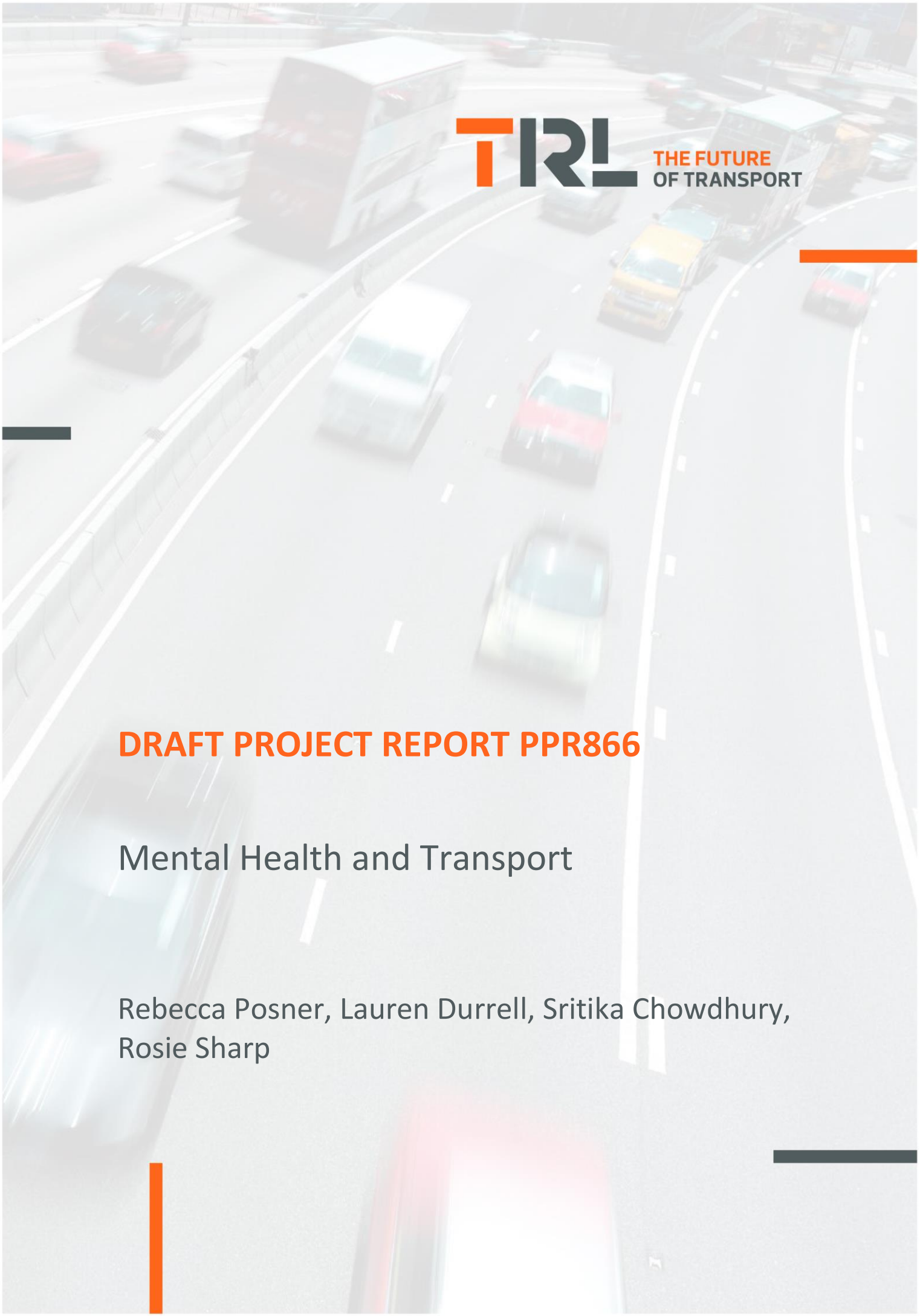

THE FUTURE OF TRANSPORT

DRAFT PROJECT REPORT PPR866

Mental Health and Transport

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Executive summary

Mental health has received increased attention in the last few years, and has been at the centre of recent policies. However, despite this progress the extent to which mental health difficulties can impact day to day life and necessary tasks such as travel has still received insufficient attention. Research relating to the impact of physical impairments on travel, and the policies developed to address these issues has become widespread. However the impact that mental health difficulties can have on both driver behaviour and travel, or that transport systems can have on mental health is still under-documented. To address this TRL undertook a review with the aim of identifying and understanding more clearly the nature of the relationship between mental health and transport. The review highlighted the extent of the relationship between mental health and transport, with evidence that mental health difficulties can influence both driver behaviour and travel mode choice, as well evidence as to the impact that transport systems can have on mental health. The review also highlighted significant limitations within the published literature, including the scarcity of UK based research and the prevalence of research with "clinical" samples. The absence of community based research limits our understanding of the nature of the relationship between mental health and transport and consequently our ability to develop relevant interventions and solutions.

To start addressing these gaps TRL has carried out a two-part research program aiming to engage with members of the general public to understand their personal experiences while travelling on the UK's transport network. The objectives of this study were two-fold: firstly to gain a better understanding of the relationships between mental health and transport by engaging with members of the general public and exploring their own experiences; and secondly to understand the factors that influence travel mode choice and examine how these vary between groups of people with varying levels of mental health difficulties.

Initial qualitative engagement was carried out with members of the general public who had experienced anxiety and/or depression in their adult life to explore their experiences of using transport in the UK. These findings were then used to design a large scale survey that included a choice experiment to further investigate the initial findings.

The choice experiment was based on a community sample who also completed brief mental health screening questionnaires. Participants were allocated to groups based on their scores in these questionnaires. Findings from the choice experiment highlighted a number of differences across the three different groups (those experiencing anxiety only, those experiencing both anxiety and depression, and those not currently experiencing anxiety or depression). These findings included:

- People with high levels of anxiety are less likely to choose travel modes where they are more likely to experience crowding and/or changes
- People with anxiety were less concerned by car delays compared to other groups, and did not tend to use this factor when choosing a travel mode
- People with mental health difficulties have a stronger bias towards cars over trains

- Those who were not currently experiencing anxiety or depression difficulties showed a bias towards cars over buses
- All groups chose car significantly more often than either train or buses
- People with anxiety felt less safe across all types of transport compared to the other groups
- People currently experiencing depression reported feeling significantly more lonely when traveling compared to the other groups

The findings from the qualitative engagement highlighted the extent to which the factors that influence travel mode choice are subjective and are therefore influenced by mental health. The findings also highlight the ways in which certain elements of the transport systems could have on impact on their mental health. These subjective factors included:

- Convenience
- Accessibility
- Information provision and the type of information provided
- Knowledge and awareness of surroundings and alternative travel options
- Crowding
- Comfort
- Time pressure
- Delays
- Other road users and passengers behaviours
- Absence of support, particularly on public transport and trains
- A need for control, or the absence of control
- Intolerance of uncertainty

The findings from the qualitative engagement also explored the ways in which mental health could at times influence their driving behaviour and the need for further support to help manage mental health difficulties if they occur during the driving task. The participants explored how mental health could influence their driving behaviour by:

- Impacting their cognitive processes and at times impairing their decision making process.
- Impacting their mood and at times increasing the likelihood of engaging in aggressive driving behaviour through increased errors or lapses

The qualitative engagement also explored concerns over the impact of mental health on young drivers and believed that the stress of the driving task and the reduced experience combined with mental health difficulties would lead to increased risky driving behaviour.

Throughout the focus group participants discussed the impact of future vehicles, particularly autonomous technologies on mental health. Unlike current cars that were often found to offer the potential for increased control and to remove the uncertainty that other modes of

transport provided. However the prospect of autonomous vehicles was also a cause for concern. Participants reported a lack of certainty surrounding the role of the 'driver' in partially autonomous vehicles, with some believing that it would be detrimental to mental health.

Recommendations and next steps

Our research highlights the extent to which more work is required to improve the current transport systems to make them more accessible, support those with mental health difficulties and minimise the negative impacts that they can have on mental health. Potential solutions include:

- Improved information provision ensuring its accessibility and increased joint-up thinking to provide more support and solutions for travellers. This could be achieved by reviewing the current information provision tools in partnership with individuals with experience of mental health difficulties.
- Improved awareness and understanding of mental health difficulties and the barriers they pose to the accessibility of certain travel modes (e.g. buses and trains) by members of the general public and staff.
- Future research should compare the impact of different types of journeys on mental health (e.g. the impact of various commuter modes on stress and anxiety)
- Future research should look at the role that mental health difficulties could play in the uptake of autonomous and connected technologies, and how CAV-enabled services could be designed to meet the needs of those with mental health difficulties
- Future research should look at the possible benefits to mental health that autonomous technologies could offer to transport users in the longer term (e.g. better access to MH services, and better retention of social capital) .

1 Introduction

The World Health Organisation (WHO) defines mental health as the state of well-being in which every individual realises their own potential, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to their community (WHO, 2016, April). This definition highlights a key that, just like physical health mental health can vary throughout the course of a person's life. At times, people experience mental health difficulties that can impact on their ability to function in everyday life. Every seven years since 1993 a comprehensive survey has been carried out to establish the current state of mental health and well-being in England. (McManus, Bebbington, Jenkins & Brugha, 2016). The Adult Psychiatric Morbidity Survey (APMS) aims to provide an assessment of the current trends in mental health and treatment access in England. The figures published in 2016 reflected that on average one in six adults in England over the age of 16 reported having experienced symptoms of common mental health disorders (CMD)[1] (20.7% of women and 13.2% of men) in the last week. This prevalence of CMDs has not only increased, but the proportion of people aged 16-64 who reported experiencing severe CMD symptoms in the past week has followed the same trend (6.9% of the sample in 1993 compared with 9.3% of the sample in 2014).

As well as the frequency of symptoms in the population as a whole, findings have highlighted what has been identified as 'inequalities in mental health' (HM, 2011). Poor mental health has become increasingly common in young people, with very few seeking or receiving the therapy or treatment they require (The Children's Society, 2016). A consistent increase in reported CMD symptoms was also apparent in both men and women aged 55-64 since the AMPS first started. These increases could be the result of a number of socio-economic or health factors. For example, the latest APMS survey highlighted that individuals who received benefits such as employment and support allowance experienced particularly high rates of mental health disorders. Similarly, all of the five chronic medical conditions asthma, cancer, diabetes, epilepsy, and high blood pressure individuals had some association with at least one mental disorder. These figures are not surprising, but allow us to understand the reasons for higher prevalence rates in certain demographics. While the APMS is used as a representative indication of the current state of mental health and well-being in England, just like other surveys it is still subject to limitations. The authors report themselves that a number of responses were not returned[2], and social desirability bias could have an impact on people's response. Mental health is subject to a large amount of stigma, whereby people will not speak or disclose their mental health through fear of the label that is still attached to poor mental health and the possible repercussions (Corrigan, 2004). Despite many national campaigns and governmental policies working towards normalising mental health this may still impact the extent to which people admit to experiencing certain

[1] Common mental disorders comprise different types of depression and anxiety including: depression, generalised anxiety disorder, panic disorder, phobias and obsessive compulsive disorders.

[2] The authors provided a number of possible explanations for these non-responses these included participants declining to take part or participants experiencing mental health difficulties can at times lack the cognitive capabilities or motivations to respond to a survey.

symptoms or even in seeking treatment. Due to this stigma it is possible that household surveys, such as the one presented above, are still subject to social desirability biases whereby people may not answer frankly. While CMDs affect insight and cognition to a varying degree, they significantly impact people's day to day life (physical impairment, social and occupational requirements, sources of strong emotional distress) as well as the lives of family, friends and careers.

The APMS survey adopts a psychiatric perspective on mental health, in which mental health difficulties are constructed as medical "disorders" with biological origins, and it uses medicalised terminology throughout. The medical model of mental health difficulties is contrasted by the psycho-social models on which clinical psychology and various psychotherapy disciplines are based. These construct mental health difficulties as the consequences of adverse experiences. To illustrate the differences in approach, psychiatry characterises depression as the result of a biological impairment in brain functioning, a current theory being that it is a consequence of inflammation in the brain. This model implies "treatment" by psychoactive drugs. Clinical psychology attributes depression to a person having adverse life circumstances – i.e. something in life to be depressed about. This model indicates psychological therapies (referred to as "interventions" rather than "treatments"). The National Institute for Health and Care Excellence (NICE) acknowledges the efficacy of both drug treatment and psychological therapies There is however vigorous debate about the validity of these contrasting approaches. TRL does not have the expertise to take a position in this debate: in this report a neutral position is adopted. In reporting the findings of the APMS, the psychiatric terminology used by McManus, et al. (2016) is used; but that should not be taken as TRL endorsement of a psychiatric rather than a psychological approach to mental health difficulties.

The psychiatric approach to mental health is a deficit model, in which mental health is impaired by various disorders. Others take the view that being mentally healthy is not just the absence of a mental health diagnosis (or an actual but undiagnosed disorder). The WHO definition at the start of this Introduction highlighted a range of positives that must be present for a person to be mentally healthy. The Mental Health Foundation (2017) suggested that a mentally healthy person can learn, express and manage a range of emotions, form and maintain good relationships and can cope and manage change and uncertainty. Good mental health effects people's day to day functioning and allows them to lead a fulfilled life, making it an important factor in determining overall quality of life. Mental health difficulties, on the other hand, can have strongly negative effects on day to day functioning and overall quality of life. Mental health problems can vary significantly from short term, minor impacts on one particular aspect of living, to long term, major adverse impacts that pervade many aspects of living. Many people will be subject to poor mental health at some point in their lives. Mental health difficulties can affect people's ability to form and maintain relationships, decision making, concentration, productivity, sleep patterns, self-confidence leading to substantial disruptions to their way of life.

Mental health has received increased attention in the last few years, and has been at the centre of recent policies, such as the 'No Health Without Mental Health' strategy published by the UK government (HM Government, 2011). This policy was designed to ensure that mental health difficulties are recognised as one of the primary causes of disability in the UK, as well as the need to ensure that people receive the most appropriate and timely

treatment to minimise the impact on their daily lives (HM Government, 2011). However, despite this progress the extent to which mental health difficulties can impact day to day life and necessary tasks such as travel has still received insufficient attention. Research relating to the impact of physical impairments on travel, and the policies developed to address these issues (accessible buses and vehicles, assistance at airports or train stations) have become widespread. However the impact that mental health difficulties can have on ability to travel, including in some case ability to drive, or that using transport systems can have on mental health is still scarcely documented.

