opening bus windows,
- reducing the length of time inside and/or travelling at quieter periods
- allowing space for others outside our households (social distancing)
- hand-sanitising,
- and when possible, boosting an individual's immunological status in relation to COVID-19 (vaccine dosage or past infection).

Within our study design we were mindful of a need to evidence how COVID-19 does not affect all population groups equally. Research shows higher COVID-19 death rates and disease incidence according to age, ethnicity, underlying health conditions (diabetes, cardiovascular disease) gender and geographical area^{viii}, that intersect with social and structural determinants of health - behavioral, social, economic and workplace factors. For example, a comparatively higher COVID-19 incidence, treatment, morbidity, and mortality has been found in Black Asian and Minority Ethnic communities. Sayaqle^{viii}, Morales^{ix} and Haque^x associate this with types of employment, multi-generational households, and lifestyles. This is supported up by data from Office for National Statistics^{xi} and Public Health England^{xii}. Thus, we sought to understand how individuals from some of these groups experienced bus use during the pandemic.

2. RESEARCH APPROACH

2.1 PROJECT: ROUTES OF INFECTION / ROUTES TO SAFETY

2.1.1 AIMS

Routes of Infection / Routes to Safety began in January 2021 as a response to the reduction in public transport use during the COVID-19 pandemic, and to government and public concerns about the safety of bus travel. A strong, safe, and accessible public transport network is vital to a green post-pandemic recovery. We identified a need for research to support the delivery of this in a way that addresses broader inequalities exacerbated by new microbial landscapes. The project's objectives were:

- To understand how corporate cleaning practices, bus user behaviours, bus architecture, and knowledges about COVID-19 and infection prevention methods (such as mask-wearing) generate feelings of risk or confidence.
- To integrate findings about bus use with microbiological data, to speculate on how SARS-COV-2 and other microbes might exist and travel on the bus.
- To creatively visualise and represent interactions between humans, microbes and buses, and demonstrate the impact of infection prevention to improve compliance and uptake, in spaces and places more widely.

2.1.2 ORGANISATION, FUNDING AND PARTNERS

The project is a collaboration between researchers in Geography and Environmental Science and in Health Sciences at the University of Southampton, and in Architecture, Planning and Landscape at Newcastle University. It is funded by UK

Research and Innovation's COVID-19 Rapid Response Fund via the Arts and Humanities Research Council. The project has been developed in dialogue with two regional bus operators and with local and national bus user and community groups. The academic team has been working together since 2016, on projects supported by the Network for Antimicrobial Resistance and Infection Prevention (NAMRIP).

2.1.3 RESEARCH METHODS

Research has taken place across two cities in the south of England, where researchers were living when the research began and when lockdown measures restricted wider UK travel. The project included three main strands and combined social science, microbiological and creative methods. These have been designed to inform each other through the course of the project:

STRAND ONE: Social science research comprising ethnography and interviews.

- a. Ethnography: Approximately 60 hours between February and October 2021 of researchers observing bus use and user behaviour, at bus stops, when boarding/exiting bus, and whilst on board the bus. One route was chosen in each city, according to its multiple socio-economic functions (serving a hospital, shopping centres, food stores, university) and focusing on stops on the routes located in ethnically diverse communities.
- b. Interviews: 37 semi-structured interviews lasting between 25 minutes and 1 hour, of 10 bus drivers, 22 bus users and 5 bus cleaners were undertaken between April and August 2021. Interviews focused on experiences of bus travel during the pandemic, feelings, and experiences of managing risk, and human interactions with microbial life. All interviewees in this report were given a pseudonym.

Research respondents were recruited through research partners and community members in Bristol, and 70% were from BAME communities. Ethical research and health and safety procedures were rigorously followed throughout.

STRAND TWO: The undertaking of a bus microbiome study that involved researchers taking and analysing swabs from 26 different sites on a bus. Buses were swabbed a number of times during May - August 2021, as we moved from lockdown to a removal of restrictions. Additionally, using a single example bus route, swabs were taken prior to a bus leaving the depot (following an overnight clean) and on its return, fortnightly from Sept to Nov 2021, tracking increasing passenger density and the move from early autumn into winter. Samples are being analysed by culture onto bacteriological agar and sequenced to identify the types and quantities of a variety of microbes (bacteria and viruses, including coronaviruses).

STRAND THREE: The creative development of four ~1 minute animated films and associated informational materials about infection prevention on the bus and human-microbial relations. A series of public engagement activities and stakeholder workshops have been planned to engage stakeholders in the process of sharing findings about passenger responses to changing microbial landscapes.

2.2 COVID-19 TIMES: A CHANGING CONTEXT FOR RESEARCH

UK Government public health measures, including lockdowns and other mandates, responded to the rapidly evolving medical and scientific reports on COVID-19 cases, early in 2020. This led to the first national lockdown from Tuesday 24th March 2020, as the Government urged people to stay at home, unless they were a keyworker. This included avoiding non-essential travel, including on public transport. This lasted for 12 weeks. During this time, people were told that mixing with those outside their household was a risk. What ensued was an out of the ordinary public level of microbial (including viral) anxiety towards the virus.

Government messaging incited cautious and vigilant behaviour – ‘stay at home, protect the NHS, save lives’, which was replaced by ‘stay alert, control the virus, save lives’ – for both self-protection, protection of others / the NHS. Paralleling actions taken by the international community, the UK moved onto a war-footing against the virus^{xiii}. For many the habits of leaving the house to catch the bus to work, shop, or school, or to see friends and spend time in a crowded space ceased. The crisis led to the improvisation of extra-ordinary ways of doing ordinary things as people found ways to carry on *within* the guidance and to manage their anxieties of the microbial landscape. At the start, in the absence of proven medo-scientific knowledge about the novel virus, new bodily positions and habits were adopted as wary strangers passed awkwardly on narrow pavements, packaged food-shopping was washed with soap and water, loved ones were greeted outside of your household through a window, and physical touch was avoided.



With the limits on where one could go, new practices were established within the home, while existing practices outside the home, including bus travel, reduced. Replacements emerged that helped manage new anxieties, fears, angers, and senses of comfort and in/security - many of which have remained despite the fluctuation in risk throughout various stages of the pandemic. Bus companies and other indoor settings have had to be nimble to this rapidly evolving picture to minimise economic impacts (i.e. to stay open) and to ensure workplace safety.

Implementing signage, shields, additional cleaning staff, and reducing carrying-capacity in response to this changing picture, has had a substantial financial impact on operators both in the short (reduced passenger numbers) and long term (consumer confidence). A fluctuating picture, with peaks and troughs in infection risk, is likely to continue throughout 2022 meaning that restrictions and guidance will continue to

evolve. Of grave concern to the bus industry is the practice of replacing bus travel with car-use, or lifestyle changes that lead to not needing to use the bus as often or ever.

- *How durable were or are these new ways of doing everyday life around bus use that emerged?*
- *And how have bus users adapted to the changing microbial landscape through the pandemic?*
- *When and why have bus passengers felt comfortable, anxiety-free travel on the bus during the various stages of the pandemic?*

As the initial lockdown eased, restrictions on bus usage stayed in place. Following government guidelines, bus operators maintained their reduced passenger carrying capacity to facilitate social distancing and the mandating of face coverings to be worn on all public transport between June / July 2020 until July 2021 in England. The requirement to still wear a facemask on public transport has continued in Scotland, Wales and Northern Ireland and while restrictions in England ended on 'Freedom day' in July 2021, mandatory face masks on public transport were reinstated on November 30th 2021, following the discovery of a suspected highly transmissible and more-dominant variant, Omicron.

Overview of key stages of government pandemic guidelines/restrictions in England. Restrictions and guidelines differed in Wales, Scotland, and Northern Ireland, where governments have generally taken a more precautionary approach.

March 2020 - June 2020 - First national lockdown.

July 2020 - Oct 2020 - COVID-19 mitigation measures.

Nov 2020 - Second lockdown, tier system.

Dec 2020 – COVID-19 mitigation measures.

Jan 2021 - March 2021 - Third national lockdown.

April 2021- June 2021 – COVID-19 mitigation measures.

July 2021 - Nov 2021 - COVID-19 restrictions end.

Dec 2021 - Face-coverings advised in indoor spaces including public transport.

Since the discovery of SARS-COV-2 in 2019, public health information, guidance, and regulations have been rapidly evolving, with 'state of emergency' like measures being implemented within a matter of days. Such measures include: scientific advice on how the virus spread and risk levels (according to vulnerability, proximity, etc); changing government advice about managing risk through social distancing and mask-wearing; geographical restrictions (tier system and by devolved governments); and restrictions on re-opening premises (e.g. shops versus beauty salon, and nightclubs). These changes have been substantial in scope and rapid in implementation.

Ethnographic research and the microbiome study captured experiences and concerns of passengers, cleaners and drivers between February and August 2021. We observed what was happening during this period and heard about other timeframes within the pandemic. The interdisciplinary team had to operate in a fluctuating research context - altering aims and methodologies along the way in response to evolving medo-scientific information (e.g. surface transmission to aerosol) and to manage outputs in relation to shifting government agendas (e.g. return to normal).

2.3 EXISTING RESEARCH

We situate our empirical research findings on how the COVID-19 pandemic has changed public transport usage, in relation to pre-pandemic social scientific research on buses and bus passenger experience. These literatures include cultures of bus ‘passengering’, socio-economic conditions of mobility, and race and public transport.

2.3.1 CULTURES OF PASSENGERING

Transport studies have explored experiences of being mobile and the cultures of bus passengering. However, pandemic conditions have sharpened appreciation for how public transport mobility and passenger experiences can be disrupted by public health crises. Sustained periods of observation (or ethnography) onboard buses have enabled scholars to describe pre-pandemic characteristics of shared public codes of conduct, behaviour, and habits.