As a result of this TRL decided to undertake a review with the aim of identifying and understanding more clearly the nature of the relationship between mental health and transport (Posner, 2017). The review highlighted the extent of the relationship between mental health and transport, with mental health influencing decisions to travel (Sposato et al, 2012; Evans et al., 2002 Evans & Stecker, 2004; Willis, Manaugh & El-Geneidy, 2013, Chataway et al., 2014) travel mode choice (Yang, 2015, Galdames et al, 2011; Van Hagen &Sauren, 2014; Le Masurier & Wilson, 2010; Mahudin, Cox & Griffiths, 2012; Gatersleben & Uzzell, 2007; Ory & Mokhtarian, 2005) found that some of the needs met through cycling included). and in some cases driver behaviour (McDonald et al, 2014; Hubicka et al, 2010 Scott-Parker et al., 2013; Panayioutou, 2015; Vingilis et al, 2013; Vaa, 2014; Zinzow et al., 2013; Oliver et al., 2015; Nesbit, Conger &Conger, 2007; Rowden et al., 2011). In addition, the research highlighted the impact that using transport systems can have on mental health (Wener & Evans, 2011; Feng & Boyle, 2014; Bergstad, et al., 2011; LaJeunesse & Rodríguez, 2012; Ward, Freeman & McGee, 2015; Ramathan, O'Brien, Faulkner & Stone, 2014; WHO, 2010; Atkinson & Weignand, 2008; Farmer et al, 1998; Bauman, 2004; British Medical Association, 2012; Willis et al, 2013; Ory & Makhtarian, 2005; Gatersleben & Uzzell, 2007; Boniface et al, 2015; Preseton & Rajé, 2007; Stanley et al, 2011). Posner's (2017) review highlighted significant limitations within the published literature, including the scarcity of UK based research and the prevalence of research conducted with clinical samples. Clinically based samples refer to studies that have recruited participants from among users of mental health services. This limits the populations that can be sampled, as there are well documented socio-demographic biases in those who seek treatment and support for poor mental health (Brugha et al, 2016). As mentioned previously, every individual has a variable level of mental health and limiting research to clinically based samples fails to provide a generalizable understanding of the impact that mental health can have on transport behaviour and the impact of using our transport systems on mental health. The paucity of community based research limits our understanding of the nature of the relationship between mental health and transport and consequently limits are ability to develop the necessary interventions and solutions to address this.

To start addressing these gaps TRL has conducted a two part research project that aimed to engage with members of the general public to understand their personal experiences while travelling on the UK's transport network. Initial qualitative engagement was carried out with members of the general public who had experienced anxiety and/or depression in their adult life (but were not currently experiencing any mental health difficulties) to explore the experiences of transport users in the UK (Section 2). These findings were then used to design a large scale survey to solidify the initial findings by reaching a much wider UK based sample (Section 3. The aim of this study was two-fold: firstly to gain a better understanding

of the relationships between mental health and transport by engaging with members of the general public and exploring their own experiences, and secondly to understand the factors that influence travel mode choice and examine how these vary between groups of people with varying levels of mental health difficulties. The community survey, explained in Section 3, was designed to answer the following research questions:

1. How does the importance of factors vary across travel modes?
2. How does the importance of these factors vary between groups of people with different scores on two mental health scales (GAD-7 and PHQ-9)?
3. How do people perceive the impacts of different transport modes on their mental health and wellbeing?

2 Qualitative research

2.1 Method

The qualitative engagement was conducted in two stages: an initial survey aimed at gaining insight into the experience of individuals who have experienced anxiety and depression, and focus groups that to explored these early findings in more depth.

As mentioned previously the research conducted to date looking at the relationship between mental health and transport has predominantly been carried out with clinical populations. In order to address this, the research chose to engage with members of the general public who had experienced poor mental health, particularly anxiety and/or depression, in their adult life (since the age of 18). Mental health is still a sensitive topic, with many choosing not to disclose or discuss their experience of mental health with others. As well as providing insight into the experiences of those with mental health difficulties, the initial survey allowed us to ensure that those who were invited to take part in the focus groups felt comfortable and sufficiently grounded in their prior experience of anxiety and or depression to openly discuss their personal experiences without becoming distressed. Therefore only adults aged 25 or over who consider themselves to have experienced depression and/or anxiety in their adult life (when aged 18 or more). In addition, those who were invited to take part in the focus groups were not currently experiencing anxiety and/or depression and had not experienced these mental health difficulties in the last three years. Due to the sensitive nature of the research area, both stages of the qualitative engagement were reviewed by TRL's full ethics panel[3]. The panel reviewed all the materials developed as part of the qualitative engagement[4], and granted ethical approval to conduct this research. The aim of the qualitative research was to gain a better understanding of the relationships between mental health and transport by engaging with members of the general public and exploring their own experiences.

2.1.1 Survey

2.1.1.1 Participants

Participants were identified through TRL's participant database. This database consists of a large sample of adults who have registered an interest in taking part in work carried out by TRL. In addition, social media recruitment posts were published through TRL's corporate accounts (Twitter, LinkedIn and Facebook).

[3] TRL's full ethics panel consists of TRL's Academy Director, TRL's chief scientists, the project's technical reviewer, as well as an external panel member who has considerable experience in the field. The ethics proposal can be found in 33Appendix E

[4] This included: recruitment material, correspondence with participants, the survey design, topic guides for the focus group, research design and methodology.

The survey was divided into three sections (see xxx for full details). Sections one and three were showed to all adults aged over 18, while section 2 was only shown to adults who met the eligibility criteria to take part in the focus groups (aged over 25, having experienced anxiety and, or depression in their adult life but not in the last three years and willing to be involved in focus groups).

A total of 243 participants took part in the survey, 26 of which completed all three sections of the survey.

2.1.1.2 Design

The survey included three sections:

- Demographic questions and self-reported questions relating to current and prior experience of mental health difficulties
- Mental health scales (PHQ-SADS) measuring anxiety, depression and somatic symptoms
- Open ended questions asking people to provide feedback on their experiences of mental health and transport and vice versa

The full survey can be found in 5Appendix A.

The mental health scales were selected as the PHQ-SADS, and its subscales are used in NHS services, including the IAPT programme (Improving Access to Psychological Therapies), as a screening and monitoring tool for current levels of anxiety and or depression. These scales are publically available and can be accessed by any individual without them seeking support from their GP, or without the support/presence of a trained mental health or medical professional. The PHQ-SADS provides three scores, which are each categorised into a number of different levels reflecting the severity of the difficulties experienced. For the PHQ-9 four cut off points represent the different levels of experienced depression (5; 10; 15 and 20)[5], and for the GAD-7 and the PHQ-15 three cut off points represent the different levels of experienced anxiety and somatic symptoms (5, 10 and 15)[6],[7]. Only those scoring below 10 on the PHQ-15 scale, below 7 on the GAD-7 scale and below 9 on the PHQ-9 scale were invited to take part in the focus groups. These cut offs are based on the criteria used in IAPT services. An individual scoring above these scores would meet the criteria to receive support from an IAPT worker. In addition, the PHQ-9 includes a question relating to self-harm. This was used as an automatic screening question. If participants scored higher than zero on this question they were not invited to take part in the focus groups.

TRL has an ethical obligation to inform those individual of the various helplines and options that can provide support in such hard times. Details of how participants can access mental

[5] Depression severity index score: 5<: Mild; 10<: Moderate; 15<: Moderately severe; 20<: Severe Depression

[6] Index scores for the GAD-7: 5<: Mild Anxiety; 10<: Moderate Anxiety; 15< Severe Anxiety

[7] Somatic symptoms index score: 5<: Low symptom severity; 10< Medium symptom severity; 15< High symptom severity

health support were provided both in the consent form and once the survey was completed and participants were encouraged to contact these organisations (e.g. contact details for Samaritans)

The open ended questions were then analysed independently. A content analysis was carried out. All the responses were systematically and manually coded, these were then counted to analyse patterns of content. A full analysis can be found in sections 2.2and 2.3.

2.1.2 Focus groups

2.1.2.1 Participants

Participants were identified through their responses to the survey administered as part of the first stage of the engagement. Those who met the criteria to take part in a focus group were emailed and invited to participate in a focus group discussion to explore their opinions, attitudes and experiences in more depth.

While 26 participants met the criteria to take part in the focus groups, only six were able to attend.

2.1.2.2 Design

As mentioned previously, the aim of the groups was to explore in more depth the findings obtained in the first stage of the engagement. Focus groups are a form of qualitative research conducted with a group of participants. They provide the opportunity to explore different points of view on a range of topic and to explore differences and similarities between group members' points of view (Braun & Clarke, 2013). Focus groups are based on a small number of broad questions/themes, which are discussed by participants at their own pace. Unlike more structured qualitative methods, the conversation is guided by the participants themselves and the researcher is simply a facilitator. The role of the facilitator is to guide the discussion where appropriate, by inviting participants to elaborate more on specific themes or bringing back the discussion towards the topics of interest, and to ensure that all participants are able to contribute equally to the discussion.

Focus groups have been found to be a strong exploratory tool when looking at unexplored areas as participants discuss their thoughts and personal experiences to a given topic (Gibbs, 1997). They allow for a range of different opinions and experiences to be explored, as participants may have contrasting beliefs and are encouraged to develop their reasoning to produce elaborate accounts in order to make their position clear to the other group members, consequently allowing for a more in-depth analysis of their thoughts (Smith, 2008). Similarly, as the conversation is directed by the participants themselves and not the researcher, this ensures a more in-depth exploration of their own thoughts, as they are able to elaborate on any topic they wish to discuss and choose the direction that the discussion should take (Gibbs, 1997). In addition, people are at times unaware of their position regarding a particular phenomenon or issue until they are prompted in conversation to think about it, generally as a reaction to an opinion put forward by someone else (Smith, 2008). Similarly, during focus groups topics may be discussed that an

individual would not necessarily have thought of alone in the context of an interview, but was reminded of such a point once it had been raised by a fellow member of the group (Smith, 2008). This, once again, allows for a greater range of topics to be raised and a more in-depth and experience based discussion, allowing for a richer analysis.

When determining the participants for a focus groups there are two important factors to take into consideration:

- Homogeneity or Heterogeneity of the group
- Participants being friends or strangers

All of the options have their strengths, but in this instance the focus groups were made up of a homogenous group of strangers. Homogenous groups are often favoured as those taking part have similarities and have experiences and opinions regarding the topics discussed (Liamputtong, 2011). Now while the participants may have all had experience of anxiety and or depression in their adult life and therefore to some extent homogenous, the ways in which this impacted their day to day lives and their experiences are likely to be very different providing a rich discussion (Braun & Clarke, 2013). When discussing topics that are personal and sensitive focus groups made of strangers can often encourage disclosure. Research has shown when discussing topic with friends can sometimes inhibit free discussion and disclosure (Liamputtong, 2011). On the other hand discussing personal topics with strangers can lead to people sharing a range of different opinions and perspectives as they will probably never see the fellow participants again (Braun & Clarke, 2013).

A full topic guide can be found in 5Appendix B.

2.1.2.3 Procedure

After being identified through their survey responses participants that were eligible to take part were sent an email inviting them to take part in a focus group. The email included the consent form, information sheets and the link to an availability survey allowing researchers to schedule the focus groups.

The focus group took place at TRL's main offices in Crowthorne and lasted approximately 2 hours 30 minutes and was recorded for later transcription.

At the beginning of each focus group participants were presented once again with the information sheets and consent forms and were made aware of their right to withdraw at any time and without having to provide an explanation. They were reminded of the basic nature of the study, reminding them of its confidentiality and anonymity. Three researchers were present throughout the focus groups. One facilitated the focus group, while the other two monitored more closely non-verbal as well as verbal cues of distress. At the start of the focus group the facilitator used an ice breaking technique to facilitate the creation of a 'safe environment', where each respondent would feel free to disclose their opinions or challenge those of others (Braun & Clarke, 2013). Once the focus group was completed participants were thanked for their time and given a £20 incentive. Upon completion the focus groups were transcribed and analysed using a thematic analysis. A full analysis of these findings can be found in section 2.2and 2.3.

2.2 Effects of mental health on travel behaviour

Of 243 participants, 94.8% (N = 228) believed that mental health can affect our travel behaviour, 3.3% (N = 8) believed that mental health cannot affect our travel behaviour, and 2.9% (N = 7) were unsure or gave no response. Only responses from those who believed that mental health can affect our travel behaviour were considered for further qualitative analysis.

Out of the 228 participants that believed mental health can affect our travel behaviour, the majority (78.5%; N = 179) believed that mental health can negatively affect our travel behaviour, 0.4% (N = 1) believed that mental health can positively affect our travel behaviour, and 21.1% (N = 48) were unsure or did not indicate whether mental health can affect our travel behaviour negatively or positively.

2.2.1 Negative effects of mental health on travel behaviour

As shown in the Table 1 below, the most commonly mentioned mental health difficulties that negatively affected travel behaviour were anxiety, depression or low mood, and stress. The most frequently mentioned negative effects of mental health on travel behaviour were avoiding travel, lack of concentration, and unsafe or impaired travel behaviour. The numbers presented in Table 1 reflect the number of times each topic was mentioned in the open ended survey responses.

2.2.2 Positive effects of mental health on travel behaviour

No positive effects of mental health on travel behaviour were detailed by the survey participants.

Table 1 Mental health and travel behaviour: negative outcomes

		Mental health aspect											
		Anxiety	Depression/Low mood	Stress	Lack of energy/ motivation	Social phobia/anxiety	Anger	Difficulty controlling emotions	Medication	Low self-esteem/ confidence	OCD	PTSD	Example(s)
Negative travel behaviour outcome	**Avoiding travel/travel modes**	36	11	2		2			1	1	1		Staying at home, avoiding unfamiliar destinations/transport modes, avoiding busy/public/lonely/unsafe transport modes
	Lack of concentration	8	3	3	2			1					Unable to concentrate on surroundings/driving/cycling
	Unsafe/ impaired travel behaviour	4	4	1	5		2		1				Erratic driving, medication/fatigue affecting driving performance
	Lessened confidence in travelling	3	2		2	1							Unconfident in driving/travelling to new destinations or by new transport modes
	Impaired reactions	2	2	1	2			1					Underreacting/overreacting/slower reaction times when driving
	Altered travel time choice	4	1	1								1	Choosing to travel at less busy times/daytime
	Anti-social thoughts/		2	2			2		1				'Road rage'/aggressive driving, lessened tolerance of others, travelling alone to

	behaviour												avoid others
	Impaired decision-making	2		1									Errors in judgement when driving, increased risk-taking (e.g. speeding)
	Disorganisation	1											Unable to efficiently plan travel/stick to plans
	Lack of enjoyment when travelling	1											Worrying about falling ill whilst travelling, rushed travel due to lack of enjoyment

2.2.3 Focus groups

The findings from the focus group support the findings from the survey. Participants mentioned a number of ways in which their mental health could impact their travel behaviour.