Pre-pandemic bus journeys were marked by interactions with unacquainted others, where conversations across difference not only become possible, but for the most part, are unavoidable^{xiv xv}. Bodies were pressed up against each other. Seats were shared. Personal boundaries were negotiated^{xvixvii}. Wilson writes, “As the passenger group shifts with each stop, the requirements and claims to seats alter. There are clearly a series of rules that work to orientate bodies in particular ways”^{xviii} She also notes that there are tactics to be read: “bags, coats, and feet are placed on chairs (...) and a quick glance may be met by a dead-eye and taken as indication of hostility.”^{xix} Differentials in public transportation design expose spatial inequalities that literally move through the city, and include the planning of schedules and routes, the quality of vehicles, stops and depots, and the provision of cleaning routines that maintain them.^{xx}

- *How has the enclosed space of the bus become a site for the shared learning of new pandemic behaviours?*
- *How are these articulated through different emotional registers - sympathy, animosity, or ambivalence – within a multicultural community that brings together diverse sectors of society by gender, race, ethnicity, age, and locale?*
- *How have the COVID-19 restrictions, guidance, and its ongoing repercussions along the process of returning to ‘normal’ brought changes to passenger interactions in pandemic, inter- and post-pandemic times?*

2.3.2 SOCIO-ECONOMIC CONDITIONS OF MOBILITY

Mobility is a marker and maker of social life^{xxi}. Previous transport studies have shown how socio-economic conditions inform personal mobilities, public transport usage, and social inequalities^{xxii xxiii xxiv xxv}, but the intersection of these with changing local public health conditions is not known. Being able to make a journey can facilitate access to economic opportunities or support social networks and the participation in leisure. However, this is not experienced evenly or equally, and the capacity to take public transport and quality of that experience, is part of this story. Bus travel continues to be associated with lower paid sectors of society^{xxvi}. Weak public transport systems are a legacy of local and regional infrastructures and can manifest socio-economic exclusions^{xxvii} helping to explain the geography of low-income communities^{xxviii} and the re/production of inequalities. It also can manifest through inadequate financial budgets and regulations (e.g. off-peak) reducing opportunities to cover distances by relatively fast and flexible transport modes.

This is contrasted with those members of society who lead less time-sensitive lives (e.g. the elderly or those on Incapacity Benefit) and for whom the travel experience may become an event in itself, and with a growing environmentally-conscious public who, despite economic power, compromise duration of journey for more sustainable and environmentally-responsible travel futures^{xxx}. Comparative journey speed and duration is still highly influential in transport decision-making^{xxxi}, because it allows greater flexibility in working practices and more time at home^{xxxii}. In contrast bus journeys can be characterized by periods of relative in/activity (e.g. waiting^{xxxiii}). There is an emotional stigma around using public transport, especially taking the bus. This is something that the bus industry along with policy moves towards a more sustainable, carbon-neutral transport system have been seeking to address for some time.

- *What are the consequences of a public health crisis in disrupting people's mobility by public transport?*
- *Does a public health crisis compound any of the structural disadvantages related to various forms of short or long-distance public transport usage, and how is the longstanding stigma associated with public transport affected?*
- *How has the pandemic left its mark on how people negotiate their own identity on the bus and what impact has it had on shaping a richer complexity of cultures and bodily performances on the bus?*
- *How have existing multicultural negotiations on the bus interacted with emergent pandemic responsive performances?*

3. KEY FINDINGS

Our key findings have emerged from interviews, ethnography, and the microbiome study, and are organized around the themes below. These findings are evidenced by interview quotes and photographs from ethnography, some of which are included.

3.1 PUBLIC TRANSPORT CHALLENGES AND COVID-19

In this section we discuss the experiences of working on buses and travelling by bus during the third wave of the pandemic (February-April 2021), slow relaxation of the rules (May-June 2021) and lifting of all restrictions (July-August 2021). We cover bus driver experiences and bus passenger experiences of face-covering, social distancing both on the bus and waiting for buses, and hand sanitising.

3.1.1 DISTORTED NORMAL BUS ENVIRONMENT

We first turn to the experiences of bus drivers.

During interviews, our drivers discussed their experiences of providing the vital service of public transport, often for key workers, during the first lockdown; what it was like to work whilst others were furloughed; difficulties in understanding changing guidance in relation to company responses and adapting accordingly; and passenger behaviours' and/or compliance with guidelines. Interviewees from this community also shared experiences of what it felt like to adjust back to 'normal' times as restrictions (on bus capacity, mask wearing etc) were lifted, but when the microbial landscape still seemed threatening, and passengers' behaviour increased this sense of risk. Themes of anxiety, coping with the changing perception of the microbial landscape, and understanding of COVID-19 risks, come across in all the interviews.

3.1.2 WORKING DURING THE LOCKDOWNS

As much of society managed or struggled with the new domestic regime brought about by COVID-19, buses continued to run but with a reduced service, often picking up no passengers throughout a complete route. This driver speaks about not being furloughed but continuing to work, finding it isolating, but needing to support his family and missing them as others stayed at home.

‘It was very lonely, it was very lonely, ‘cos there was only about fifteen drivers here. And there was no one at the University. [...] It was quite difficult for us all ‘cos I was missing out on – I've got two twin sons.’ (Dan, driver)

At the start of the pandemic before lockdown and the later implementation of reduced passenger capacity, the potential risks of COVID-19 transmission to bus-drivers were a cause of great concern as some bus operators experienced drivers falling sick and, in several cases, dying. Higher rates of death involving COVID-19, were identified in bus and coach drivers (44.2 deaths per 100,000; 53 deaths; ONS 2020). In March 2021, the BBC reported that London bus drivers died with COVID-19 at almost three times the national average for other occupations, with at least 51 drivers losing their lives in the early months of the pandemic (BBC 2021a). The absence of staff through sickness, heightened this driver’s sense of risk of the microbial landscape:

‘When we first started (beginning of lockdown 1), obviously, I was – like we were really worried when we first started. And also when we first came back, I was really anxious as well. And there was a time when a lot of our drivers were going off sick with it. And at that point I was – I was like really anxious and I was kind of like staying away from everyone.’ (Dan, driver)

Here another driver who worked through the lockdown shares how they only didn’t feel safe when there was a slow return to normal bus timetables and an increase in bus drivers. It is at this point he struggled with his anxiety about dealing with ‘a massive amount of people’ in an enclosed space

‘It was when everyone was starting to come back was my issue, that’s when I wasn’t feeling safe, where I had to go and speak to people, or speak to my boss and tell her everything. Basically, the anxiety attacks I was starting to get of knowing that we’ve worked through all this with only minimum amount of drivers that was capable, and then all of a sudden the next day we’re told right, there’s thirty drivers coming back tomorrow, and it’s like where are they going to – what are they going to do?’ (Rebecca, driver)

‘And they [bus drivers] come back and it was like nothing had happened, (...), where we’ve had to work through it and they couldn’t understand that. (...) And the anxiety was through the roof with me, it was quite nasty. (...). It’s the only times I’ve really felt unsafe with it was with the anxiety coming through of a massive amount of people. Yeah, it’s not nice, it was a very scary thing.’ (Rebecca, driver)

This driver also identifies a distinction in perceived behaviour and anxiety between those who had to work during the highest risk period – with less information about viral transmission and infection prevention measures – and those who returned at a time when the pandemic was deemed to be ‘coming under control’ in latter parts of summer 2020 (with the easing of lockdowns and the mandating of masks).

The feeling of anxiety and apprehension expressed by our bus drivers, about returning to normal levels of activity after the first lockdown, have parallels to their passengers' apprehension at returning to the bus.

'being a bus driver is just driving around empty buses really at first [in the lockdown] – the public lost a lot of confidence, which to be fair you know, we've still had to put on a service and still provide that service for passengers, but there wasn't the passengers out there, slowly they gradually come back. But a bit apprehensive at first, you know. Because although they had designated seats some people chose not to sit there, or if there was up to capacity of seats some people would sit next to a person and they'd like, you know.' (Colin, driver)



With the backdrop of daily scientific and government information briefings, informing the public against mixing outside of our households or bubbles, and avoiding shared indoor spaces (such as public transport), key workers including bus cleaners were returning to a familiar setting, but where the microbial landscape was now deemed risky, and where uncertainty of infection-risk dominated, neither able to fully see it, nor comprehend the virus's capacity to infect. Here a cleaner expressed their concerns using scientific knowledge about aerosol transmission and applying that to the bus environment, only finding a sense of personal security through a distortion in the everyday workplace (introduction of one-way systems, highly visible hand sanitiser stations):

'Coming back from furlough, I was very, very sort of nervous. And I didn't want to come back until I knew that the workplace had a one-way system and hand sanitizers, which was all in place. And, like I say, it was very nerve wracking to begin with. Because you didn't know how easy you were going to catch it. You didn't know by just being on a bus with still sort of that air around you, you just didn't know, really, what you're dealing with.' (Katie, cleaner)

In addition to the work safety measures implemented at bus depots, bus operators introduced a range of infection prevention measures in late spring of 2020 to better protect bus drivers from COVID-19 transmission. Such measures primarily responded to the importance of increasing physical distance between passenger and driver; preventing passengers from entering and exiting from the front of the bus (if it had two doorways), installing plastic screens blocking off the driver's cab (known as screen

guards), closing off the front seats (to ensure social distancing from passengers), encouraging e-tickets and touch-free ticket payment and hand-sanitisers (to reduce touch-based infection), and in the June of 2020, introducing mandatory face-coverings to minimise airborne transmission.