One of the factors mentioned throughout the discussion was the impact of mental health on the decision making process. Participants explored the ways in which their mental health could impact and impair their ability to make decisions in unexpected situations, such as sudden changes or delays, and how this could influence their travel mode choice

> *'Instead of thinking how are you going to get out of it, you go down into thinking all the what's IF and they get worse. When you start panicking you do, because you don't think rationally, do you '*

> *'My own experience of mental health affecting my transport because it was a while ago that I had the problems, I was waiting for a bus, we're going back into the '70s, and the bus was late and I was really panicking because I had to get somewhere on this bus because I hadn't got a car then. The bus was late so I was actually, is the bus going to come or is it not going to come, do I need to get a taxi, so it can add on to the stress if you're already stressed'*

Participants also reported that their mental health difficulties often led to them needing to be in control over their own behaviour, including their travelling behaviour. This need for control influenced their travel mode choice, as the absence of control could lead to feelings of stress, anxiety and at times even panic attacks. As a result of this many chose to avoid modes of transport where they had 'give up' control.

> *'You're getting a train or a bus and it's not turning up or you get delayed, you just implode, it gets worse. You're not in control of what's going to happen to you. If you've got a car , okay, I can go here, I can get out and stop or go somewhere else.'*

As well as influencing travel mode choice, participants explored the extent to which mental health could influence driving behaviour. Participants discussed the ways in which mental health could influence the decision making process while driving, as well as the impact on confidence while driving with drivers being more hesitant and consequently making them more dangerous drivers. In addition, they believed that the mental health of a driver would impact their state of mind when they entered a vehicle, which in turn would lead to more aggressive driving.

> *'That's why I think mental health can affect things like that, and also affect your confidence, people can be more hesitant in pulling away or things like that, as well as the anxiety side of it.'*

> *'I do, and I think a lot of road rage can come from it, so people that are stressed or depressed have got less patience or could have less patience on the road which could then cause road rage.'*

A particular group that was mentioned was young drivers. Participants discussed the increase in prevalence rates of poor mental health in adolescents and young adults and how this would transfer to the driving task. Participants believed that the stress of the driving

task and the lack of experience, combined with the mental health difficulties would lead to increased risky driving within this driver group.

> *'How many of these youngsters, under-25s, would be feeling anxiety and stress and then get in the car and doing something and not making the right decision because you're very anxious, leading to an accident? They're all then relating it to driving, and then later on it just gets bigger and bigger. Well, they've not got the experience either, so they're going out driving with less experience but having that anxiety as well .'*

2.3 Effects of transport systems on mental health

Of the 243 participants, 94.7% (N = 230) believed that transport systems can affect our mental health, 2.1% (N = 5) believed that transport systems cannot affect our mental health, and 3.3% (N = 8) were unsure or gave no response. Only responses from those who believed that transport systems can affect our mental health were considered for further qualitative analysis.

Out of the 230 participants that believed transport systems can affect our mental health, the majority (77.4%; N = 178) believed that transport systems can negatively affect our mental health, 4.4% (N = 10) believed that transport systems can have both positive and negative effects on our mental health, and 18.3% (N = 42) were unsure or did not indicate whether transport systems can affect our mental health negatively or positively.

2.3.1 Negative aspects of transport systems

As shown in Table 2, the most frequently mentioned negative transport system aspects were busyness or congestion, overcrowding, and journey complications. In relation to the negative transport system aspects, roads, trains, and public transport in general were the most commonly mentioned transport systems. Findings from the survey responses about how these negative transport system aspects affect mental health are discussed in section 2.3.2[8]. The numbers presented in Table 2 reflect the number of times each topic was mentioned in the open ended survey responses.

2.3.2 Effects of negative aspects of transport systems on mental health

As shown in Table 3, the most frequently mentioned outcomes for mental health resulting from negative transport system aspects were stress, anxiety, and feelings of isolation. Busyness or congestion, delays, and overcrowding were the most commonly mentioned negative transport system aspects that can impact on mental health. The numbers presented in Table 3 reflect the number of times each topic was mentioned in the open ended survey responses.

[8] Negative transport system aspects differ slightly between sections 2.3.1 and **Error! Reference source not found.** due to the context of the responses (i.e. some participants did not state the transport system in relation to the negative transport system aspect or did not state how the negative transport system aspect can affect mental health).

Table 2 Negative transport system aspects

		Transport system										Example(s)
		Roads	Trains	Public transport	Buses	Driving	Underground trains	Aviation	Walking	Taxi	Pedal cycling	
Negative transport system aspect	**Busy/congested**	37	7	2	4	7	1					Heavy traffic (vehicles/people)
	Overcrowded	1	16	13	8		7	1				Too many people occupying the same space
	Journey complications	14	6	2	3	2		1				Roadworks, accidents, road closures, unexpected changes to travel schedule, cancellations
	Delays	5	7	9	5	2						Delays due to heavy traffic, roadworks, accidents, cancellations, late public transport, strike action
	Other peoples' behaviour	8	2	4		10	1					Unwelcoming staff, dangerous travel behaviours (e.g. tailgating), inconsiderate/aggressive/judgemental/impatient people
	Presence of other people	4	3	12	1	3	1		1			Travelling with strangers, lack of personal space, lack of available seating, requirement to interact with others
	Confusing	2	4	4	3	2						Unclear road signs/travel timetables/maps/platform or station layout, unfamiliar travel etiquette, purchasing tickets
	Expensive	1	2	2	1	1						Cost of maintaining personal vehicles/public transport fares
	Unpleasant		3	1	1		1			1		Noisy, confined, dark, dull, foul-smelling, unhygienic,

surroundings												outdated, in need of repair
Lack of information		2	2	3								Lack of information about timetables/travel etiquette/purchasing tickets/journey complications, lack of staff to answer questions
Poor management	4	1	1									Lack of staff, lack of transport options, unhygienic surroundings, poor management of delays/traffic, poor road conditions
Unsafe	2	2		1						1		Lack of provisions for safe cycling, large gaps between pavement/platform and bus/train, insufficient lighting
Unfamiliar	1	1	1	2	1							Unfamiliar destination/transport system/route/travel etiquette
Lack of escape when in transit		2		2			2					Prohibited exit on aeroplanes/trains/buses when in transit
Confined/enclosed space		1	3			1	1					Restricted space
Unpredictable/ unreliable			2	3								Unexpected delays/cancellations/changes to travel schedule or route, varying degrees of availability/traffic
Associated with long journeys	1	1	1		1							Long journeys (distance/time) caused by journey complications/delays/too many required travel changes
Pressure to be on-time		2		2	1							Concerns about missing public transport/unexpected delays, having to take full responsibility for being on-time (e.g. driving)
Lack of control				1	2	1						Requirement to relinquish control of timekeeping/travel behaviour/travel routes (e.g. to the driver)

	Inconvenient	1	1	2								Too many required travel changes, too much planning required, lack of available transport options/routes, journey complications
	Lack of other people			1		2						Safety concerns about travelling alone, lack of interaction with others
	Responsibility to ensure safety					2						Ensuring safety of others when driving through constant vigilance
	Lack of distraction					1						Opportunity to focus on mental health issues

Table 3 Negative impact of transport systems on mental health

		Negative transport system aspect																						
		Busy/congested	Delays	Overcrowded	Journey complications	Presence of other people	Other peoples' behaviour	Confusing	Expensive	Confined/enclosed space	Unpredictable/Unreliable	Inconvenient	Unpleasant surroundings	Poor management	Unfamiliar	Lack of control	Lack of information	Pressure to be on-time	Unsafe	Responsibility to ensure safety	Associated with long journeys	Lack of other people	Lack of escape when in transit	Too much information	Requirement to be outside
Mental health outcome	Stress	27	26	17	13	3	5	4	3	3	5	1	2	2	3	2	2	3		1	2				
	Anxiety	15	16	20	10	10	9	4	3	3	3	1	2	3	3	3	3	1	3	1		1	1	1	
	Feelings of isolation (staying at home/ avoiding travel)	8	1	6	2	9		1	1	2		1	1	2	1				1			1	1		1
	Depression /low mood/ negative thoughts	1	4	2	1		1		1				2								1	1			
	Anger	3	1		2							1													

	Lessened self-esteem/ confidence		1	1			2																			
	Less able to focus (e.g. on driving)	1					2																			
	Decreased leisure time											2								1						
	Social phobia/ anxiety			1		1																				
	Anti-social thoughts/ behaviour (less tolerant of others)					1	1																			
	Decreased energy		1																							
	Sleep deprivation											1														
	Confusion																								1	

2.3.3 Focus groups

Once more the themes discussed in the focus group supported the findings from the survey. Participants mentioned a number of ways in which the transport systems could influence their mental health and particularly the specific factors that had an impact on mental health and how these varied across different modes of transport.

Convenience and accessibility

Convenience was one of the factors that influenced travel mode choice, with participants reporting that while they would like to use certain modes of transport that might have a more positive impact on their mental health and wellbeing (e.g. cycling, public transport) this was often not possible. Participants suggested that their main aim was to travel to their destination without any difficulties, including mental health difficulties. Convenience often meant that participants chose to drive, as it was easier to access, provided more flexibility and removed some of the uncertainty that could occur by using public transport.

> *'It's all down to convenience and getting from A to B without too many problems'*

Accessibility was also an important factor. Participants mentioned that while certain modes of transport would be more convenient, such as using public transport to access an urban environment, these were not always accessible. This lack of accessibility meant that road users would avoid the modes of transport that might require additional effort to access as they might have a more negative impact on their mental health. This was seen across a number of modes of transport, with many prioritising car use over public transport and active travel to avoid difficulties

> *'It would take me half an hour to walk to a bus stop from where I live, and then it would take me another hour to get in just to the town centre from home. So that's why I wouldn't use'*

> *'Until a couple of years ago I walked, because I lived so close to the town centre. Now I have to drive'*

Information provision, knowledge and awareness of surroundings

Knowledge, or the lack of local knowledge was an important factor that could have negative impacts on the mental health and wellbeing of road users. Participants mentioned that knowing their surroundings and their route was an important factor to minimise negative impacts. When travelling in unknown areas road users mentioned that they would avoid cars, as it required the ability to make decisions in a high pressured environment. The absence of local awareness and at times information often lead to increased stress and anxiety for those travelling.

'I think if you know where you're going, that's half of the –Yes, it makes a difference, certainly'

''And knowing where you're going and the one way systems. I've always been a confident driver, and I used to live in [sub-urban town] which was on the outskirts, but not now, I wouldn't contemplate driving.'

'Yes, and if I was going into [major urban town], I would always go on the train. I wouldn't contemplate driving.'

In addition, the current levels of information provision were often reported as having negative impacts on peoples' mental health and wellbeing. Indeed participants believed that the current level of information provided when travelling was insufficient, leading to feelings of anxiety, distress and stress. This was the case across a number of modes of transport, including public transport, train and car use. In relation to car use, participants discussed that the current information provided wasn't sufficient and a lot of the information wasn't necessary. Participants described events where an incident has happened in which they found themselves experiencing high levels of stress. This was also due to the inconsistency in the levels of information provided across the road network. This inconsistency was also a source of anxiety and stress impacting road users' driving behaviour.

'I think there should be, like you said, a bit board prior to going anywhere, so you know. Once you're in the car, you can't instantly turn around in the car and start looking. You need to know that instant, and information is everything, especially if you're going up to [major town], even if it's 10 miles down the road and there's a horrendous accident or whatever, at least you know. You don't add to the problems then, do you.'

'The signs will say, say if the A34 is closed, they'll give you lots of warning for something like that which is more of a minor road to a motorway, but you don't get the same from a minor road telling you if the motorway'

This was also an issue on other modes of transports, particularly trains. Participants discussed their experiences of dealing with unexpected situations when on the trains and the difficulties they faced due to the lack of information that was available. While participants accepted that the information required to make an informed decision in those events may be available, they were unaware of where to find it, and reported said that it would require the ability to think on one's feet in order to take appropriate action. The absence of information emphasised the negative impacts of these situation on the mental health and wellbeing of travellers.

'If I was somebody who was panicky and anxious, I honestly don't know. I would have had to have sat at Waterloo until this problem was fixed, if it was ever going to be fixed, I don't know what a signalling problem entails. You really have to think on your feet.'

Crowding

Crowding often led to total avoidance of a mode of transport due to the impact that it had on the mental health of transport users. Participants described feelings of claustrophobia, social anxiety and general distress. Crowding, and the negative aspects of crowding were most often mentioned in relation to train travel. Participants described feelings of dread, and often feeling anxious simply thinking about travelling on crowded transports. Their experience of travelling on crowded trains often lead to them feeling stressed, some described increase heart rate and difficulties breathing, feeling trapped and overall feelings of psychological distress.

'Mentally, you're drained by the end of the week, then you've got to do a day's work when you get there. People feel tired, dirty, drained before even getting to work'

'They are busy but you can still move. Some of them, people's faces are going like that and the door's closing, that would freak me out.'

'Yes, and I'd never get on a train, like you were saying, where people were squashing on. If I couldn't get on and move, I wouldn't get on that train'

As well as train, the other mode of transport that was mentioned was the London Underground. Just like train travel, travel on the Underground often led to feelings of claustrophobia, with some reporting feeling trapped and experienced feelings of anxiety as a result of the high density. Some described that they had experienced panic attacks as a result of the crowding on this mode of transport which had led to total avoidance.

'Quite often it's jam packed and it stops in the tunnel and it's boiling hot. We still enjoyed it, but yes, I'd never ever go on the tube, I'd have a panic attack.'

To avoid these experiences, participants had adopted a number of different techniques and mitigations. Some chose to avoid modes of transports all together, while others chose to alter their plans to travel at quieter times where crowding was not an issue.

'If I was ever going on the train, especially from [sub-urban town] because it's horrendous, I'll always get the train earlier than I mean to'

'I walk or I get a taxi or I drive. I was up in [major urban town] week before last with a group of people. They got a tube and me and my mates just walked. It was about a three or four mile walk.'

Comfort and safety

Lack of perceived safety could often lead to feelings of stress and anxiety. This was a factor that had an impact across a range of different modes of transport including walking and cycling. Participants discussed that while they would like to walk and cycle they often felt unsafe while doing it, especially at night or when they were on their own. This was at times due to the poor infrastructure, such as poor street lighting, absence of cycle paths, which meant that while these modes of transport could be enjoyable they were also a source of stress and concern.

> *'No, in [sub-urban town] there are lots of underpasses, in the past there have been lots of problems there. Even as a guy, I wouldn't really walk at night'*

> *'If the lights aren't working, which invariably they're not, especially if you're a lady, you wouldn't even go in there.'*

Safety was also a concern on public transport, with some participants saying they would feel unsafe and anxious travelling on public transport alone. Participants believed that when an individual was stressed, using a mode of transport where one felt safer would minimise any negative impacts of travel on mental health.

> *'If you're particularly stressed, particularly anxious, you know that using that mode of transport you feel safer, that you feel more comfortable'*

Time pressures and delays

Time pressure and delays was some of the most frequently mentioned factors that could influence mental health while travelling. When using public transport participants described many instances of buses being delayed leading to feelings of panic, concern and stress. The main concern however, was the fear of being delayed as a result of time pressures and the possible repercussions of delays on other aspects of day to day life. The possibility of these delays, combined with the inability to adapt their travel behaviour, often led to increased anxiety. This often meant that participants chose to avoid public transport and trains when travelling under time pressure.