These interventions made the bus environment seem strange, unfamiliar, and for many, threatening. Yet for others, such measures offered reassurance to drivers and users that companies were doing *something*; taking measures to ensure public health and minimise risk. Below, a driver reflects on the screens and the closing off the front bus seats:

‘When these new screens came in it was better, we had a bit more protection, but then one of the guys spoke to the NHS and somebody to do with COVID and they said, “Actually, screens have no protection for you ‘cos they’ve got holes in. So they are basically a comfort blanket for you.’ (Rachel, driver)

‘The only thing we did like through the pandemic is two seats that were near the driver weren’t allowed to be used. They’re being used again now. [...] because [if] you’re going to be sat there with everyone walking past you. So that, you know, for a general passenger is not a good thing, so I thought them being shut off was a great idea. And then for us [drivers], obviously you haven’t got that person sat breathing, you know, when everyone is getting on and then walking past, it’s something you have to put up with. But when they’re actually sat next to you, sometimes for the entire journey, you kind of like to shut those seats off.’ (Rachel, driver)

3.1.3 PASSENGER EXPERIENCES

During the pandemic, users made a range of different journeys, primarily for work and activities like shopping and medical appointments. Leisure and social journeys were reduced. What was also lost were experiences of sociality on the bus itself. Users spoke of minimizing interactions with other passengers, while drivers noted that they missed social interactions, including those with regular passengers. Collectively, these speak of a loss of a sense of community on the bus.

‘We used to sit and talk to a lot of them ‘cos we didn’t have the screens, especially the regulars and the elderly. We used to be the only people they’d talk to, um, very rarely do you have a conversation. You can’t hear them through the screens which doesn’t help, but you don’t have really any interaction with them. Some of them barely talk anymore.’ (Rachel, driver)

Adapting passenger experiences of taking the bus, and expected behaviour while onboard the bus, was critical to demonstrating bus operators and passengers took COVID-19 seriously. As Government mandates eased in the summer of 2021, the bus has become a space where enforcement of recommended measures has weakened. Consequently, individual, and peer-to-peer nudges about how to behave on the bus have become more significant. The effect has been a gradual sliding towards no masks, hand-sanitising, or social distancing, and everyday rhythms of travelling according to a pre-pandemic normal.

There has been a lot of interest in people’ feelings about COVID-19 mitigation behaviour measures and in the willingness to adopt them. A common source of stress for passengers was being on a busy bus and being unable to socially distance from others. This, and discussions about opening windows, were perceived as potential sources of conflict with other bus users. All passengers we spoke to were

using face coverings on the bus (albeit when they were mandated), and most were using hand sanitizer and were conscious of interacting with high touch surfaces. Only some were attentive to whether windows were open on the bus, and even fewer of them felt comfortable opening them.

Next, we share further details about how bus passengers have experienced the application of the four key public health measures.

FACE-COVERINGS

The acceptance, conformity and understanding for the need to wear a face covering on the bus has changed throughout the course of the pandemic. During the first wave, there was low uptake and a general sense of uncertainty about their effectiveness. With increased scientific evidence of the efficacy, this changed in July 2020 with the compulsory introduction of mask wearing in indoor spaces and on public transport. Restrictions on face covering eased again in July 2021 in favour of personal choice, before returning to mandatory in the fight against spiralling cases in December 2021. Most people we spoke to talked about face coverings guidelines positively, and people variously valued them for self-protection and for protecting others. Research participants recognised they were important for reducing spread but also for providing reassurance.

‘as long as I keep my facemask, as long as I try to keep my social distance, I feel safe enough to take – go on a long journey if I have to.’ (Ahmed, passenger)

‘oh, this person’s coughing, does he have it? Does that lady have it? Is it – it was that kind of thing that would play on your mind. But now, what it is, is just I learnt the science, basically, saying, oh, you know what, by wearing a mask you're limiting the exposure.’ (Ahmed, passenger)

‘the face mask is protecting me and also it’s protecting others as well. So, it’s okay.’ (Arif, passenger)



For many, the face covering became part of everyday infection prevention.

‘during pandemic is I should be careful and vigilant and I shall keep my face mask also and I use, you know, the hand sanitiser as well, yeah, sanitiser to sterilise and to clean my hands.’ (Khadar, passenger)

‘a lot of people they get on the bus – they’re allowed on the bus without a face mask, or when they get on the bus they can just like take the face mask off as well. And the bus driver doesn’t really seem to, you know, say anything as well. So there’s no kind of challenging by the bus driver about that behaviour.’ (Yasmin, passenger)

Mask wearing compliance onboard buses was highly varied, not least depending on time of the day, passenger levels, and stage of the pandemic. Ethnographic notes reveal mixed compliance with poor application (mouth not nose) and reduced time usage (boarding with mask, taking it off when upstairs, when drinking, when talking on the phone). Mask wearing was a cause of conflict both between passengers and between passenger/bus driver. Medical exemption was a further point of conflict (not knowing/misuse of the exemption).

‘I had a couple of confrontations with passengers, argument. For example, there was a young girl, she’d got on the bus, had a mask on, she went and sat upstairs. I stopped here and said look, do you mind – I went – walked up the stairs, kept as much distance between me and her as I could and said to her, “look, do you mind putting your mask on.’ (Rachel, driver)

By April 2021, the weather was improving. More people were boarding the buses but with less stringent attention to how they wore their face covering. Two ladies chatting earnestly placed it under their noses. A man drinking a bottle of Redbull sat on the backseat, centre, with no mask on at all. On a previous journey the driver had refused travel to a man holding an open can of drink. Drivers seemed to be able to direct passengers to follow the guidelines or not. They also were active at opening all windows, at the start of their journey (or not).

SOCIAL DISTANCING

The buses in spring of 2021 were often rather empty. Consequently, bus passengers got a lot of choice about where they could sit. Yet we noticed some repeated preferences - hot seats (Fig.1) that were used more than others. Namely, the downstairs back row window seats and the front row seats upstairs. A new passenger arriving could be completely unaware that the air they were moving to sit in had so recently been occupied by someone coughing and sneezing.

Upstairs back	0	3	5	8	front	across 14 buses
	3	2	stairs	5		
	Upper	Lower	Flipseats			
Downstairs back	19	16	4		front	across 22 buses
	18	11	4	stairs/driver		

Figure 1. Hot Seats on the bus -most popular in a reduced capacity bus.

As passengers started to return to the bus, mandatory social distancing measures were adopted. These were understood positively, as physical distance on the bus provided a sense of safety and reassurance to many.

‘[At] the beginning, people didn’t care. What it was, even before we went into the first lockdown when all the news we were hearing, I was still trying to keep my distance from people ’cos we’ll never know how far this might go, so I tried to limit it. But it was just – it was just – the thing is, people didn’t have no knowledge back then.’ (Ahmed, passenger)

'I've seen people blowing off for the smallest things, just decide like, oh, you're sitting too close to me, even though they're sitting next to each other, – there's a whole issue on a bus, especially on a rush hour'. (Ahmed, passenger)

'I find it better because it's more like – before, on the buses, they used to be – the buses used to be packed and everyone used to just have to sit next to each other. But now, it's more spread out, so they can't sit every – they've got like a little thing that's saying one person can sit here, one person can't, one person can sit here, one person can't. So it's more spaced out.' (Musa, passenger)

'All I know is to wear your mask and stay away from people and to wash your hands if you touch things. [...] Just to keep the virus away from you. And generally, I'm like a bit of a germophobe so all that makes perfect sense to me. I didn't need much explaining [laughs]. Stay away from people and stay away from anything, it's like a clear message.' (Najima, passenger)

Social distancing was shown to be a key consideration when passengers selected seats, opting for lower usage areas, often scanning the layout of the bus and opting for lower occupied sections of the bus.

The bus has become increasingly occupied as we head south toward the city. Yet there is clear spacing throughout. A lady of south Asian descent plays on her phone in the row in front of me. A black lady with her son occupy the swing seats by the stairs. A quick glance behind me reveals another lady in the back row, shopping bags and her purse in hand. Time is spent filling time, avoiding contact with others, looking out windows, and scrolling through screens. A student, perhaps Chinese, joins, surveys the bus and decides on a seat, before the stairs, nearer the main doors. There is a flurry of activity as people enter and exit. A male Chinese student is next to board. He scans the layout of the bus, mapping people and the space in between. After a few moments of contemplation, he heads upstairs. (Ethnography, CV, 11th March, 2021).

Social distancing was largely maintained except in conditions when usage made this difficult (e.g. end of school day). And yet, there are examples when social distancing was put aside to assist passengers in need:

The mum with buggy stands and moves toward the middle door, pushing her son in front of her. As she exits the bus, the front wheels of the pushchair get caught between the bus and the pavement. The bus is thrown into commotion as the two elderly ladies exiting behind her, and a gentleman in his 60s sat by the door, help to pull the pushchair free. Social distancing is forgotten. Thank you's and smiles are exchanged. Sometimes rules don't matter. Care trumps infection prevention. (Ethnography, ER, 29th April 2021).

Some passengers identified moments when social distancing could not be maintained, and how buses (and their architecture) create encounters where passengers are forced into relations with unknown others. Other expressed heightened anxiety caused by being asked to perform previously unknown behavioural practices like social distancing.

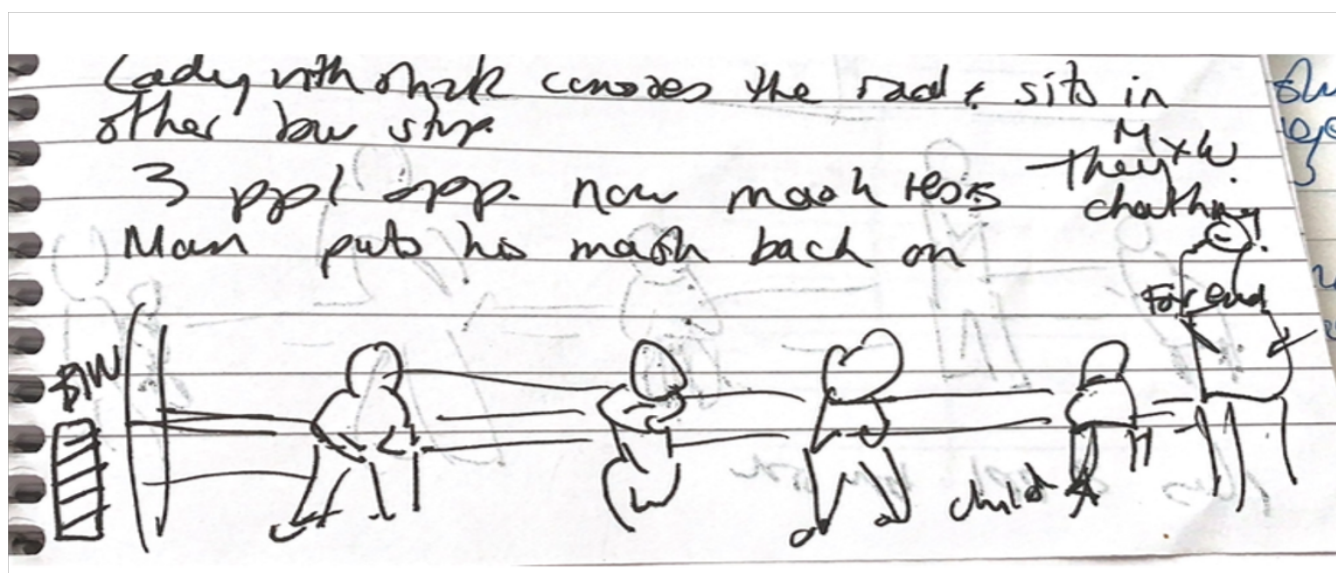
'I was in a seat where the bell was nowhere near me and it was next to somebody that was sitting already down so I had to bend over and press their bell and I didn't like that. It's like, they should have extra bells and stuff like that because we're meant to social distance.' (Najima, passenger)

'Q: How do you find people wearing masks, social distancing, how does it feel to be on the bus?

A: Using the bus in that condition was quite scary but it was like essential. It's not something that you can change.' (Liban, passenger)

It was not only on the bus that social distancing shaped passenger interactions. Bus shelters can be places where negotiations between people can occur, when passengers are embarking, disembarking, and waiting. During early 2020, the research team observed how bus shelter benches have a dual purpose as street-seating, and not only seating for people waiting for a bus. This added to the number of people using the limited space of the shelter.

'Yeah, I just move away from people [at the bus stop]. But I see people, they still stay close to each other. I don't know, maybe they take the bus more often so they're used to it more. But yeah, I guess I just – I don't know, I just usually stay further away'. (Najima, passenger)



It is a grey, mild morning in February 2021 at 1130am. People are arriving at a bus stop. Some have a mask on their chin, others no mask, others fully masked. People arrange themselves with empty seats between them - a bag is sometimes placed on the seat to emphasise its lack of availability. This is the period when buses are running at half-capacity. Seats carry stickers to explain they are out of use. A person gets up off the bus seat to stand - do they feel only one seat between them and another in a bus shelter is not sufficient. Other people don't move to sit down on an empty seat but stand at either end. Masks are pulled out of pockets as the bus approaches and people board. The mask rests under his chin, on one man and is pulled up as he steps up onto the bus. (Ethnography, ER, late Feb 2021)

'Q: So have you tried to make people realise that they're too close to you?

A: No, because I feel that I kind of try to avoid like, you know. I don't want to argue with people and, you know, people have different opinions on social distancing. So I can't force them, so I have to remove myself from the situation so I have to kind of move back or move somewhere else.' (Jasmin, passenger)

Anxiety around bus travel, conflict and transmission risk emerged during ethnography in peoples embodied responses to travel – including the practicing of social distancing, the wearing of gloves (and masks), selection of seats (moving upstairs) and avoidance of touching high touchpoint areas (light vs firm touch).

We are speeding on towards the High Street and supermarkets of (town), and as the bus jolts and jars to a stop, my attention turns to the bus stop which appears especially busy today. As the bus doors open, a sense of anticipation and anxiety creeps over me as the spatial configuration of the bus is set to change. I look reassuringly toward the open window and check the seal of my FFP2 mask. A white man in his 60s, boards first. He is masked. Tentatively he holds the rails as he lowers himself into the parallel aisle seat. Following closely behind is another white male who occupies the seat in front of me. While masked, the strong, lingering smell of smoke leads me to recoil. The act of drawing in smell, through my mask, turns my attention to the airborne particles that I cohabit this space with. The steady rhythm of boarding, paying, traversing, and seating continues, as a male and female, perhaps in their 50s, join this community of passengers. She is supported by a walking stick and appears breathless. What strikes me most is the surgical gloves they both wear to protect themselves from potentially hazardous surfaces. Each holds firmly onto the seat, chair, and handle as they lower themselves carefully into priority seats. A simple act sends the bus into flux and motion as a Japanese lady, occupying one of the swing seats, stands and heads upstairs. A threshold of capacity, of sharing space, or social distancing, seems to have been reached. Spatial configurations are renegotiated (Ethnography, CV 2nd March 2021)

VENTILATION

Windows were sometimes open, sometimes closed. It was especially rare to see anyone attempt to open a window. Indeed, some of our interviewees were not even certain how to do it.

‘Oh, my – just at the back of the bus, ’cos you get two windows next to you, you get fresh air come in. Even though it’s hot at the back, in winter that’s my favourite spot.’ (Ahmed, passenger)

‘Yeah, I try to keep the windows open as much as I can just to get fresh air to coming through, ’cos the kind – the air is just kind of stagnant if you don’t open it. But the majority of the time I come in and they’re all open because some other person has the same idea as well, yeah, and they have every time, yeah’. (Ahmed, passenger)

‘Before COVID I’ve been on a bus when the bus is all full, it’s hot and humid but yet once you open the window people shout at you just because, oh, yeah, it’s too cold. But yet there’s so many body heat there, and yet – yet you have to try to get some fresh air.’ (Ahmed, passenger)

At certain points open-able bus windows had stickers saying “keep the windows open, to let fresh air in.” Yet awareness of windows and their open/close status in relation to effecting the microbial landscape (i.e. creating a safer microbial landscape) was not high on the preoccupations of some bus passengers, nor the signs themselves. We heard accounts of wooden blocks stuck with glue on some windows to force them to be kept open, but the bus company managers said passengers pulled them off. For

those anxious and looking out for reassurance these adaptations by the industry perform in a particular way, but not everyone is engaged.

'I'm not sure I've seen if more windows are opened. I haven't noticed that.'
(Ahmed, passenger)

'I don't know how [fresh air] applies to me yet, but I have heard that it's good because it releases the COVID'. But I don't know that much science about it, but it's very interesting.' (Maalik, passenger).



In our study cities, these stickers were removed in autumn 2021, when restrictions had eased, despite the public health benefits of ventilation in reducing the risk of transmission of COVID-19 and of other viruses like colds, flu and norovirus.

'Q: And how about the windows being open? Are you aware of thinking about that, in terms of just having more fresh air?

A: Hmm-hmm. I'm not sure I've seen if more windows are opened. I haven't noticed that.' (Najima, passenger)

'I have my own sanitiser that I keep with me when I go on the bus, especially like when I've touched like the handrails. But usually on the bus the windows are not open, unless it's like warm they don't keep the windows open.' (Najima, passenger).

'my understanding it's in the air and it's in like surfaces and like if we touch it or if we're too close to somebody, like feel like – like their oxygen I think, we can get COVID.' (Yasmin, passenger)

Spontaneous discussion about ventilation received considerably less attention by bus passengers and often we needed to prompt participants about their thoughts about the fourth point in the Government guidance for infection prevention - Hands, Face, Space *and* Fresh Air.

'I think the guidelines were a good choice that they've done, to, like you say, keep the windows open, keep the air flow going, get them out and everything, but it's – it goes back to the same thing, it's the passengers' mentality. It was they'll sit by a window, it's cold, they shut the window. You can't turn round and say look, there's a sign there saying that window's got to be open because you're then causing a confrontation again. So it was easier just you leave them, let them get on with it, and when your bus is empty - go round reopen all your windows again. It does get frustrating' (Rachel, driver)

Equally, during our ethnographic observations we mostly witnessed windows staying in the status quo position (i.e. either left open or left shut), although there were exceptions including when we opened the window and observed it being promptly shut when we got off and left our seat, and windows being closed when weather conditions worsened.

It has started to rain. Windows stay open for the moment. As I write this an enormous slam resonates across the bus. It has come from upstairs. A window to my right joins the shut position. An announcement is made. "If you want to close the windows on the top please do so. It looks like it might be blown in." (Ethnography, CV, 11th March)

Bus drivers often left doors open during longer stop periods and during the second wave opened windows at the beginning/end of a route. Overall, the perceived airborne risk of COVID-19 as a reason to not sit or stand too close to another passenger didn't lead to collective passenger activity of keeping windows open.

HAND HYGIENE

Passengers and drivers both spoke about recognising the need to keep hands and cabs clean. One of our bus operators did have a hand-sanitiser dispenser on the bus, another didn't. However, where there was a hand sanitiser on board it was infrequently used.

'I have a sanitiser, a small one, so before I go on the bus I sanitise my hands and before and after, immediately I come off, I just like immediately sanitise it. Whenever I get to any place I just wash my hands with soap.' (Ahmed, passenger)

'I think like it's almost a bit like trying to surf down the bus without holding on to the rails, you know [...] But for me it's just the bus itself is just another hazard if you don't hold on to a rail, so might as well hold on before you get off, just use a sanitiser and go' (Ahmed, passenger)

'They say that but there's no hand sanitiser on the bus, there's only like in offices and stuff like that. I don't even see them in shops. Yeah, you do see them in some shops, but it's like I feel like they should be more available, maybe outside even, I don't know, in front of bus stops and stuff like that. (Najima, passenger)

We suggest that viruses are ill-suited to the category of 'dirt - they don't smell, they are breathed out, you can't see them and know they are (for instance, after a known sick person, has left a place). This raises questions about the applicability of scholarship about cleaning and dirt to discussions of infection prevention on spaces like the bus. Such thinking seems well-suited to bacterial biofilms that grow and become visible stains on various surfaces, but less suited for aerosols.