> *'If you're going somewhere and you've got to be there at a specific time, say you've got to go to a job interview or something and that train's not going to get you there, then that's going to really, well, it would me, increase my anxiety levels'*

> *'That is awful that they're relying on public transport to get them to their place of employment and they've had to move, either move job or move house. The stress that must have caused them.'*

Other road users and passengers

Other road users and passengers were another factor that could have negative impacts on the mental health and wellbeing of road users. Car users mentioned that the presence of other people in the car could lead to increased stress while driving which could impact their driving behaviour. In addition, some participants mentioned that the safety of their passengers, particularly children could have negative impacts on their mental health while driving.

> *'As you say, if you drive for seven hours on the motorway and you've got young children in the back, that'd be stressful enough for anyone really.'*

> *'There are other people in the cars and everything else, you think it's hard, and the stress hits you straight away '*

The presence of other passengers on trains and public transport was also frequently mentioned. Participants reported instances of other passengers that made them feel anxious as a result of anti-social behaviour.

> *'You get trouble on the trains as well, if it ever kicked off there's nowhere for you to go, and it's really frightening for only a couple of stops but not very nice.'*

> *'I had a seat booked and there were these horrible looking girls sitting in the seat. I said, "I've got that seat reserved," and they told me to f*** off and got very vocal'*

Absence of support

One of the main reasons why transport systems impacted so negatively on the mental health and wellbeing was the absence of support, especially on public transport and trains. Participants all agreed that in the event of an unexpected event that could lead to stress and anxiety the absence of support amplified these aspects. As a result of this lack of support many have had to find different alternatives to receive support, with some resulting to emotive reaction as they believed this was the only way to receive help. Indeed, they believed that people are more likely to respond to intense emotions.

> *'I think just bursting into tears would probably be the best bet , somebody might come and help you in that sort of a situation, just look helpless and burst into tears and, "I need help.'*

> *'I've thought of all these things, you just can't stop it if you're that stressed, and I think people would probably come to your aid more if you were a single woman sitting on a bench crying your eyes out thinking what the hell. I think a friendly person would come along.'*

Participants believed that there was still a poor understanding of mental health. For some participants the fear of having a panic attack and not being able to receive any support put them off using certain modes of transport. Overall they believed that staff on public transport and train stations had insufficient knowledge to be able to support all those who travel.

> *'If you have a panic attack where you can't breathe and you're hyperventilating, how many people would just walk past and not understand. I think the best thing is just to burst into tears in a situation because at least that's a release rather than hyperventilating and not having your paper bag with you if that's what you need to breathe into the paper bag. If you see somebody doing that, do they think, "Oh, that's a weirdo"?'*

Participants all had experience of looking for, and failing to find, support staff at train stations in the event of an unexpected change to their journeys. As well as the lack of understanding of support staff, they often believed that there were insufficient numbers of staff around to provide the necessary information and minimise the negative impacts of travel on the mental health and wellbeing of travellers.

> *'A lot of these train stations don't have anybody there now, they're unmanned. You go down to the middle of nowhere with the same sort of situation we've talked about, what would you do?'*

> *'It's a two-way thing really, that the person needs to know how they can get help and the help needs to be available .'*

A need for control and intolerance of uncertainty

An important factor that could have a negative impact on the mental health and wellbeing of transport users was the absence of control. Modes of transport where the participants did not feel in control of their own behaviour led to higher levels of stress and anxiety. This was particularly the case for train and public transport. When travelling by public transport or train control is handed over to another person, and those travelling cannot make decisions in the event of unexpected events or delays.

This need for control often came from an intolerance of uncertainty. Participants all described personal experiences where the absence of control over their own behaviour often leads to uncontrollable and intrusive 'what-if' thoughts. These thoughts often led to them experiencing intense stress and anxiety.

> *'Every day you're walking to the station, a) am I going to get seat? Is the train on time? I'm going to be late for work? Am I going to lose my job again because I've been late three times this week? That's before you've even get on the train'.*

'This train is not going anywhere - I have no idea how I'm going to do that.'

'When you haven't been somewhere for the first time and you don't know how long it's going to take you. You can look it up on maps but you've no idea how long it's going to take you.'

Control included a need to be on time, a need for information so that an informed decision could be made in the event of an unexpected change to their journey and an ability to change the course of travel if required. To do so road users often chose to avoid modes of transport where they had to hand over control, or where there might be a change in plans. Participants often chose to drive, or the use the car in order to ensure that they were in control of their own behaviour and felt that they were able to minimise the negative impacts on their mental health.

'I think I'd still rather leave early because I feel I've got more control , because if am in traffic I could find a different way.'

'Yes, I would use a car too, because you're in control of that. There's nothing else influencing really.'

'It's the control of, "I know where I'm going, I know exactly how to get there. If it all goes wrong, you can just stop and get out and go somewhere .'

Throughout the focus group participants discussed the impact that future vehicles, particularly autonomous vehicles. Unlike current cars that were often found to provide increased control and remove the uncertainty that other modes of transport provide, autonomous vehicles were a cause for concern. There was a lot of uncertainty surrounding the role of the 'driver' in autonomous vehicles especially around control. This topic led to 'what-if' thoughts and concern amongst the participants, with some believing that it would be detrimental to mental health.

'Well, are you going to be sitting behind the wheel with your laptop doing your work, driving in your driverless car, and you just go from A to B? When do you take over? Do you have to keep your eyes on the road the whole time? Driverless lorries, I've heard things about they're going to have a convoy of driverless lorries on the motorway so that if you're in the middle lane you can't see the road signs because you get so many convoys of lorries. How is it all going to work practically?'

'I think people drive because they want to drive, they're in control. I'd feel anxious being in a car without having a driver.'

'I'd feel more stress in a car I wasn't driving'

2.3.4 *Positive aspects of transport systems*

As shown in Table 4, there was little mention of positive transport system aspects and each aspect was mentioned as frequently as the others. Driving, pedal cycling, and underground trains were the only transport systems mentioned in relation to positive transport system aspects. Findings from the survey responses about how these positive transport system aspects affect mental health are discussed in section 2.3.5. The numbers presented in Table 4 reflect the number of times each topic was mentioned in the open ended survey responses.

Table 4 Positive transport system aspects

		Transport system			
		Driving	Pedal cycling	Underground trains	Example(s)
Positive transport system aspect	**Source of distraction**	1			Opportunity to focus on travel instead of mental health issues
	Increased control	1			Increased control over environment (e.g. driving instead of public transport)
	Lack of other people	1			Lack of requirement to interact with others
	Quick		1		Saves time compared to other transport systems
	Being outside		1		Exposure to fresh air and daylight
	Overcrowded			1	Presence of others provides sense of anonymity

2.3.5 *Effects of positive aspects of transport systems on mental health*

As shown in Table 5, there was also little mention of how positive transport system aspects can affect mental health. The most frequently mentioned outcomes for mental health resulting from positive transport system aspects were decreased stress, distraction from mental health issues, and increased leisure time. Being a source of distraction, increased control, and lack of people were the most commonly mentioned positive transport system aspects that can impact on mental health. The numbers presented in Table 5 reflect the number of times each topic was mentioned in the open ended survey responses.

Table 5 Positive impact of transport systems on mental health

		Positive transport system aspect					
		Source of distraction	Increased control	Lack of other people	Quick	Being outside	Overcrowded
Mental health outcome	Decreased stress		1	1	1		
	Distracted from mental health issues	2					
	Increased leisure time					1	
	Decreased anxiety (provides feelings of safety)						1

2.3.6 Focus groups

The participants also explored the ways in which transport systems could have a positive impact on mental health and wellbeing. One of the modes of transports that bought the most benefits was active travel, and walking in particular. Participants reported that walking provided them with an opportunity clear their head, relax and escape the stress that other modes of transport might induce. In addition, it also provided an opportunity to carry out physical activity which could impact their overall wellbeing.

> *'I used to walk to work and I used to love that walk to work, especially when it's a nice day. Not necessarily in the winter, but I think walking for me was nice.'*
>
> *It was through the woods so it cleared my head before I get to work, I'd get to work feeling quite refreshed and clear-headed because I didn't have the stress sitting in traffic trying to get into work, and I felt fitter as time went on'*

At times car use could also have a positive impact on mental health and wellbeing. Indeed, it provided a welcomed distraction from life stressors, and opportunity to spend time alone and to relax. In addition, the control provided through personal car use often meant that drivers could relax and take the time to reflect on their own thoughts.

> *'Yes, if you are stressed, after work I can listen to music and that can destress.'*
>
> *'Is it just that moment, you're in your own bubble?'*
>
> *'Yes, I can think about whatever I want to think about.'*

3 Community survey and choice experiment

3.1 Objectives

The survey was designed to address the following research questions:

1. How does the importance of factors vary across travel modes?
2. How does the importance of these factors vary between groups of people with different scores on two mental health scales?
3. How do people perceive the impacts of different transport modes on their mental health and wellbeing?

The survey included a number of sections:

1) Mental health scales (GAD-7 and PHQ-9)
2) A choice experiment to explore the impact of mental health on transport mode choices (this section also includes some open questions to further explore this relationship and allow people to discuss journey factors than could not be included in the choice experiment)
3) Attitudinal questions (using Likert items) on the impact of transport on mental health
4) Demographics.

The survey focused on the following journey modes, in order to replicate the typical travel choices between two town centres:

- Car
- Bus
- Train.

Questions on alternative transport modes such as walking and cycling were also included in this survey.

Results from the focus groups helped identify the main travel-related factors that affect mental health (see Table 2 to Table 5). Certain factors like feelings of control are embedded in the mode of transport themselves, i.e. a driver has a higher level of perceived control over their journey than a passenger on public transport. Some variables like safety, habit and route familiarity are not easily quantifiable and largely subjective. Due to feasibility and ease of estimation, the travel choice experiment aimed to answer Research Questions 1 and 2 whereas the later part of the survey (attitudinal questions) was used to answer Research Question 3.

3.2 Method

3.2.1 Survey design

3.2.1.1 Mental health scales

The GAD-7 and the PHQ-9 mental health scales (as describes in section 2.1.1 and used in the initial survey) were used to collect data on the participant's current mental health.

Participants were allocated to one of the following groups, based on their GAD-7 and PHQ-9 scores:

- Anxiety
- Depression
- Both depression and anxiety
- Low scores

Participants with a GAD-7 score above 7 were allocated to the 'Anxiety' group; participants with a PHQ-9 score above 9 were allocated to the 'Depression' group. Those with a GAD-7 score above 7 and a PHQ-9 score above 9 were allocated to the 'Both depression and anxiety' group; the remainder to the 'Low scores' group.

These groups were used to allow for participants to be experiencing depression and anxiety together or one of these without the other. It was decided not to use the physical symptoms scale due to the number of groups and comparisons this would create (four additional groups) and the burden this would have placed on the sample size requirements. Physical symptoms were also not a strong theme in the qualitative findings which focused on anxiety, depression, and stress.

3.2.1.2 Stated preference survey

The aim of the stated preference survey (or choice experiment, as they are otherwise known) was to explore, as realistically as possible, the impact of mental health difficulties on the mode choice decision-making processes followed by people in the real world. The design of the survey encouraged participants to trade-off between different journey attributes in order to choose their preferred mode of transport. For instance, participants could trade-off between journey time and cost in order to come to a decision between car, bus or train. The choice experiment quantified the different weighting that participants applied to each journey attribute and calculated the overall 'utility' of each mode of transport. Assuming rational behaviour, participants were assumed to choose the alternative with the highest 'utility'. Therefore, results could be used to understand how mode choice differs based on different journey factors.

A stated preference survey was identified as the most effective method to answer Research Question 1 and 2 as it allows us to estimate the impact (positive or negative) of journey attributes on travel mode choice. For instance, it allows us to estimate the amount of importance people with different scores on the mental health scale give to journey time when choosing a given mode of transport. This approach also allows us to estimate the

general biases or preferences towards a certain mode of transport, i.e. people with a certain mental health score would always chose a particular mode of transport (say, train over bus) even when other attributes such as time and cost are the same for the two modes. This is further explained by the ASC variable in the next section.

Experimental design

A labelled experimental design was constructed with three journey mode choices or alternatives: bus, train and car, in order to replicate the typical travel choices that someone might make when taking a journey between two town centres. This allowed for variability in the parameters for each attribute across the modes. For example, people may value money differently for cars and trains, and hence the parameters for these two values would be different.

Stated preference surveys estimate a participants' preference by asking them to choose between a set of alternatives (in our case, choosing between bus, train or car) within a certain choice scenario. A choice scenario is described by multiple attributes (journey factors) that relate to the set of alternatives and aid in the decision-making process. Each set of alternatives consist of different levels which are varied across each scenario in order to obtain maximum information from the participants. The qualitative research findings (conducted through focus groups and described in section 2) were used to identify the attributes to be incorporated in the choice experiment. Attributes used in stated preference surveys should have the following two qualities: firstly, they should be quantifiable and secondly they need to be easily understood by all participants. It is also important to consider the total number of attributes included in a choice experiment, since adding too many attributes would increase the length and complexity of the survey. Based on the results in Section 2.3, five attributes were identified as most relevant to answer our research questions and suitable for the chosen approach. These were:

1. Journey time (in minutes)
2. Journey cost (in GBP)
3. Maximum potential delay time (as a percentage of journey time)
4. Number of changes
5. Level of crowding

Journey time and cost: These standard travel attributes were included in the survey to allow calculations of willingness to pay (WtP) for each of the participant groups. WtP is a calculation based on the estimates for both the journey time and cost variables and computes the amount the participants are willing to pay for a 1 minute reduction in their journey. Although many previous surveys have studied WtP for the general population or specific target groups, this measure is understudied for people with different levels of mental health difficulties.

Maximum potential delay time: It was suggested through the results of the focus groups and the literature review that journey time variability and potential delays can be a cause of anxiety and stress, and may be situations that are avoided by people already suffering from mental health difficulties. This attribute was calculated as a percentage of the journey time

but was shown to participants in minutes (e.g. if the maximum delay time was 20% for a 40 minute journey, then the participant was told their journey could take between 40 and 48 minutes). Previous work has found that percentage delay was a much better predictor of whether people felt their drive was delayed than absolute delay time. It was also found that drivers did not perceive their journey as delayed until the delay reached around 30% of the expected journey time (this study used the expected journey time, the actual journey time, and a yes/no response to whether the participant thought they had experience a delay). These results have been considered when designing this attribute and the levels.

Number of changes: The number of changes required to complete the journey was included in the survey design based on the results of the qualitative work, where it was suggested that changes could introduce uncertainty and stress into a journey and the perception of needing to spend more time planning the journey. In general, it was suggested that it has the potential create situations that people with existing mental health difficulties may try to avoid as it may cause them distress. This attribute is only relevant to the bus and train alternatives, since travel by car would rarely involve a change of vehicle during the journey.

Level of crowding: The level of crowding was included for the same reason as the number of changes attribute. Again, this attribute is only relevant to the bus and train journeys.

Along with the attributes mentioned above, alternate specific constants (ASCs) were included in the model in order to capture the participants' general preference towards a specific mode of transport. Certain factors, such as feelings of control and safety, are embedded within the mode of transport and therefore cannot be varied across the choice options. However, these factors are still likely to impact participants' choices. The ASC parameters are used to account for these factors. In this study, ASCs were included in the utility function for the public modes of transport (bus and train) in order to allow comparisons to be drawn between public and private transport modes. Further details on attributes and attribute levels are given in Section 3.2.2.1 and Section 3.2.2.2 that outline the piloting of the survey.

Habit and previous behaviours are often strong predictors of future behaviour (Orbell & Verplanken, 2010; 2015). The stated preference element of the survey was designed to remove as much of the bias resulting from habits and previous choices as possible. The choice situation was described as a rare or novel journey where all three transport modes are viable (i.e. between to town centres). This type of journey scenario was used as it reduced the likelihood of participants referring, consciously or non-consciously, to their own previous travel patterns. As well as this a journey purpose was not specified (to which participants may have an associated habit or example they can easily draw to mind).

The survey was formulated as follows:

> "The next set of questions is about your travel choices.
>
> Imagine that you are planning to make a single journey that you don't make very often. You are planning to take this journey on your own. The journey is between two town centres and around 15 miles long.
>
> There are three possible transport modes you could choose from: bus, car, and train.
>
> For each journey option you will be given the following information:

- journey cost
- the journey time without any delays, and
- the amount of time the journey could be delayed by.

For the train and bus options you will also be given information on the number of changes required and the level of crowding. The level of crowding in each scenario is described as either not crowded or crowded.

- Not crowded: There are vacant seats and very few people standing in the aisle.
- Crowded: All seats are occupied and a lot of people are standing in the aisle.

For the car journeys options, the cost given takes into consideration any toll or parking fees as well as the fuel cost (car maintenance, tax, and insurance costs are not included).

For each scenario you will be asked "Which mode of transport would you choose?"

	Bus	Train	Car
Cost	£6	£6	£4
Journey time	20 minutes	40 minutes	20 minutes
Journey could be delayed by up to….	No delay	No delay	8 minutes
Level of crowding	Crowded	Not crowded	N/A
Number of changes	0	1	N/A
Which journey would you choose?	☐	☐	☐

Following each scenario you will also be asked to give a brief description explaining why you made the choice."

The stated preference survey section was placed prior to the attitudinal questions to reduce any potential priming effects of the attitudinal questions on the stated preference responses. However, the key survey aims could not be hidden from the participants for ethical reasons; as a result, this may have had some priming effects, resulting in the participants considering their mental health states for each mode in the choice experiment more than they typically would when making real life choices. Where survey studies are conducted in a fixed order, there is always some chance that the process of answering earlier sections can prime responses to later sections. That may have been the case here, since the choice experiment items always preceded the attitudinal items.

Model design, efficiency and nests

The choice experiment data was analysed in R using a nested logit model, with car nested against train and bus. A nested model allows for correlation between the two alternatives, bus and train. For instance, people's perception of delay, the number of changes, and

overcrowding might be similar for public modes of transport but different for car journeys. The model structure is shown in Figure 1.

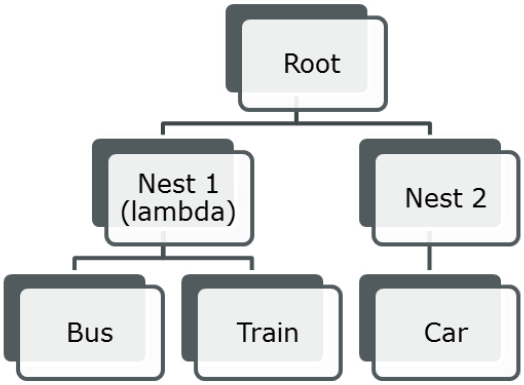


Figure 1: Structure of a nested model

Lambda (λ), estimated from attributes of bus and train, is known as the independent parameter; as the correlation between bus and train increases, λ decreases. If the model output shows λ is not significantly different from 1, then the model collapses into a multinomial logit model (MNL) and shows that the three modes of transport are independent from each other. If λ is significantly different from 1, then the model should be interpreted at the nest level, instead of the alternative (or mode) level. All the parameters in the model were estimated using simulated maximum likelihood estimation.

The Ngene software[9] has the capability to create surveys with either an orthogonal or efficient design. Efficient designs aim to minimize the standard errors of the parameter as opposed to orthogonal designs which minimize correlation of data. Due to their capability of producing efficient estimates when the sample sizes are small, an efficient design was used to design the survey in this study (Cascajo, Garcia-Martinex, & Monzon, 2017).

The analysis was completed separately for each of the mental health groups (anxiety, depression, both depression and anxiety, low scores) to allow comparison of the results.

3.2.1.3 Attitudinal questions

Attitudinal questions were included in the survey to cover the key themes from the focus groups and qualitative responses to the initial survey in order to a) gather further evidence on their importance, and b) allow comparison to be made to the results from the qualitative research.

The first section of attitudinal questions asked the participants to rate how much they agreed with a number of statements on how travel can impact mental health and emotions (see Appendix C for the full survey) e.g. “I don’t get anxious or stressed when there are multiple changes involved in my journey”.

Data from the focus groups suggested that people’s mental health may be affected differently by driving alone, with passengers they are close to, and with passengers they do

[9] http://choice-metrics.com/

not know well. A question was included in this section to understand the impacts on mental health and emotions these different driving situations have.

Feelings of loneliness and isolation were a key theme from the qualitative work (see Table 1). This was explored through the survey by asking participants to rate how lonely and isolated they felt when using the following types of transport: London Underground, train, bus, car, walking, pedal cycle. Feelings of safety were explored in the same way.

3.2.2 Piloting phase

A pilot survey was carried out to test the design structure and validity of the survey. Additionally, more accurate and precise priors[10] can be obtained from pilot studies which can improve the design of the final survey.

The pilot surveys were hosted on SmartSurvey and participants were a self-selected sample of TRL employees. Participation was voluntary, anonymous, and no incentives were offered for participation. The pilot surveys included an additional open question to gather general feedback on the survey design and presentation.

3.2.2.1 Pilot: Phase 1

Design, attributes and utility function

As described in Section 3.2, five attributes were included in the survey to answer the first two research questions (How does the importance of these factors vary across travel modes? How does the importance of these factors vary between groups of people with different scores on two mental health scales?) . The attributes and attribute levels used in this pilot phase are shown in Table 6.

Table 6: Attributes and attribute levels for survey design in Phase 1

Mode of transport	Attribute	Number of levels	Levels
Bus	Journey time	3	20 /30 /40 minutes
	Journey cost	3	£4/£6/£8
	Maximum potential delay time	3	0%/20%/40% of journey time
	Crowding	3	Not crowded/Somewhat crowded/ Crowded

[10] In statistics, a prior of an uncertain quantity is the probability distribution that would express a person's beliefs about this quantity, before any evidence has been gathered. It can be determined from past information or subjective assessment. For example, in the context of this choice experiment, we might expect that as the cost of the journey increases people are less likely to pick that option. This prior belief can be quantified as a negative coefficient for cost, which can be updated as we get more information about its magnitude of importance.

Mode of transport	Attribute	Number of levels	Levels
	Number of changes	2	0/1
Train	Journey time	3	20 /30 /40 minutes
	Journey cost	3	£4/£6/£8
	Maximum potential delay time	3	0%/20%/40% of journey time
	Crowding	3	Not crowded/Somewhat crowded/ Crowded
	Number of changes	2	0/1
Car	Journey time	3	20 /30 /40 minutes
	Journey cost	3	£4/£6/£8
	Maximum potential delay time	3	0%/20%/40% of journey time

Journey time and cost were treated as continuous variables; maximum potential delay time and crowding were treated as dummy variables[11]; and number of changes was treated as binary variable. As described in Section 3.2, maximum potential delay time was calculated relative to the journey time attribute[12]. Although this attribute was coded and interpreted as a percentage, it was presented as a time variable (in minutes) in the survey. The utility functions for the three alternatives were defined as follows:

$$U_{bus} = \beta_{bus\_asc} + \beta_{bustime} Journeytime + \beta_{buscost} Journeycost + \beta_{busdelay} Delay + \beta_{buscrowd} Crowd + \beta_{buschange} Changes$$

$$U_{train} = \beta_{train\_acs} + \beta_{traintime} Journeytime + \beta_{traincost} Journeycost + \beta_{traindelay} Delay + \beta_{traincrowd} Crowd + \beta_{trainchange} Changes$$

$$U_{car} = \beta_{cartime} Journeytime + \beta_{carcost} Journeycost + \beta_{cardelay} Delay$$

Based on total number of parameters being estimated and three alternatives, ten different questions (or choice scenarios) were generated in Ngene. As there are no previous studies utilising stated preference surveys to understand the relationship between mental health and transport, assumptions about the signs for the priors were based on the findings of the focus group and the assumption of rational behaviour. The priors for all the continuous

[11] In statistics, a dummy variable is one that takes the value of 0 or 1 indicating the absence or presence of a categorical variable that might have an impact on the response variable.

[12] For instance, a 40% delay would translate to an 8 minute delay if the journey time is 20 minutes; 12 minute delay for a journey time of 30 minutes; and 16 minute delay for a journey of 40 minutes.

variables were assumed to have a very small negative value (-0.001) i.e. as the time or cost of a journey increases, participants are less likely to pick this option; and the priors for dummy variables were also assumed to be slightly negative (-0.001) when the base levels were 'Not crowded' or '0 changes' or 'No delay' i.e. as crowding, number of changes or delay increases, participants are less likely to pick this option. Both the ASCs were assumed to be 0 (i.e. no preference for bus or train over car) as the sign for those could not be pre-estimated.

Results

Twenty-six participants completed the first pilot survey; 42% of whom were male. Seven participants had a high score at least one of the two mental health scales of interest (depression and anxiety).

Results from the nested model and the multinomial logit model showed some inconsistencies. Firstly, the standard errors for some parameters were either very large or not able to be estimated. This suggests that the model results were not that reliable.

Secondly, the direction of the parameter estimates (i.e. the direction of the relationship between the variable and the likelihood to choose that journey) weren't as expected and difficult to interpret. For instance, results suggested that as level of crowding increases, the likelihood of choosing that mode of transport increases, which contradicts the findings from the qualitative work in Section 2.

Thirdly, results from the qualitative data suggested that participants did not seem to distinguish between 'no crowding' and 'somewhat crowded' leading to unreliable results. These seem to suggest that the survey design was not as robust as expected and improvements could be made.

Results from the qualitative and choice experiment data also suggested that participants chose car as their preferred mode of transport when the bus or train options included crowding. This suggested they perceived car as 'not crowded'. However, the design did not include crowding as an attribute for car. In light of these pilot results, a second phase of piloting was recommended.

Recommendations for phase 2

Based on these results, a second pilot study was conducted with the following changes:

1. Based on the qualitative results, Crowding was changed from a three level dummy variable to a binary variable: 'Not crowded' and 'Crowded'.
2. Originally, maximum potential delay time was coded as a dummy variable. However, it is possible to interpret the data as a continuous variable with an odds ratio for every 1% increase in delay. This change simplified the structure of the model.
3. Crowding was coded as a constant 'no crowding' for all choice scenarios where car was the alternative. This simplified the design and allowed a single parameter to be estimated for Crowding across all modes of transport. However, this change reduces the granularity of the results and did not permit investigation of whether people perceive crowding differently between the three modes.

4. Similar changes were made to the Number of changes attribute: it was coded as a constant '0 changes' for all choice scenarios where car was the alternative. Therefore, a single parameter would be estimated for all modes.

3.2.2.2 Pilot: Phase 2

Due to the large number of changes made to the design of the choice experiment and the large standard errors, the parameter estimates for pilot 2 were the same as in pilot 1 and those obtained from the results of pilot 1 were not used.

Design, attributes and utility function

Based on the conclusions drawn from phase 1 of the pilot study, the attributes and attribute levels are shown in Table 7.

Table 7: Attributes and attribute levels for survey design in Phase 2

Mode of transport	Attribute	Number of levels	Levels
Bus	Journey time	3	20 /30 /40 minutes
	Journey cost	3	£4/£6/£8
	Maximum potential delay time	3	0%/20%/40% of journey time
Train	Journey time	3	20 /30 /40 minutes
	Journey cost	3	£4/£6/£8
	Maximum potential delay time	3	0%/20%/40% of journey time
Car	Journey time	3	20 /30 /40 minutes
	Journey cost	3	£4/£6/£8
	Maximum potential delay time	3	0%/20%/40% of journey time
	Crowding	2	Not crowded/ Crowded
	Number of changes	2	0/1

Journey time, journey cost and maximum potential delay time were coded as continuous variables; crowding and number of changes were coded as binary variables.

The utility functions were defined as follows:

$$U_{bus} = \beta_{bus_{asc}} + \beta_{bustime} Journeytime + \beta_{buscost} Journeycost + \beta_{busdelay} Delay + \beta_{crowd} Crowd + \beta_{change} Changes$$

$$U_{train} = \beta_{train\_acs} + \beta_{traintime} Journeytime + \beta_{traincost} Journeycost + \beta_{traindelay} Delay + \beta_{crowd} Crowd + \beta_{change} Changes$$

$$U_{car} = \beta_{cartime} Journeytime + \beta_{carcost} Journeycost + \beta_{cardelay} Delay + \beta_{crowd} Crowd + \beta_{change} Changes$$

Based on the number of parameter estimated and three alternatives, each respondent was presented with seven choice scenarios.

A multinomial logit model was used to analyse the data from this phase of the pilot study, as it is not as complex as a nested model. This has no impact on the design or analysis of the final survey, as the structure of the survey and resulting data remains unchanged.

Results

Twenty-five participants completed the second pilot survey; 56% of all participants were male. Six participants had a high score on either of the mental health scales.

The results from phase 2 of the pilot study can be seen in Table 8.

Table 8: Results from MNL model in phase 2

Mode of transport	Attribute	Coefficient	t value	Significance[13]
Bus	Asc	- 0.48	-0.05	Not significant ($p > 0.05$)
	Journey time	- 0.26	-1.53	Significant ($p < 0.05$)
	Journey cost	- 0.33	-0.11	Not significant ($p > 0.05$)
	Maximum potential delay time	-0.12	-1.05	Significant ($p < 0.05$)
Train	Asc	- 4.83	-0.30	Significant ($p < 0.05$)
	Journey time	- 0.04	-0.30	Not significant ($p > 0.05$)
	Journey cost	- 0.38	-0.97	Significant ($p < 0.05$)
	Maximum potential delay time	-0.06	-0.41	Significant ($p < 0.05$)
Car	Journey time	- 0.15	-0.29	Significant ($p < 0.05$)
	Journey cost	- 0.78	-0.46	Significant ($p < 0.05$)
	Maximum potential delay time	- 0.03	-0.26	Significant ($p < 0.05$)
	Number of changes	-0.70	-0.21	Significant ($p < 0.05$)
	Crowding	-2.61	-0.33	Significant ($p < 0.05$)

All of the parameters had the expected signs, showing that the direction of the relationship between the likelihood to choose the option and the attributes was as expected. For example the negative coefficients for journey time or delay time, indicate that as these variables increase the likelihood for choosing that mode of transport reduces. These results indicate that participants tend to prefer lower costs, lower likelihood of delay and shorter

[13] Based on two tailed t-value of 2.06 (for the two ASC coefficients) and one-tailed t-value of 1.71 (for the other attributes).

journey times on all three modes of transport; and they tend not to choose options with crowded trains or buses and a greater number of changes (both variables being statistically significant).