'For me, to be honest with you I try to limit the thought of thinking of a bus as dirty. [...] Generally buses will be dirty, just because of the amount of people that come in and out and there will never be a person always on the bus just to clean a seat after everyone – every person gets off. So, what it is, with me is just I try to limit my own exposure of touching every seat that I – that's near me, so I'm not leaving dirt on the bus for the next person.' (Ahmed, passenger)

‘[Before lockdown] sometimes people leave their rubbish because there’s more people on there not respecting it [...]. But now it’s more like – they look after the buses more because of the COVID, they put protocols in place.’ (Musa, passenger)

For our drivers, hand sanitizing was an important act in the negotiating of boundaries with unknown others and the objects they brought with them to ensure their personal safety and to take control of their relationship to the changing microbial landscape:

‘I have got a big pot of hand sanitiser in the cab as well, so if someone gives me £2 I put it in my bag and straight away I’m sanitizing.’ (Richard, driver)

High touch points areas were also identified by our drivers as spaces where the microbial landscape might be most risky:

‘Obviously the high touch areas are going to be dirty, like by the doors and certain bells downstairs. Downstairs is always used more than upstairs. The hand barrier all the way down the stairs obviously is probably quite a big thing, we’ve obviously got the cleaners on which help. But yeah, some of the high touch areas downstairs, especially some of the elderly use the door handles quite a lot when they get on, obviously around the cab area where they put their hands through that little, tiny hole. And obviously the back door as the kids have got a bad habit, they swing down the stairs and swing around the pole at the back door. It’s those real high traffic areas that are the ones that are obviously going to be a lot dirtier’ (Henry, driver)



3.1.4 INVISIBILITY: THE BUS MICROBIOME AND KNOWN UNKNOWNNS

We now move in this section to discuss how bus-users described the invisibility of COVID-19 and how that contributed to their unease and anxiety. We discuss how the practice of cleaning is used by bus operators to address bus users’ anxiety, by increasing touchpoint cleaning – often at public sites like city centre termini. We then introduce early findings from the bus microbiome study in our project

MICROBIAL UNCERTAINTY

The first wave of the pandemic was characterized by microbial uncertainty that gradually was allayed by bus operators and government action. This microbial uncertainty includes a lack of clear information about the virus and modes of transmission, and for many people instability around work, income, home life and school^{xxxiv}. Especially in the first wave, black, Asian and minority ethnic communities had higher rates of infection and death^{xxxv}, and many of our interviewees had first-hand experience of catching COVID-19 or of knowing people who got very sick or died from COVID-19.

Perhaps unsurprisingly, fear and anxiety were recurring themes throughout the interviews.

‘Yeah, up until lockdown and then everything – and then the fear set in, like the – this is the COVID, it’s unseen, you can’t see it. Without you knowing, you could contract it. So, what I did is just I tried to just limit, try – like, I bought a bicycle to try to distance from people, just to keep myself safe and my family safe’. (Ahmed, passenger)

But occasionally doubt crept in as individuals lacked first-hand experience of witnessing someone or themselves being ill with the virus.

‘Really to be honest, my opinion, I don’t know what to believe. Does it exist or not? Because we just listen. We just hear, but we don’t see, we don’t know. So this thing everybody probably from the government can say, oh it’s this one we close. We do it. And like you know to keep the people how they want, you know. They can do this one, because you don’t know, you didn’t see. You just hear and you see on the TV like too many people die, but we can have no proof about this one. Nobody didn’t prove anything. So be honest me, I don’t believe’ (Sasha, cleaner)

Some interviewees attributed catching COVID-19 to traveling on public transport (or working for public transport sector), and many were still avoiding bus travel because of fear and anxiety around this.

‘I still think it’s really unsafe because you wouldn’t be in a room with somebody who has COVID, so why would you be in a bus with somebody who has COVID? It’s like very risky. And to be honest, my sister got COVID like that.’ (Najima, passenger)

Anxieties over touching the virus come through strongly in interviews:

‘Sometimes I worry if I don’t, you know, use the hand sanitisers, so whenever I touch a place I have to quickly use the hand sanitisers. So, I was in a mood which is careful and alert and I was scared deep down from the virus.’ (Aden, passenger)

‘At the beginning of the pandemic I feel scared about the seats and touching the handles and I always worry I might catch, you know, the virus and transmit it myself, or also carry it.’ (Arif, passenger)

Bus companies were actively trying to build confidence in bus travel through visible cleaning (touch point) and public health measures (introduction of sanitiser onboard).

‘But it was really hard at the beginning. Then I’ve seen how, you know, the bus transport was really, really good. The measurements they put into place, that made me feel a bit more happier’ (Fadouma, passenger)

Passengers did seem aware of the visible signs of cleanliness and cleaning practices, and these made them feel more reassured to travel.

‘Before – before lockdown, it was [dirty]. But not any more too much, not too much. I think they keep it relatively clean now.’ (Musa, passenger)

‘They’re very – they’ve been really clean, and I haven’t been to a bus that’s not new yet. I’ve noticed more and more buses are newer now. So yeah, they’ve been clean. I can’t complain about the cleanliness of the buses’. (Fadouma, passenger)

Across all our interview groups there was an important recognition of the role of ‘hygiene theatre’ – how visible and excessive cleaning provided a (false) sense of security in a period of uncertainty about an unknown microbial landscape.

REDUCING BUS USAGE

Fluctuating anxieties about mixing with those outside your household in enclosed spaces, coupled with the legacy of successive national lockdowns restricting movement, led to a plummet in public transport passenger numbers. Bus companies reported significant drops in passenger numbers, with many services running empty during the initial lockdown. In April 2020, passenger journeys dropped to just 4.5% for rail and 11.33% for bus usage of pre-pandemic numbers, while car journeys in the same period remained at 33.23%^{xxxvi}. By September 2021, rail journeys had returned to 62.1% of pre-pandemic levels, bus journeys to 72.7%, and car journeys to 98.9%^{xxxvii}. The high level of car journeys may suggest people opted to take the car, rather than public transport. At the time of writing the report, passenger numbers remain below pre-pandemic levels and with the identification of a new, highly transmissible variant (Omicron), this is likely to continue.

Most of the respondents we spoke to had reduced bus use during the first waves of the pandemic, except for essential travel. While many were simply not traveling, others had replaced it with cycling or driving.

‘I don’t like it. It’s expensive, it’s uncomfortable, that’s why I cycle. But then again, when I want to go into town I don’t want to risk my bike getting stolen so I take a bus. But it’s not nice at all.’ (Najima, passenger).

Fear was attributed as a factor in people’s decision to limit the number of bus journeys or the duration of journey.

‘It might be a long or short journey, but there could be someone inconsiderate that’s not wearing a mask or anything. It’s like a fear. It’s just a fear. Yeah, so I try to – I try to avoid it as much as I can’. (Ahmed, passenger)

‘So, well, if I have to get it, I will get it. But if I try to limit it in a certain sense, I would try to limit it, and even if I have to walk five, ten minutes, I will try to walk it. Like, if I really need to I will still take the bus’. (Ahmed, passenger)

‘during the first lockdown where the schools were shut, everything was shut, we weren’t traveling anywhere. If my daughters had a doctor’s

appointment, we – I was always cancelling it because I did not feel comfortable taking my kids on a bus.’ (Najima, passenger)

This experience of anxiety about the behaviour of fellow passengers, as well as how the physical architecture of the bus restricts how one could make socially distanced space, was managed by imposing reduction in bus carrying capacity and seat-use reduction. This at times led to frustration and conflict between drivers and passengers:

‘A: the most difficult part I found, was leaving people behind [laughs]. Because that was – yeah, that’s difficult. Because I understand that some – that people rely on buses to get to work and things like that. (...) It’s hard, but I understand. And I think they kind of understood as well why we had to cut our numbers right back, so –

Q: Did you have any conflict around that?

A: I wouldn’t say – obviously I could see people were visibly like upset about missing the bus. I, luckily, didn’t have any conflict. But I know there’s drivers that did. So – and that’s tough, isn’t it, when – to leave people behind. Especially when this is their bus that they get on regularly to go to work. And now they’ve been told they can’t get on it, it’s tough. I understand why people were upset. But hopefully they understood why the company was doing it.’ (Malcolm, driver)

Introducing changes to address anxieties to an increasingly knowable and potential dangerous microbial landscape was seen as attractive for some, and unattractive for others.

‘I mean I was a passenger on a bus myself several times, and it – you get a bit apprehensive when a person’s sat next to you, a bit close, and you’re like, it’s – I’ve – I suffer with a lot of anxiety due to it, I think. I never used to be before, but I don’t like being close to people, I get a bit like – and I think that’s due to the pandemic, because I never used to be like that, when you’re in your box it’s not a problem, you know, you felt safe, you know, you’ve got your own little bubble really. But when you’re a passenger on a bus it’s totally different, when you’ve got to pass each other to get a seat, so you’re not even giving that distance’. (Colin, driver)

Many anecdotal conversations, including from our research participants, have focused on where COVID-19 was caught, with public transport being identified as a potential site of infection. The ways in which public transport has been governed (hard messaging around avoiding public transport, soft message including media campaigns that depict the bus as potentially dangerous space) during the pandemic has a direct effect on people’s microbial anxieties, shaping ordinary experiences and sense of safety and risk as a bus passenger.

For some the anxiety was rejected and messaging distrusted and instead felt like authoritarian restrictions of civil liberties that sat at odds with their personal political beliefs around individual freedom. Whichever orientation of peoples’ sentiments about the restrictions, there persists a legacy from those earlier pandemic times on how people chose how to travel, the reasons they have continued now not to travel, a range of behaviours associated with mixing with people in a potentially crowded space with people outside your home. Whilst some have held on to suspicion and unease, for others the ending of Lockdown restrictions led to a confident return to former ways. The restrictions in various ways were uncomfortable reminders of potential risk, whereas the comfort of a return to normal bus behaviour is welcomed.