The negative coefficients for both ASCs suggest that participants tend to prefer car over public modes of transport. This preference is likely to be related to variables that are embedded in the mode of transport itself such as perceived level of control and safety.

Results from this pilot study suggested that the design was efficient and reliable.

3.2.3 Final survey design

The parameter estimates from phase 2 of the pilot study were implemented as the priors in the utility function for the final survey, and an efficient design with nine[14] choice scenarios was generated using Ngene. The main survey design remained unchanged (number of attributes, attribute levels and model design) compared to phase 2 of the pilot (see Table 7).

To identify an efficient stated preference survey design and associated target sample size, the choice experiment design software Ngene was used. Using the results from the second pilot phase, Ngene suggested a target sample size of at least 28 people for each of our participant groups. In order to achieve this sample size across all groups, a sample size of several hundred participants was required (in order to account for 16% of population who have reported having experienced symptoms of common mental health disorders). This sample size should also be sufficient for powerful statistical tests to be made on the data from the attitudinal questions.

3.2.4 Implementation

Six versions of the survey were created to pseudo-randomise the order in which the stated preference choice modes were presented to each participant (i.e. car, bus, train or bus, train, car). This was done to reduce the effect of the 'left hand bias', where participants are more likely to choose the left most option regardless of the attribute levels. Randomising the order in which the choice options were presented (between participants) meant this bias was randomly distributed across the results and hence impacted each mode ASC parameter equally.

The survey was hosted on SmartSurvey and opened to the public on 2nd May 2018 and closed on 22nd May 2018. The survey links were posted on social media using TRL's LinkedIn, Facebook, and Twitter accounts. The TRL participant database[15] was also used to as a recruitment tool.

[14] Results from phase 1 of the pilot study had 10 choice scenarios and participants showed no indication of boredom or fatigue due to the length of the survey. Based on this, nine, instead of seven, choice scenarios were used to extract more trade-off behaviour from the participants in the final survey.

[15] This is a database consisting of a list of people who have agreed to be contacted for any surveys conducted by TRL.

A prize draw was used to incentivise participation; 18 prizes between £10 and £100 worth of Amazon vouchers were available (survey completion was not required to take part in the prize draw and the draw was run in accordance with the MRS guidelines). Data for the prize draw was collected separately to the main survey to ensure that no personal data could be linked to the survey results, this was done by routing participants to a separate 'prize draw' survey which collected their names and email addresses.

R studio (statistics and data visualization software) was used to analyse the results.

3.3 Results

3.3.1 Sample

In total, 425 people responded to the survey; 215 identified as males and 209 as females (one participant chose not to provide a gender). A wide range of ages were represented in the sample as shown in Figure 2 with the majority of the sample being in the middle age groups (30-59 years).

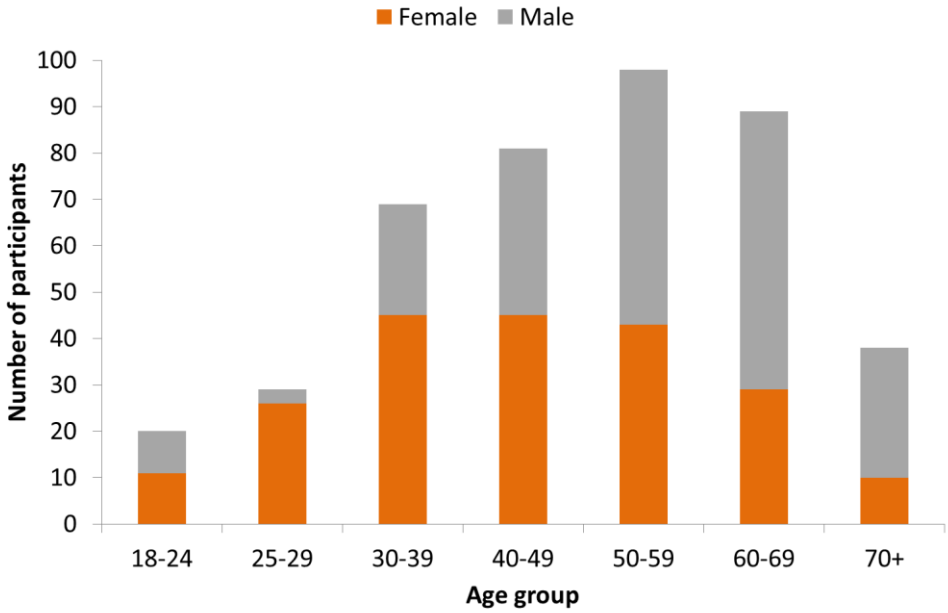


Figure 2: Sample age and gender

Half of the participants were fully employed (50%), 22% retired, and 21% in part time employment. The remaining 6% were either not able to work, full time students, or not employed. Five-percent reported having a disability (see survey in Appendix C for the list of disabilities included).

The survey times were checked to ensure only surveys completed within a reasonable time (and hence likely to provide valid data) were included, by calculating 30% of the median time spent completing the survey. No responses had to be removed from the sample as a result of these checks.

3.3.2 *Mental health scales*

In total, 20% of the sample scored above the grouping criteria on one or both of the mental health scales. Of these, 7% had a score above seven on the GAD-7 scale only, 3% had a score above nine on the PHQ-9 scale only, and 10% scored highly on both scales. The remaining 80% scored below the grouping criterion values on both scales.

Table 9: Mental health scores sample groupings

Group	Total	%
Both	44	10%
Anxiety	28	7%
Depression	13	3%
Neither	340	80%

As discussed in Section 1, around one-in-six people in the UK report suffering from symptoms of a CMD in the last week (McManus *et. al.,* 2016). Within our sample, one-in-five people reported suffering symptoms of anxiety and/or depression in the last week. This is a slightly higher fraction than expected within a representative sample, especially given that the survey was limited to anxiety and depression. However, these difficulties are thought to be the most prominent worldwide and it was expected that the survey would be of interest to people with experience of mental health difficulties.

3.3.3 *Travel mode choices – Choice experiment results (RQ1&2)*

This section presents the findings of the stated preference survey looking into the impact of various factors on travel mode choice, across the four mental health groups. The data was first analysed using a statistical technique known as nested logit (NL) modelling to estimate the relative weightings (or importance) the participants gave to each attribute. The result for independence parameter or λ, estimated from the attributes of bus and train, was not significantly different to 1 ($p > 0.05$). This implies that the model can be collapsed into a multinomial logit (MNL) model with the three modes of transport independent of each other. Therefore, MNL models were run separately for each of the four groups to allow comparison of the results. The results for each group are presented below.

On examination of the open questions asking participants to explain their choices, one participant was excluded as it was apparent they did not understand the overarching choice scenario.

Due to small sample size for participants in the Depression group (N=13), results from the MNL model may not be robust and should be interpreted with caution. Hence, only results for the other three groups are presented here and results for Depression can be seen in Appendix D.

3.3.3.1 Low scores

Table 10 presents the results from this model for participants with low scores on both mental health scales, i.e. those who did not report suffering from symptoms of anxiety or depression in the last two weeks (N=340). The table presents the coefficient (parameter estimate) for each attribute, along with a significance value showing whether the coefficient is significantly different from zero; where this is the case it implies that the attribute is an important factor in the participants' decision-making process between the three modes of transport.

Table 10: Results from the final MNL model for group with low scores (i.e. neither anxiety nor depression)

Mode of transport	Attribute	Coefficient	t value	Significance[16]
Bus	ASC	-0.76	-2.44	Significant ($p < 0.05$)
	Journey time	-0.10	-9.03	Significant (p < 0.05)
	Journey cost	-0.18	-5.20	Significant (p < 0.05)
	Maximum potential delay time	0.00	-1.06	Not significant (p > 0.05)
Train	ASC	0.14	0.35	Not significant (p > 0.05)
	Journey time	-0.07	-10.54	Significant (p < 0.05)
	Journey cost	-0.35	-9.73	Significant (p < 0.05)
	Maximum potential delay time	-0.02	-6.38	Significant (p > 0.05)
Car	Journey time	-0.07	-9.96	Significant ($p < 0.05$)
	Journey cost	-0.19	-4.76	Significant ($p > 0.05$)
	Maximum potential delay time	-0.02	-7.22	Significant ($p < 0.05$)
	Number of changes	-0.78	-9.13	Significant (p > 0.05)
	Crowding	-0.64	-6.44	Significant (p > 0.05)

A significant negative ASC was found to be associated with the bus alternative, implying there was a significant bias towards car over bus above the attributes included in the model. In other words, if all five attributes were constant across each mode of transport, participants would tend to choose car significantly more often than bus. The ASC results for train show that there was no significant bias between train and car above the attributes included in the model.

Aside from maximum potential delay time for bus, all attributes were statistically significant and therefore, can be considered important factors in the participants' decision-making process. The coefficients for all attributes are negative and consistent with our priori

[16] Based on two-tailed t-value of 1.96 (for the ASC coefficients) and one-tailed t-value of 1.64 (for all other attributes).

assumptions; indicating that as the attribute for a mode increases by 1 unit (e.g. the cost of the journey by bus increases by £1), the likelihood of that mode being chosen decreases (by exp(-0.18)=0.83 or 16%[17]). Additionally, the coefficient estimates for level of crowding and number of changes show a negative effect on travel mode choice, suggesting participants are less likely to choose a mode of transport if it is crowded or has multiple changes. In other terms, assuming all other attributes to remain constant, if the level of crowding changes for a mode from 'not crowded' to 'crowded', the likelihood of a participant choosing that mode of transport reduces by a factor of exp(-0.64)= 0.52 or 48%.

Overall, journey time and number of changes had the highest t-values[18], indicating that these attributes had a strong effect when deciding between mode of transport. Instances of this can be seen in the qualitative results where some participants did not mind a crowded mode if the journey time was short.

Comparing the magnitude of the coefficients, the cost coefficient for a train journey is around 80% higher than bus and car journeys (which have similar coefficients) suggesting that participants in this group give more importance to costs for a train journey than a bus or car journey. Similarly, the time coefficient for a bus journey is around 40% more important to participants than time for train or car. The importance given to maximum potential delay time was the same for train and car.

3.3.3.2 Anxiety

Table 11 shows the results from a MNL model for participants with high scores on the mental health scale for anxiety, i.e. those who suffer from symptoms of anxiety but not depression (N=28). The table presents the coefficient (parameter estimate) for each attribute, along with a significance value showing whether the coefficient is significantly different from zero.

Table 11: Results from the MNL model for high anxiety scores

Mode of transport	Attribute	Coefficient	t value	Significance[19]
Bus	ASC	-1.72	-1.35	Not significant ($p > 0.05$)
	Journey time	-0.24	-2.10	Significant ($p < 0.05$)
	Journey cost	-0.44	-2.43	Significant ($p < 0.05$)
	Maximum potential delay time	-0.08	-1.59	Significant ($p < 0.05$)

[17] The rate of change in a logit model can be calculated by rate= exp(estimate). If the rate is greater than one (say 1.05) then response variables increases by 5% and if the rate is less than one (say, 0.85), then the response variables reduces by 15% for a unit change in the attribute.

[18] When comparing between attributes which are measured using different units (e.g. time in minutes and cost in £s), it is necessary to consider the magnitude of the t-value and not just the coefficient, since this converts results into a t-distribution which is then comparable across attributes.

[19] Based on two-tailed t-value of 2.04 (for the ASC coefficients) and one-tailed t-value of 1.70 (for all other attributes).

Train	ASC	-4.03	-1.40	Significant (p < 0.05)
	Journey time	-0.13	-2.75	Significant (p < 0.05)
	Journey cost	-0.47	-2.78	Significant (p < 0.05)
	Maximum potential delay time	-0.07	-1.92	Significant (p < 0.05)
Car	Journey time	-0.21	-2.72	Significant (p < 0.05)
	Journey cost	-0.74	-1.86	Significant (p < 0.05)
	Maximum potential delay time	-0.02	-1.09	Not significant (p > 0.05)
	Number of changes	-1.91	-3.08	Significant (p < 0.05)
	Crowding	-2.70	-2.30	Significant (p < 0.05)

Model results for this group show a significant negative ASC coefficient for train whereas the ASC coefficient for bus is not significant. This suggests there were a significant bias towards car over trains, and no significant bias between bus and car.

Apart from maximum potential delay time for the car, the analysis revealed statistically significant effects for all the attributes. This suggests that participants with anxiety do not attribute much importance to potential delays in car journeys; however, delays by train or bus (which are both significant) are similarly important (based on the size of the coefficients).

Similarly to model results for the group with low scores (Table 10), all the coefficients are negative indicating that as the attribute levels for a mode increase, the probability of choosing that mode of transport decreases. Interestingly, the estimates and t-values for level of crowding and number of changes show a strong negative effect on the utility functions for mode choice.

Both the cost and time coefficients for a car journey are around 60% higher than bus and train journeys, suggesting that participants tend to give more importance to these attributes for car journeys than bus or train journeys. A potential reason for this might be that participants are not willing to pay more for a car journey beyond additional maintenance costs or taxes. As shown in the qualitative results (Section 3.3.3.5), some participants were anxious about costs and tend to go for the cheapest option. Similarly, when navigating through a new route, some participants were less likely to drive if the journey is long and tend to opt for public transport.

3.3.3.3 Both depression and anxiety

The results of the MNL model for participants with high scores on both mental health scales (N=44) are presented in Table 12.

Table 12: Full MNL results for group with high anxiety and depression scores

Mode of transport	Attribute	Coefficient	t value	Significance[20]
Bus	ASC	-0.01	-0.01	Not significant ($p > 0.05$)
	Journey time	-0.55	-2.19	Significant ($p < 0.05$)
	Journey cost	-0.52	-1.35	Significant ($p < 0.05$)
	Maximum potential delay time	-0.12	-1.18	Significant ($p < 0.05$)
Train	ASC	-6.71	-1.15	Significant ($p < 0.05$)
	Journey time	-0.16	-2.54	Significant ($p < 0.05$)
	Journey cost	-0.72	-2.87	Significant ($p < 0.05$)
	Maximum potential delay time	-0.14	-1.86	Significant ($p < 0.05$)
Car	Journey time	-0.24	-1.45	Significant ($p < 0.05$)
	Journey cost	-1.34	-1.74	Significant ($p < 0.05$)
	Maximum potential delay time	-0.08	-1.64	Significant ($p < 0.05$)
	Number of changes	-1.77	-2.43	Significant ($p < 0.05$)
	Crowding	-2.45	-1.21	Significant ($p < 0.05$)

Similar to the results in the anxiety group (Table 11), the ASC coefficient for train is statistically significant and ASC coefficient for bus is not significant, suggesting that those in this group have a bias towards car travel over use of a train.

All other attributes are significant and have negative coefficients, implying the likelihood to choose a mode of transport decreases as the attribute levels for that mode increases. In this group, maximum potential delay time for all three alternatives is statistically significant indicating that participants were deemed this to be an important attribute across all three modes of transport.

As shown by the magnitude of the coefficient and t-values, participants gave most importance to the level of crowding and number of changes when choosing a mode of transport. Comparing the coefficients across modes shows that participants gave more importance to cost for a car journey than train or bus, suggesting that they are less willing to pay more for the journey when made by car than by public transport.

3.3.3.4 Comparison across the three mental health groups

Due to small sample sizes in the group of participants with depression, it was only possible to compare the model results from the other three groups.

[20] Based on two-tailed t-value of 2.01 (for the two ASC coefficients) and one-tailed t-value of 1.68 (for all other attributes).

The results from the models have highlighted a number of differences between the typical mode choice of the three mental health groups. The results from the three models are only comparable in the form of ratio of coefficients, and not as absolute values or differences between two coefficients. For instance, the relative importance of journey time by car for participants with anxiety compared to those with neither anxiety nor depression is calculated as the ratio of the beta coefficients of the two groups[21]. Therefore, participants with anxiety tend to give journey time 3 more importance than those suffering from neither.

When comparing the bias towards public transport compared to cars, it is interesting to see that participants with anxiety, or both depression and anxiety, tend to have a stronger bias towards cars over trains than those with low scores on both these mental health scales, where the bias towards car over train was not significant. In fact, participants with low scores showed a bias towards cars over buses, which was not significant for the other two groups.

In general, all mental health groups value journey time and cost similarly, i.e. the higher the cost or greater the journey time, the chances of choosing that mode of transport reduces. The main differences arise in the level of crowding and number of changes. Participants with anxiety gave 2.44 times more importance to number of changes than those in the low scores group; and participants with both anxiety and depression gave 2.26 times more importance to number of changes than those with low scores.

Participants with anxiety do not attribute much importance to potential delays in car journeys compared to those with low scores. A possible reason for this could be that participants with anxiety feel more comfortable in cars and are not affected by delay. An instance of this is shown in qualitative results (Section 3.3.3.5).

3.3.3.5 Qualitative results

After each choice scenario, the participants were asked to briefly describe why they made the choice. In most cases the participants reasoning reflected the attributes provided (cost, time, delay, crowding, and changes). However, these open questions provide insight into the biases people have towards the different modes as well as insight into people's perceptions of crowding and making changes.

Participants linked crowding to a lack of seat availability, lack of comfort, and heightened anxiety. Some mentioned the bus and train were "open environments" which could cause them to feel self-conscious. Although, most people said they would not mind busy transport for short journeys.

> *"… no crowds or delays forecasted, one of the cheapest and all these factors outweigh the fact that it will take ten minutes longer."* (Anxiety and depression)
>
> *"… crowded buses puts me off!"*(Anxiety only)

Changes were associated with additional effort and stress. Some participants said a longer journey (potentially delayed) was preferable to one with changes. Some participants linked

[21] In this case it will be -0.21/-0.07 =3

this cause of stress to a lack of trust in the service. Luggage was also mentioned as a consideration when thinking about whether to choose an option with a change.

> *"… changes on trains make me anxious"(*Depression only)
>
> *"Struggle getting in and off public transport, esp. if carrying a bag"* (Neither)

Biases towards the car appear to be related to having a familiar and personal space, as well as an assured comfortable seat. People mentioned the car being 'less effort' and providing a single transport system to get from door to door. The car was also perceived as providing more control and freedom compared to the other modes where the route and stopping points are pre-defined. Some participants were biased towards a car as being a car owner the feel they should use it as their primary mode of transport, whilst other said they use a car because they enjoy driving. Other reasons for choosing the car included not being tied to a timetable and for travel sickness reasons.

> "*The possible delay doesn't worry me when I am in the comfort of my own car*" (Neither)
>
> "*I like to drive sometimes. Plus it's obviously not crowded in a car solo*."(Anxiety and depression)

However, people also discussed why they didn't choose the car option. Some participants mentioned driving alone could make them stressed or anxious especially when navigating a new route. Stress related to locating parking was also mentioned as well as the environmental impact or cars (although some people mentioned owning electric vehicles and saw their car to be the most environmental option).

> "*I get very anxious driving to places I have not been to before. I would opt for a train so I didn't freak out if I was unsure of the directions… I would feel anxious for driving 40 minutes by myself. If there was an adult passenger that also held a license I would be more relaxed, however if I was on my own or with a child I would not like to do a 40 minute drive by myself."*(Anxiety and depression)
>
> *"Whilst car is similar. You have the hassle of driving yourself and potential parking. I think the stress of driving would be higher than the bus." (*Anxiety only)
>
> *"..don't have to worry about navigation and parking"* (Depression only)

Specific comments around trains tended to be related to train journeys being "pleasant". This was often linked to generally steady speeds and "smooth ride". Relinquishing control of the vehicle was also seen a positive by some as it meant they could use their time relaxing or doing other activities such as work or reading.

> *"Relaxing and straightforward"* (Neither)
>
> *"…means you can sit and read a book, or something else that can't be done d riving."(*Neither)

Comments by participants on why they chose the bus options were similar to train in relation to having time to do other activities whilst traveling. Others said they prefer the bus for environmental reasons.

> *"I would relax with my MP3 player"* (Neither)

"Best environmental impact for a reasonable journey time." (Neither)

However, others felt the bus could be, unpleasant, unreliable and have inconvenient timetabling, as well as it being difficult to know when to get off.

"It's hard sometimes to figure out the correct bus stop to get off at." (Neither)

"Public transport is unreliable."(Anxiety and depression)

Some people mentioned that they worry or feel anxiety about money and hence chose the cheapest options.

"I tend to worry more about saving money, and tend to take the train where I can, as well as minimising travel time." (Anxiety only)

Familiarity also played a part in peoples choices. Some participants mentioned that they generally tend not to use the bus and are unfamiliar with the system and hence wouldn't be likely to choose it.

"Buses are stressful because it's hard to know what the route is." (Neither)

"Not likely to get bus due to unfamiliarity" (Neither)

Some responses mentioned that they could use their senior card to get discounted/free travel which could have influenced their choices towards the bus and train options and would also mean that their 'recalculated' cost is different to what was entered into the stated preference model. This may have impacted the results of the choice experiment although given the size of the sample, the effects are considered to be minimal.

3.3.4 Mental health and transport (RQ3)

Participants were asked to what extent they agreed or disagreed with a set of statements on transport can impact on mental health. These statements were drawn from the findings of the earlier survey as well as the focus group:

- I find other people's behaviour on public transport distressing
- I find other people's driving behaviour distressing
- I avoid travelling on public transport as I may be re-routed
- I enjoy driving because I have my own space
- I don't mind travelling when there are lots of other people using the same transport system
- As a driver I don't get stressed or anxious when I get diverted
- I don't get anxious or stressed when there are multiple changes involved in my journey

An exploratory factor analysis using principal components analysis as the extraction method was conducted on this set of survey items. Factor analysis is a data reduction technique which is used to reduce large numbers of related variables into a smaller set of unobserved variables called factors, which reflects most of the variability contained within the original variables. In other terms, it can be used to reduce a large number of items collected on the

same scale to a smaller number of coherent subscales for analysis. The factors are sometimes given a particular name and interpreted as representing underlying variables.

A three factor solution was identified, explaining 63.4% of the total variability for the full set of survey items and met all of the data assumptions (KMO >.5; Bartlett's Test of Sphericity p<.001). These three factors are shown in Table 13.

Table 13: Factor loadings[22]

	Factor		
	1	2	3
I enjoy driving because I have my own space	.701		
I avoid travelling on public transport as I may be re-routed	.674		
I don't mind travelling when there are lots of other people using the same transport system	-.576		
As a driver I don't get stressed or anxious when I get diverted		.807	
I don't get anxious or stressed when there are multiple changes involved in my journey	-.461	.689	
I find other people's driving behaviour distressing			.864
I find other people's behaviour on public transport distressing	.461		.707

Rotation Method: Varimax with Kaiser Normalization.

Factor loading <.4 have been supressed

Factor 1 is potentially the most difficult to interpret as it draws from the majority of the scale items. However, all items that load onto this factor are related to shared/public transport. This suggests that this factor can be interpreted as the level of general anxiety or stress related to using public transport. Looking at the items most strongly loading onto this factor suggests crowding is a big part of this.

Factor 2 can be understood as the level of stress or anxiety caused by additional travel activities such as being diverted or making changes.

Factor 3 related less to transport and more to 'other people' and can be explained as the factor that measures peoples' intolerance of other peoples' behaviour, either in driving or when using public transport.

Each factor was tested for reliability using Cronbach's alpha. Cronbach's alpha is a measure of internal consistency ("reliability"), i.e. the extent to which all the items in a test measure the same concept or construct. In this case it was used to determine whether the survey items in each factor all reliably measure the same latent variable. Cronbach's alpha is a value between 0 and 1 where values of >0.6 are generally taken to indicate an acceptable level of consistency.

For factor 1, Cronbach's alpha value was acceptable (.602[23]) and was not improved by removing any of the survey items. For Factor 2, the alpha value (.705) was acceptable (as only two items strongly loaded onto this factor it cannot be checked if the score improves

[22] Small factor loadings (<.3) have been supressed in this table.

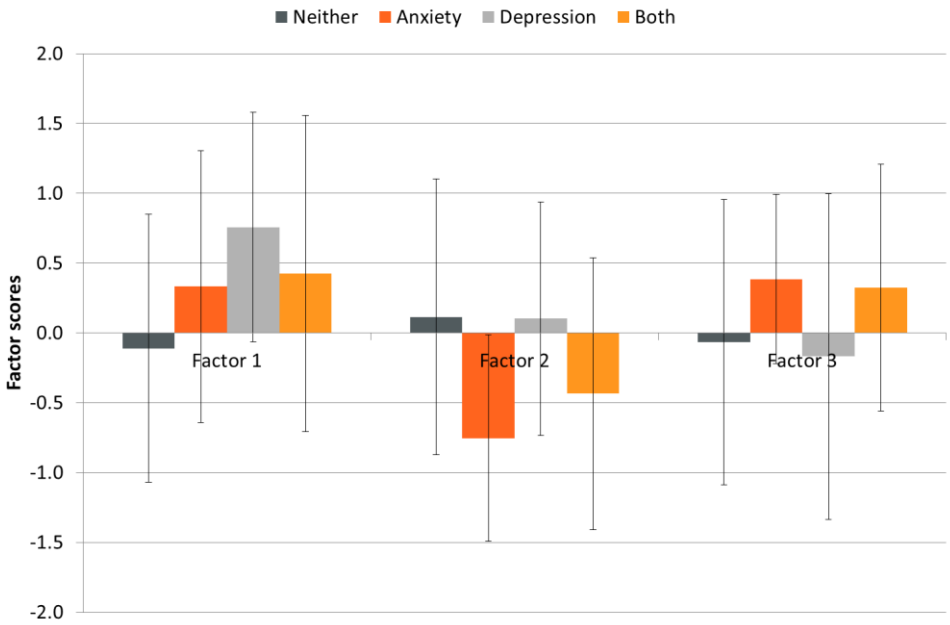
[23] This alpha value is acceptable for a scales with less than 10 items loaded.

when removing each item). For factor 3, Cronbach's alpha was only .50 meaning that the level of internal consistency is questionable.

Factors 1 and 2 are not significantly different to the normal distribution and can therefore be treated as normally distributed continuous variables. Factor 3 is not normally distributed; therefore non-parametric tests have been used for this variable as these tests make fewer assumptions about the variable distribution.

One-way ANOVAs were used to compare whether the mean score of Factor 1 and Factor 2 differs significantly between the groups. It tests whether the mean score for each of the groups differs and whether this is unlikely to have occurred by chance. Additional tests (post-hoc tests) are required to identify where the significant differences lie. For both factors, Leven's test for homogeneity of variance was not significant (p>.05), and as there are different numbers of participants in each groups, the Hochberg's statistic was used for the post-hoc tests. One-way ANOVAs were used to compare whether the mean score of Factor 1 and Factor 2 differs significantly between the groups. It tests whether the mean score for each of the groups differs and whether this is unlikely to have occurred by chance. Additional tests (post-hoc tests) are required to identify where the significant differences lie. For both factors, Leven's test for homogeneity of variance[24] was not significant (p>.05), and as there are different numbers of participants in each groups, the Hochberg's statistic[25] was used for the post-hoc tests.

The three factors have been presented in **Figure 3**.



[24] Levene's test is used to examine if the variance across all comparison groups are homogenous. This is an assumption of ANOVA and a violation of this assumption would lead to an over or under-estimation of the F statistics and thus, significance level.

[25] Hochberg's statistic is a powerful method that adjusts the p-value to control for significant results that are actually false positives.

Figure 3: Factor scores for the four mental health groups

A higher factor score on factor 1 represents someone who is more likely to enjoy their space and avoid re-routing or other people's behaviour on public transports. A higher factor score on factor 2 represents someone who does not get anxious or stressed due to additional travel activities such as diversions or multiple changes in their journey. A higher factor score on factor 3 represents someone who is more likely to find other people's driving or behaviour on public transport more distressing.

For Factor 1, a significant difference between the groups was found ($F(3,421)=7.93$, $p<.001$). On examining the post-hoc results, the 'low scores' group (i.e. those with neither high levels of depression nor anxiety had significantly) had lower scores than the group who had depression ($p=.01$) and the group who had both depression and anxiety ($p=.004$). This suggests that general anxiety and stress around public transport is higher for people suffering from depression than those who do not.

For Factor 2, a significant difference between the groups was found ($F(3,421)=10.27$, $p<.001$). The post-hoc tests found similar results to Factor 1: the only significant differences between groups were those between of the group with depression and those without (regardless of anxiety). The group with low scores had significantly higher scores on this factor than those with depression ($p<.001$) and those with both anxiety and depression ($p=.003$). Due to the direction of this factor, the results can be interpreted as participants with depression (regardless of anxiety) report experiencing higher levels of stress and anxiety around additional journey activities such as driving diversion routes or making changes.

As Factor 3 was not normally distributed, a Kruskal-Wallis test was used to explore the between group differences. This also found a significant difference ($H(3)=11.96$, $p=.008$). However, the post-hoc tests did not identify any between group differences that were significant[26].