3.1.5 BUS CLEANING PRACTICES

There are strong popular beliefs in the value of handwashing and surface cleaning to prevent infections - a belief deeply embedded in a cultural understanding of medicine and biosecurity, which help to constitute microbial landscapes. These practices perform easier-to-understand interactions with real or imagined settled, static microbes (which are too small for most of us to see), through scrubbing, water, and the application of a soap.

We have seen on public transport and in other spaces the bus company performing a level of infection prevention measures – such as grab rail cleaning at different time-points in the day – previously restricted to clinical settings. (Indeed, initial findings of our swabbing of a recently cleaned bus showed levels of cleanliness comparable to a hospital ward).

‘Majority of them [cleaners] is, um, they need to basically clean the floors and, um, but we have also cleaners at the bus stops, basically, like in town when a bus has a little time they come and there's some cleaners, so who has the cleaning equipment and they clean it and they [go on].’ (Hassan, driver)

In some instances, these performances become exaggerated, distorted, or misguided, as in the ‘hygiene theatre’ of visible measures that do little to reduce actual risk.



The bus industry has long recognised a stigma attached to bus travel expressed by some sectors of society, stretching far back into the pre-pandemic world. This stigma can be towards not only who uses the bus, but also makes unfavourable comparisons to train or private car usage. The pandemic and concern about greater risks associated with public transport, which have not been scientifically substantiated have not helped this negative stigmatisation.

‘For me, to be honest with you I try to limit the thought of thinking of a bus as dirty. [...] Generally buses will be dirty, just because of the amount of people that come in and out and there will never be a person always on the bus just to clean a seat after everyone – every person gets off. So, what it is,

with me is just I try to limit my own exposure of touching every seat that I – that's near me, so I'm not leaving dirt on the bus for the next person.' (Ahmed, passenger)

'[Before lockdown] sometimes people leave their rubbish because there's more people on there not respecting it [...]. But now it's more like – they look after the buses more because of the COVID, they put protocols in place.' (Musa, passenger)

The dirt that Ahmed describes seems to be microbial surface-based traces of people, not airborne traces, while for Musa it is litter.

We might think of hand gels and signage at the entrances of buildings with closed windows, or Perspex screens that customers talk around, rather than through. These are often reassuring performances for the audience of customers or employees, rather than engagements with the viral actors of infection. And while it is true that some of these measures have a practical function (which they may or may not effectively fulfil), they also serve a symbolic one - to remind us that we are still in the midst of a pandemic, in which SARS-CoV-2 is circulating and in which bodies remain at ever varying levels of risk.

'But not everyone sees the cleaners 'since COVID, from the beginning 'til now I've never seen any cleaner on the bus. Never.' (Yasmin, passenger).

To address the growing stigmatisation of bus travel in COVID-19 times, bus operators worked hard to increase confidence and to respond to greater public and political attention to a changing microbial landscape. They increased the frequency of deep cleaning and daily maintenance cleaning regimes onboard buses. This surface cleaning targets the removal of microbes found on surfaces, which could include viral or pathogenic particles that fall out of the air. However, for airborne viral particles this cleaning has little effect in removing them.

'They brought the cleaners on the buses, which gave a bit more comfort to the passengers and us, and they're great the cleaners to be perfectly honest.' (Henry, driver)

'But they're done in about a minute and it's – it's actually doing the job properly. It's like one of them, he would – a cleaner, he would only do half the pole, and I had to explain to him that this is an airborne variant and it doesn't stop at eye line, it goes above. And his excuse was I can't do that 'cos I can't touch the ceiling. But everyone can do those poles. I mean he does them now and the same as the hanging loops, I said to him, do you clean them? He said, no, he said, cos I don't see anyone touching them. I said "but this thing is airborne, so if it's going through the bus it's going to go on those, you're going to need to clean them as well.'" (Rachel, Driver)

'I've even had a conversation with somebody on the street and they've sort of said about what do you do? And I said I clean buses and they've literally, "Thank you for doing that. It's such a good job, you know, to know that somebody's out there doing that." So, yeah, I'd say people are quite happy, yeah.' (Katie, Cleaner)

3.1.6 NEW FINDINGS ABOUT MICROBIOME OF BUS SURFACES

The microbiologists in the research team have been finding out about the microbiome of bus surfaces. Surfaces made of different material types (stainless steel, plastics, fabric, glass) around the bus were swabbed and are being examined for the presence of bacteria and viruses. The full microbiological results will be available shortly when all samples have been comprehensively analysed. Preliminary results clearly demonstrate the impact and effectiveness of cleaning, showing high touchpoint areas to have no (or low) detectable bacteria at the start of the day. The initial analysis of the microbial communities also shows high levels of environmental bacteria, being brought into the bus from the outside as well as species more commonly associated with our own bodies e.g. from our skin. The results are as expected for a high-density public space.

When the complete data set is available, we will have a detailed understanding of what is onboard and where. We will be able to describe the microbial landscape and help to explain where these microorganisms come from and how they might link to risk.

UNKNOWN MICROBIOLOGY OF THE AIR ON THE BUS

Within this work, the presence of microorganisms in air samples was not analysed. While we now know that aerosol transmission is of critical importance in the spread of SARS-CoV-2, detection of virus particles in air samples remains challenging, requiring high viral loads and specialised equipment. In an environment such as a bus, where there are many varying factors (doors opening and closing, passenger density changing), sensitive detection, which requires a long period of time, becomes very difficult. Additionally, such sampling is difficult in a 'live' social space where passengers may already be anxious regarding potential microbial risk and misunderstanding related to this. These are the same challenges facing every public space and an area of research we hope to develop in the future. Therefore, our knowledge of microorganisms in the air remains limited.

3.1.7 CAN WE CLEAN AIR?

The method of cleaning unwanted airborne invisible particles expelled by an infectious bus passenger demands a very different strategy to traditional cleaning practices. And while regular surface cleaning practices in commercial spaces like the bus has maintained a prominence in our study, the bus companies have been keen to tell us about the 'Ozoning' of buses where there has been a specific risk of SARS-CoV-2 being onboard. Ozone cleaning doesn't involve human cleaners scrubbing or wiping over surfaces with sprays, but instead the air and surfaces are cleansed by mechanical fumigation.

'But if a passenger comes on and does something or spit or whatever or throw up, we'll take the whole bus back to the depot and it's going to be – it has to be COVID-cleaned. (Hassan, driver)

However, one infection prevention measure that is still inconsistently practiced and understood as an air-cleaning practice is ventilation. This works through dispersing the concentration of an airborne non-smelly, invisible, in-sensible threat. We suggest that the struggle to grasp the significance of ventilation is linked to a poor cultural understanding of what is always carried in the air. The air carries many things - floating viruses, bacteria, fungal spores, dust, pollen - that may be barely sensed except by an extreme physical reaction such as a sneeze or itchy eyes.

'Q: you're relating that sense of a smell [of the bus] with risk of COVID?

A: No, even before it smelled bad. I think it's just some people are not hygienic and they just come in and – and I just don't like being that close to people in general [laughs] and then if they smell bad it just makes me more uncomfortable.' (Aisha, passenger)

Sensory reminders like smell can create feelings that move people to act in a particular way. Where there is an absence of a sensory reminder of the presence of an airborne risk, this is where creativity is required about how to grapple with novel landscapes of human-viral interaction, or some people may imagine and develop their own personal affective cues for risk.

'like stuffy air, you can't breathe in. My sister said the air was making her nose feel itchy, so something like that would make me feel as well [laughs] there's a virus in the bus. I think science, invisible science, or some actual things I can see. [...] I think it's transmitted through the breath. Like, usually when somebody's ill they have – they can feel it themselves, they have like a hot breath.' (Aisha, passenger)

- How are different 'respiratory publics' or communities of people sharing the air they breathe constituted, and is there a collective response they might make?
- What does air contain?
- What do, or don't different people *imagine* air does or doesn't contain?
- And perhaps most importantly could they coordinate around a set of shared beliefs and understandings of airborne transmission and mitigation, in the same way handwashing has achieved universal understanding around hand hygiene?

These questions are highly significant for the role ventilation can play in infection prevention strategies.

One challenge in terms of the relationship between health and fresh air is the cultural history that exist around keeping windows closed if you are feeling ill, to stay warm and not cold, to avoid draughts. The new messaging to keep windows open for ventilation, to let fresh air in, runs counter to that belief.

'Before COVID I've been on a bus when the bus is all full, it's hot and humid but yet once you open the window people shout at you just because, oh, yeah, it's too cold. But yet there's so many body heat there and yet – yet you have to try to get some fresh air.' (Ahmed, passenger)

'Q: do you feel warm or cold [on the bus?] –

A: Neither, to be honest. The windows are I think open most of the time.

Q: Does that clear the horrible smell at all?

A: No, because it's too – because people just close it. Some are closed, some are open.' (Aisha, passenger)

'Q: Can you – I mean can you see that there may be problems keeping the windows open for some people?

A: Yeah, definitely. Like especially, I don't know, some people, they feel cold and some people, they're not feeling well. But I think it could be good for people, you know, that have like asthma and stuff like that, I think it could be helpful for them'. (Yasmin, passenger)



It is easy to imagine the person who is feeling ill, who is a little feverish, would not want windows to be open because of the challenge of managing their thermo-regulation. Passengers spoke about favouring the seats that are on top of the warm bus engine at the back of the bus, in the winter. Yet, to reduce airborne infections, like COVID-19, appealing to an apprehension that a cool breeze running through the bus is positive is a big switch in established cultural thought.

VIRUSES ARE ILL-SUITED TO CATEGORY OF DIRT

Building on this consequently we suggest that viruses are ill-suited to the category of 'dirt - they don't smell, they are breathed out, you can't see them or have an inkling they are there at a dangerous level, or even potentially harmful level if a known sick person has left the place. This raises questions about the applicability of the language on cleaning and dirt that seems well-suited to bacterial biofilms that grow and become visible stains on various surfaces, but less suited for aerosols. Passenger Arif, even draws a distinction between the clean bus and the virus:

'[the buses] seemed like they were clean, but I just worry about the virus'.
(Arif, passenger).

The virus particle is scarcely material or a matter, and therefore unlike the relationship of cleaning with tackling dirt - which Mary Douglas famously calls 'matter out of place^{xxxviii}'. the concept of a viral particle as being 'out of place' does not seem to agree with experiences of transmission risk that are actively produced in the respiratory tract of an infected person. Indeed, both its invisibility and its transmissibility in aerosol form, hanging within air, not settled on the terrestrial earth makes it hard to place, to locate, to tether. Rather it floats, it gets carried along by invisible forces in the air, eddies, gusts. The aerographies of cleaning require tactics that challenge the terrestrial techniques of cleaning - the wiping, brushing, polishing, rinsing, agitating soap to make foam to destroy it.

3.1.8 SUMMARY

11. **DISTORTED NORMAL BUS ENVIRONMENT:** Changes to the bus environment under pandemic conditions has distorted the bus passenger experience. a) The interior of the bus was re/organised and redesigned. This in turn b) changed how those on the bus imagined the space, leading to c) altered

passenger behaviours, and of those former passengers who have not returned to taking the bus.

12. **INVISIBILITY:** The COVID-19 pandemic has brought attention to the buses' microbial landscape on surfaces or in the atmosphere/air and yet the microbial world's invisibility creates problems about how bus-users know how to respond and feel about it.
13. **BEHAVIOURS / FEELINGS IN MICROBIAL LANDSCAPES:** Not only have there been obvious changes to what passengers see inside and outside the bus to remind them of pandemic times (heightened cleaning, signage), but passengers have been mandated or requested to behave in unusual ways. Collectively, there are new feelings that can be felt on the bus - caution, alarm, reassurance, confidence, relief, are just a few that this study has identified.
14. **BUS STIGMATISATION AND CLEANING:** The bus is often stigmatised for being dirty. This is unfair, rather the bus is repeatedly having a changing line-up of human passengers through the day who bring 'stuff' on with them from the 'microbial' (viruses, bacteria, fungi) through to macro-scale litter (tissue, bus ticket, drink can). In light of the pandemic, bus operators have responded with much stricter cleaning protocols to reduce bus surfaces as potential sites of COVID-19 transmission. For economic and environmental reasons, it is necessary to better cultivate the collective interest of bus-users about their personal role in keeping the bus clean of not only macro but micro 'stuff', to build confidence in returning to/using public transport.
15. **SURFACE CLEANING:** Early findings from the bus microbiome study shows that bus operator's surface cleaning works to reduce the scale of microbial populations on surfaces immediately after a clean. The microbial communities build up as passengers get on and off the bus, but there is no evidence that these increase any likelihood of catching something if basic infection prevention measures are adopted. Personal well-being – such as an open-cut that could become infected or having a compromised immune system – can reduce or increase ones' risk levels. There is a research gap about how much, when and what types of microbial life, commonly thought of as the mostly invisible microbiome, pose a risk to humans.

3.2 CULTURES OF PANDEMIC (MIS)INFORMATION

In this section we discuss passenger experiences of public health measures and cultures of microbial science and the challenges of language barriers in COVID-19 communication.

3.2.1 PASSENGER EXPERIENCES OF PUBLIC HEALTH MEASURES

Although people seemed to be getting information from various sources, the government's early simple messaging 'Hands, Face, Space' did appear memorable for many. Several of our respondents repeated this phrase, some of them without clearly knowing what it meant. Few of them were aware of the updated version of the messaging 'Hands, Face, Space, Fresh Air'.

We have identified that shorter messages with clear visuals are important for conveying quickly and simply to non-specialist audiences. Bus companies recognized their corporate social responsibility to provide practical/informative advice on bus travel. Ethnographic evidence / interviews revealed the introduction of soft and hard messaging. Hard messaging included signage onboard and notices on the onboard screen. Softer messaging included taping off specific seats.

'Yeah, it is a challenge, but at the same time we've just got to make sure that they're open 24/7. That's it when it comes to that because it is a government rule now. Scientists have said, "Keep your windows open," it gets rid of COVID as far as I'm concerned, and we should follow that.'

(Maalik, passenger)

In contrast others indicated to us that the found Government communications were unclear, and rapidly changing leading to confusion. One driver reflected

'Generally, it's been like up and down. Sometimes they've been a bit confusing. Like other – when we went into the tier system, that was a bit confusing for quite a few people. Generally they've been okay, but it's just like at times they've been confusing. (...) I think at the beginning – well, I understand that no one really knew what was going on. So things were just coming out thick and fast, we didn't know what was really going on.'

(Malcolm, driver)

There was particular criticism about how mass communications from the Government were not translated or tailored for minority communities. Speaking about his local Somali community, Ahmed felt that many members didn't have the education to understand the scientific news about how the virus spread. Somali language is a relatively newly written language, and scientific terminology may not be easy to translate. Members of the community didn't know why scientifically they needed to behave in a particular way but were instead completely reliant on behavioural guidance and instruction. He even suggested that his community were at the start of the pandemic a little too casual about the threat:

'They have their own notion in their heads where, oh, this is nothing, man, we've suffered more of this and that, I came from [war Somalia]. I'm like, [laughs]. Yeah. So, a lot of people put their own past into the present, yeah.'

(Ahmed, passenger)

We sensed confusion and scientific misunderstanding in how some respondents displayed their know-how about the COVID-19 virus, that resolved in a tendency towards believing in conspiracy theories.

'the world leaders are not telling us the truth. They have just used something, just a little thing to deceive the world that there is a virus because you hear today it's India virus, tomorrow it's South Africa virus, today this virus. So you don't know what kind of virus you are in now, whether it's a world virus or something different. So it's, we are praying to God that everything will pass by soon, very soon.' (James, cleaner).

'[government] guidelines keep changing as well. And then they have Track and Trace and then they don't have Track and Trace anymore and then they do have it, but you don't have to do it. It's – it's really – I decided I'd just make my own choice, which is I just keep distance from people, two metres, anyway.' (Najima, passenger)

'They could have been improved because there were a lot of mischief around this COVID because tomorrow they will say this, the following day they will say a different thing. The communication is very strict like do this. There is this, we are going on this path, nobody is to do this, but if the minister you tell me this, then tomorrow minister you do different thing. It means you are the senior members in the government you are not following

the regulations. You expect the citizens to do that, but you are not doing it. So the communication was very poor, and how they communicate sometimes it's no good.' (James, Cleaner)

Many of our research participants, for whom English was a second language, expressed concerns around this fluctuating information and therefore turned to different members of society for clarification (including family members, friends, faith leaders - many of whom had differing scientific expertise). Bus users shared with us their opinions about what they knew, felt, and understood, and who or what they turned to for information about the right way to behave in relation to the virus.

'But now situation changed, maybe because of the jab that I took or maybe the weather change or maybe the God become kind to us. [...] I just know that the situation has changed and now I can think about the virus, it's not like before. It is not around like before and it is – I feel more safe than before.' (Aden, passenger)

'And as a Muslim person you got a duty not to put yourself at risk but also not to put others at risk when you know you're not well. So, like what happened in the past, during this pandemic is people, they shouldn't leave [...] their city or in their house. And that was making easy people to stay indoors. And also he also mentioned, you know, knowing that you infected and interacting with others is like committing suicide, you know, throwing yourself into fire. And that is religious view, that's what Prophet say.' (Aden, passenger)

Some users were aware of disinformation but didn't necessarily feel they could access information they understood from a trusted source, because of the lack of a translation button for non-English speakers. Language barriers to public health information was identified as a key concern and detrimental to their public health practices. This included the advice to socially distance, wear a mask and improve ventilation through letting fresh air in. All of which were directly translatable to shared social spaces such as buses and bus stops but some of the evidence from our interviews is that these messages about fresh air were not getting through.

What is clear is that there is a diverse array of information sources that continue to be drawn on. Some people we spoke to were very reliant on news media and government announcements, while others got information from social media, peers, or religious leaders.

'the information from like the news, [...] it's kind of confusing I would say, because sometimes I kind of feel like I understand what's going on and sometimes I feel like I don't know what's going on. Sometimes I feel like it's clear and sometimes I just don't.' (Yasmin, passenger),

'On the government website, if they had like some kind of translation button or something like that where people could be like okay this is a website that they wouldn't be having misleading information, so I can trust this information and like, you know, read it for themselves, instead of like finding out through other people and stuff.' (Yasmin, passenger).

'People, they listen, you know, the story of the COVID, from TV and they also listen to the guidelines and government advertisements from the TV.' (Arif, passenger)

Also, it was evident that at different points in the pandemic, the capacity to communicate clearly and to be heard changed. At the start, people were more fearful of the unknown, but as their personal experience of living in a pandemic world grew, they became more sceptical about some of the guidance and instead more assured in what they knew worked, because up to that point they hadn't caught the virus, nor knew anyone who had. Or they felt they couldn't cope with the ongoing stream of COVID-19 news.

'A: I don't listen to the news that much. I just stay updated on my phone from time to time. [...] If not, I'm not too up to date with it, if you get what I mean.

Q: Yeah, yeah, yeah. So you know that if there's something really important to know, then you'll get it on your phone in some way?

A: Yeah, yeah, I'll see it, I'll see it.' (Musa, passenger)

'So if, okay, if it exists this virus, okay we can put the mask on, we can wash the hands antibacterial, you are safe. If you are going to take that bus, any way you are going to take it if it exists, but I don't know, from two years nearly now, I don't know nobody to have this.' (Sasha, cleaner).

For some individuals, not knowing anyone who had had COVID-19 seemed to lead a certain set of more risky behaviours, as they questioned the virus's existence. And with that they became lax at following good infection prevention measures.

'Really, I don't believe because any time I put me in my situation sometimes when they start with that virus, and they lockdown and everything, everybody just take the shopping and go and stay closed in the house. Me, in that time, I was not scared, and I go everywhere out. I go in the shop with no gloves, without no antibacterial on my hands, nothing, but I don't know, I still was safe. So if these people, they are dying so many people, then I'm happy for me to see, you know, because I didn't protect myself for nothing and I still got nothing. So be honest I don't know what is going on.' (Sasha, cleaner)

3.2.2 CULTURE AND MICROBIAL SCIENCE



The pandemic has seen an increase in public interest in understanding science, and many of those we spoke to had tried to learn about the virus and its transmission. But as scientific knowledge around the virus has evolved quickly, public understanding has not always kept up. We found that many people's decisions and rationale for personal behaviour were based on following government guidelines and cultural norms, rather than on an understanding of science. Cultural norms are becoming increasingly fragmented as multiple poles of different positions on aspects of the pandemic emerge. These relate to the science, the vaccinations, and associated cross-party political allegiances that form across the patch-work world of highly varied, personally applied, pandemic knowledges.

Thus, whilst science has felt increasingly confident of the major role of aerosol transmission (as opposed to surfaces) of SARS-COV-2 and of the success of the vaccines in reducing death by COVID-19, there are many people who didn't closely 'follow the science'. Instead, many people were receiving guidance from government and so now continue to receive guidance filtered through government or other organisations', political and economic interests. Science has

increasingly lost its authority on the virus and how to behave, as the COVID-19 pandemic has continued. At the same time, there exists among some a suspicion of medical science and how applies to their personal experience. This can be attributed to a range of personal experiences related to existing hard to treat health problems, ethnicity, political positions, and language barriers - in these cases we heard of alternative narratives that were circulating that questioned the science, gave prominence to conspiracies, and contributed to confusion about who and what to believe.

‘Yeah, before there was like any virus, but they find a solution for that one. Now it’s taking nearly two years and they find a vaccine, which even that is no good to be honest, yeah. They put the people to vaccine, it’s two times and after they have the chance to get the virus. So for what should I vaccinate myself if I’m going to get that thing back to my body? So there’s no point, you know’. (Sasha, Cleaner)

‘When it came firstly in China, actually I was not scared or something like that, but they said it goes to Europe, it’s like ten hours travel from China, from Asia to Europe, it went to America. So it’s like, what I thought was the world leaders, maybe they have planned maybe three years before that 2020 we are going to do this. We want the population to reduce or something like that because I once heard Bill Gates said, the world population must reduce and by the year 2022 the COVID will pass. So if you have a motive of doing this that means you want to reduce what God has created, that’s not good.’ (James, cleaner)

3.2.3 SUMMARY

1. **CONFUSION ABOUT THE SCIENCE:** Science is not the sole authority on microbial landscapes. Indeed, a lack of scientific clarity on COVID-19 infection risks, and subsequent misunderstanding (about spread, vaccine, and spaces of perceived ‘high’ risk like the bus etc) and circulation of misinformation, particularly at the start of the pandemic, requires broader interdisciplinary approaches that recognise the important role social and cultural dimensions play in public health adherence. The concept of a ‘novel virus’ was simply not grasped by all, along with other scientific terminology like ‘strains’, R-rates and microbial loads.
2. **SIMPLICITY OF GOVERNMENT GUIDANCE:** In contrast, Government guidelines about how to behave (if not the reasoning for it) was initially widely understood and adhered to as the way to stay safe, by bus-users. Cautionary guidelines were welcomed and resonated largely with bus-users’ fears about the virus and shock about the changes to everyday life as people experienced Lockdown.
3. **REDUCING EFFECTIVENESS OF COVID-19 MESSAGING:** Yet as the pandemic has continued, the Government’s simple messaging has become less effective. The scientific communications have become more confusing because of microbial evolution, the stated success of the vaccine roll-out alongside political shifts to Government public health guidance and rules which have sought to be attentive to the negative economic and social impact of the pandemic. Different types of bus-users or potential bus-users have increasingly made their own decisions and rationale about how to behave in and around taking the bus.

3.3 CREATIVE INTERVENTION IN INFECTION PREVENTION MATERIAL

In this section we reflect on a pressing need to develop novel tools of communication that engage wider, non-specialist publics in the importance of infection prevention behaviour, especially within indoor spaces like the bus.

3.3.1 NOVEL PUBLIC ENGAGEMENT

The research identified a need to experiment with ways of communicating in the context of confusion and uncertainty about microbial landscapes that exists for bus users and stakeholders without scientific expertise. The microbiologist within the research team played a crucial role in making information about the virus not only accessible but relatable, not only for the social scientists in the team but also for other partners on the project.

Through our previous experience of creating public engagement around a variety of other complex subjects – antimicrobial resistance^{xxix}, ecological diets^{xl}, and animal research^{xli} – we identified an opportunity to make an innovative contribution to the field of pandemic communications. We were aware that government messaging had been successful to a point (in inspiring action during the first lockdown, thereby significantly reducing community infection) but that in 2021, many of those we interviewed were unclear of the rationale behind mandates and guidelines around infection prevention. This had a direct impact on people’s behaviour and adherence to such mandates and guidelines.

3.3.2 THE MANIFESTO BEHIND THE FILMS: NEVER ALONE ON THE BUS

Building on a previous film produced about antimicrobial resistance in healthcare settings (entitled *In Our Hands*^{xlii}) we sought to create novel public engagement films that articulated human-viral interactions as part of new microbial landscapes of the pandemic. These were created to engage with viewers’ positive feelings and experiences of being on the bus or other spaces, and to offer a light-hearted aesthetic as an alternative to didactic, moralizing or anxiety-inducing communications campaigns produced by UK governments.



A set of creative parameters emerged that drew from artistic and more-than-human approaches, to diverge from existing public health communications aesthetics. These parameters were:

- i) to represent human and microbial communities on the bus;
- ii) to focus on nonhuman characters;
- iii) to use humour instead of shock tactics or didacticism;
- iv) to create positive rather than negative messaging;
- v) to avoid anthropomorphism of microbes as individuals (such as in the 'germ monsters' in cleaning product adverts);
- vi) to acknowledge microbes' invisibility to humans, but to somehow represent them;
- vii) to avoid stigmatisation of particular human bus users.

These parameters presented significant creative challenges, which were met by creating a set of narratives in which elements of bus architecture (e.g. windows, stop bell) became characters, commentating on the behaviour of human bus users and non-human 'micro-pets' or 'micro passengers'.



The films series (*You're Never Alone on the Bus*^{xliiii}) combined live action and 2D animation, and each film illustrated a different aspect of infection prevention (e.g. mask-wearing, ventilation), and finished with a short caption (e.g. "Use your head, stop the spread", "Fresh air shows you care") that summarised action that could be taken. The language within each film was simple but scientifically grounded, and dialogue was voiced by actors of diverse heritage and from different UK regions.

Films were screen-tested with bus users, community members and with various stakeholders, who experienced the films differently. From some in the bus industry, there was concern that the film explicitly talked about microbial landscapes ('pet micro-passengers') and that this would reinforce stigmatisation of the bus as a dirty place. Such concerns were not met by some viewers, but we acknowledge that presenting the microbial landscapes of buses on their own, without comparing them to similar landscapes of shops, homes, etc., could increase confusion and anxiety among some, by appearing to single out the bus as a space of risk.

The films have been released under a **Creative Commons licence**, and it is our hope that they will be of use for bus operators, local and national government, and other organisations. This could be as **readymade assets for internal or external communications, as a discussion tool, or to inform the production of new communications materials.**

3.3.3 SUMMARY

1. **NOVEL PUBLIC ENGAGEMENT:** The *Never Alone on the Bus* films build on these insights from our studies to experiment with a creative medium of communicating about the changing microbial landscape and infection prevention on the bus.
2. **INTERDISCIPLINARITY APPLICATION:** An interdisciplinary approach that combines social scientific and microbial studies (hereon socio-microbial) of buses and other public spaces – pubs, supermarkets, cafes, hair salons, libraries – can articulate how the microbial landscape imagined, felt, believed can achieve two things. Socio-microbiology of the bus can address cautious passenger behaviours by providing some clarity on the bus microbiome. These insights could improve infection prevention guidance and recommendations through supporting bus-user’s interventions to manage potential risks within these invisible, dynamic microbial landscape.

4. RECOMMENDATIONS

Based on the key findings from the research above, we make the following recommendations to stakeholders in the field of public transport:

- (1) Actively work to re-establish cultures of co-responsibility and care on the bus.
- (2) Engage with scientific research about ventilation and aerosol transmission, in relation to COVID-19 and other respiratory conditions.
- (3) Acknowledge and respond to seasonal health challenges by employing ventilation as a form of infection prevention.
- (4) Update and expand signage about mask wearing, social distancing and ventilation, taking into account different linguistic and cultural barriers.
- (5) Develop more sophisticated ways of communicating about dynamic microbial landscapes, rather than just generic risk.
- (6) Develop more sophisticated ways of communicating about aerosols, rather than just focusing on surfaces.
- (7) Consider accessibility issues – around disability and health, as well as cultural diversity – in designing and implementing infection prevention measures and messaging on the bus.
- (8) Acknowledge that different bus users experience risk and confidence in different ways, and so use the right messaging at the right time for the right audience.
- (9) Recognise transport as spaces of care serving diverse needs and people.
- 10) Recognise that people became bored with press conferences and government slogans, so seek ways to engage audiences in more creative ways.

This report was compiled by Dr Emma Roe*, Dr Paul Hurley*, Dr Charlotte Veal**, and Dr Sandra Wilks***, December 2021.

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