3.3.5 Driving with passengers

The following survey question was a two item question asking the participants to rate how anxious they feel driving a) passengers they are close to, and b) passengers they don't know very well compared to driving alone[27].

Figure 4 shows the distribution of their rating on how anxious they feel driving with passengers they are close to compared to driving alone.

[26] Mann-Whitney tests were used with the critical p-value adjusted using the Bonferroni correction to take into account multiple comparisons (this changes the critical p value from .05, standard common standard for behavioural research, to .009 as six comparisons were made).

[27] Ten people in total reported not traveling with one or both passenger types. These were excluded from this analysis.

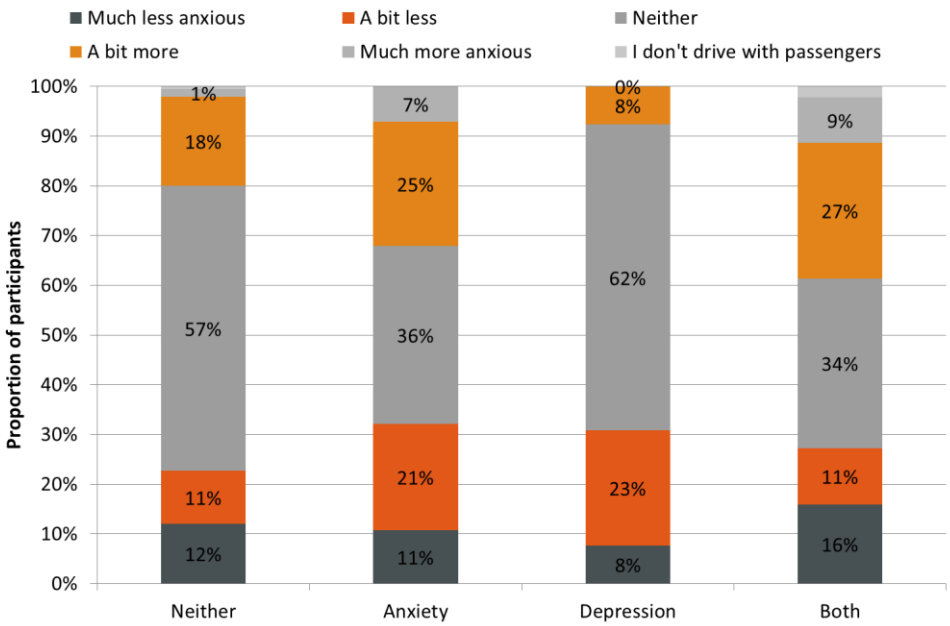


Figure 4: Distribution of responses for each mental health group

A higher proportion of participants with anxiety and both (anxiety and depression) felt 'a bit more' anxious compared to the other two groups. Around 62% of the participants with depression said they were not really affected.

This variable was not normally distributed and so a non-parametric test (Kruskal-Wallis) was used to test the differences between the groups. No significant difference was identified ($p>.05$) suggesting that mental health (specifically anxiety and or depression) is unlikely to influence weather people feel anxious when driving with passengers compared with driving alone when driving with passengers they are close to.

Figure 5 shows the distribution of their rating on how anxious they feel driving with passengers they don't know well compared to driving alone.

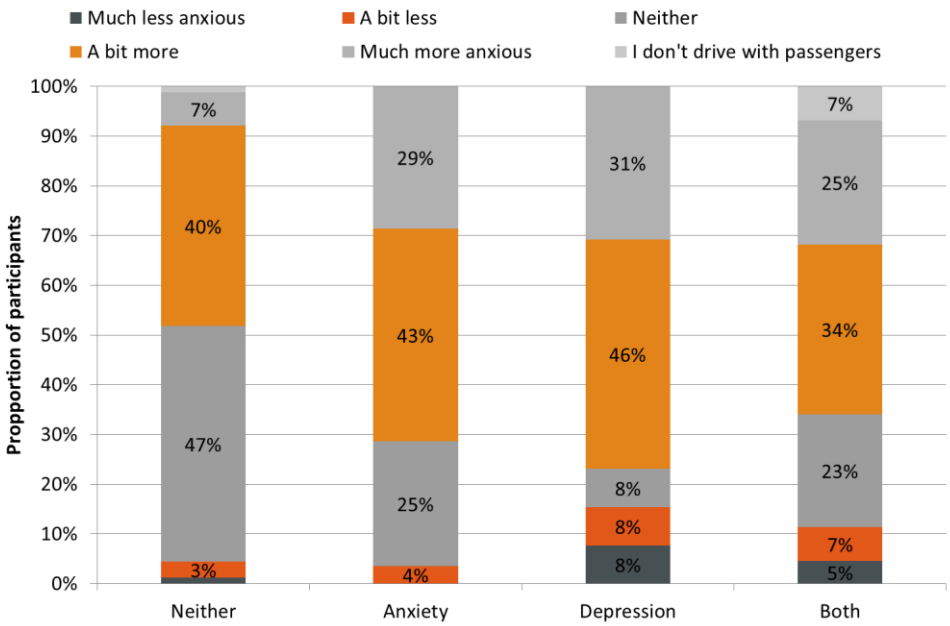


Figure 5: Distribution of responses across four mental health groups

A higher proportion of participants with anxiety, depression or both (29%, 31% and 35%, respectively) said they were 'much more anxious' compared to the low group. A greater proportion of participants with anxiety or depression said they were 'a bit more' anxious compared to those with neither or both (anxiety and depression).

The ratings were not normally distributed (consists of ordinal ranks) and therefore, a non-parametric test (Kruskal-Wallis) was used to test for changes in participants' feeling of anxiety when driving with passengers they don't know very well across the four mental health groups. Results showed significant differences in scores across the four groups ($p=0.001$). Post hoc analysis (adjusted for Bonferroni correction) showed that the there was a significant different in participants' scores between those with anxiety and those with low scores on both scales ($p=0.046$) and none of the other pairwise comparisons were significant. This suggests that participants with anxiety (regardless of depression) report experiencing higher levels of anxiety when driving with passengers they don't know very well compared with driving alone.

3.3.6 Loneliness and isolation when traveling

The next survey question asked the following:

> "If you were travelling alone, how lonely and isolated (if at all) would you feel using the following types of transport?"

The types of transport included where car, bus, train, tube, walking, and pedal cycle.

A factor analysis was completed on this set of survey items as it was hypothesised that feelings of loneliness and isolation would be comparable across different modes (with potentially different responses to 'lone travelling' and using public transport. This was the case with a single factor being identified (meeting all of the required data assumptions and having a good Cronbach's alpha of 0.85). This factor can be interpreted as the general level

of loneliness and isolation felt when traveling. Interestingly, 'car' loaded onto this factor the least (as seen in Table 14) and in general, people felt the least lonely in the car.

Table 14: Loneliness and isolation items factor loadings

	Factor 1
Bus	.897
Train	.888
Tube	.859
Walking	.767
Pedal cycle	.662
Car	.399

The average scores, along with the error bars[28], for the factor 1 are presented in **Figure 6**.

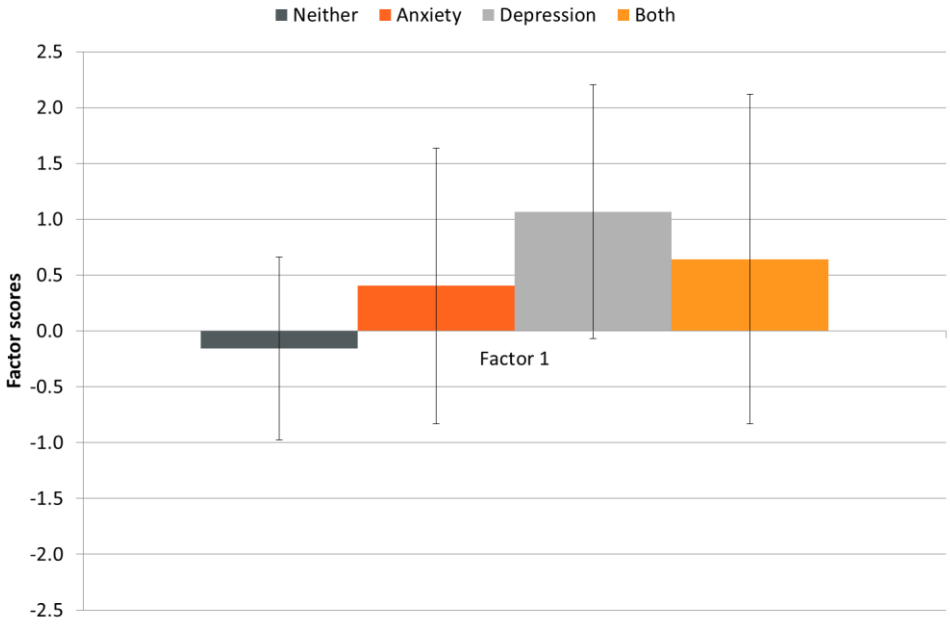


Figure 6: Factor scores for all four mental health groups

A higher factor score would represent someone who is more likely to feel lonely when travelling alone. Therefore, on average, those with depression tended to feel lonelier when travelling alone compared to those with neither.

This 'loneliness factor' was not normally distributed so a Kruskal-Wallis test was used to look at the differences between the groups. This identified a significant difference between the groups ($H(3)=32.24$, $p<.001$). In general, people with depression reported feeling higher levels of loneliness and isolation across all transport modes. This result found was to a lesser

[28] The error bars show the standard deviation of the factor scores.

extent for cars than other modes. However, the post hoc tests (Mann-Whitney using the Bonferroni adjustment) did not find any significant differences.

3.3.7 Feelings of safety when traveling

Participants were also asked a similar question around feelings of safety for the same transport types. The factor analysis on these items again identified a single factor as shown in Table 15 (meeting all of the required data assumptions and having a good Cronbach's alpha of .81).

Table 15: Feelings of safety items factor loadings

	Factor 1
Bus	.871
Train	.861
Tube	.841
Walking	.730
Pedal cycle	.534
Car	.430

The average, along with error bars, for the factor 1 are presented in **Figure 7**.

Figure 7: Factor scores for all four mental health groups

A higher factor score represents someone who is more likely to feel safe when travelling alone. Apart from participants who had neither anxiety nor depression, on average, all three groups felt less safe when travelling alone.

There were significant differences between the groups (Mann-Whitney tests with a Bonferroni adjustment). The group with low scores on both mental health scales (i.e.

neither depression nor anxiety) had significantly higher feelings of safety than the group with anxiety (p=0.003) and the group with both anxiety and depression(p=0.0001). These results suggest that feelings of safety are more strongly linked with anxiety symptoms than depression and that people suffering from anxiety (regardless of depression) tend to feel less safe when traveling.

3.3.8 Summary

- Overall, there was no significant correlation between the train and bus choices i.e. if the train option was no-longer available, those who chose train there would be equally likely to move to the bus or car options. This resulted in a simpler choice model structure (a multinomial logit model was applied, rather than the nested logit model).

Research Question 1: How does the importance of these factors vary across travel modes?

- Participants in the group with low scores on both scales gave more importance to costs for a train journey than a bus or car journey. Time for a bus journey is more important to these participants than time for train or car. The importance given to maximum potential delay time was the same for train and car.
- Participants with anxiety tended to give more importance to time and cost coefficients for car journeys than bus or train journeys.
- Participants with both (anxiety and depression) gave more importance to cost for a car journey than train or bus, suggesting that they are less willing to pay more for the journey when made by car than by public transport.
- The group with low scores on both the anxiety and depression scales were biased towards the car over the bus.
- All groups with high levels of anxiety and/or depression significantly preferred the car over the train.
- Number of changes and crowding were significant and negative for all the groups, suggesting these attributes had a strong negative effect when deciding between modes of transport.

Research Question 2: How does the importance of these factors vary between groups of people with different scores on two mental health scales?

- The journey factors cost, journey time, wait time, maximum delay, crowding, and changes were all more important to people with high levels of anxiety or depression than people without for all transport modes.
- **Table 16** summarises the key findings for each of the three groups.

Table 16: Key findings by group

Anxiety	Depression	Both
• Feel less safe traveling	• Feel more lonely and isolated when traveling • More anxious and stressed about public transport in general • Higher stress and anxiety around additional journey activities	• Feel less safe traveling • More anxious and stressed about public transport in general • Higher stress and anxiety around additional journey activities

Research Question 3: How do people perceive the impacts of different transport modes on their mental health and wellbeing?

- Feelings of loneliness and isolation are comparable across transport modes although people tend to feel less lonely and isolated traveling by car.
- Participants with low scores on both mental health scales (i.e. neither depression nor anxiety) had significantly higher feelings of safety than the group with anxiety and the group with both anxiety and depression.
- Participants with anxiety report experiencing higher levels of anxiety when driving with passengers they don't know very well compared with driving alone, as opposed to participants from the other groups.

4 Discussion

Our research has highlighted a number of important findings. Comparison of the model coefficients and t-values, which give a measure of the relative importance of the different attributes, showed that participants with anxiety do not consider potential delays in car journeys as particularly important; however, delays by train or bus (which are both significant) were similarly important. This result is interesting as it suggests delays in public modes of transport have a greater impact on mental health than private mode of transport. In addition, participants with high anxiety tend to give greater importance to crowding and the number of changes when choosing between modes. These findings support those from the qualitative research which show that individuals with anxiety value greater control over their journey, like the feeling of comfort when travelling by car and said that overcrowding has a negative impact on their mental health.

The results from the models have highlighted a number of differences between the typical mode choices of the three mental health groups. Participants with anxiety, or both depression and anxiety, tend to have a stronger bias towards cars over trains than those with low scores on both these mental health scales. In fact, participants with low scores showed a bias towards cars over buses. This shows that all three groups would choose cars significantly more often than public modes of transport; this may be related to journey attributes such as familiarity, control, and personal space that are inherent to traveling by car (support by the qualitative responses in Section 3.3.3.5).

In general, all mental health groups value journey time and cost similarly, i.e. the higher the cost or greater the journey time, the chances of choosing that mode of transport reduces. The main differences arise in the level of crowding and number of changes. This is particularly the case for participants with anxiety, or both anxiety and depression, who gave more importance to these attributes when choosing a mode compared to those with low scores on both the anxiety and depression scales. These results align with the results from the qualitative research where participants suggested that an overcrowded mode or multiple connections could have an adverse impact on their mental health.

An interesting finding from the survey was that people reported feeling less lonely in a car. This supports findings from the focus group, where those who had experienced anxiety and/or depression often found driving alone a relaxing mode of transport. Participants reported that it could provide a welcome distraction from life stressors, and opportunity to spend time alone. In addition, the control provided through personal car use often meant that drivers could relax and take the time to reflect on their own thoughts.

However, there are a number of limitations that need to be taken into consideration when drawing conclusions from this work.

Firstly, choice experiments assume that people make rational choices when making decisions in the real world. The survey was designed to replicate this rational decision making process as far as possible. However, while many may believe that their choices are always made in a rational and well deliberated, this is generally not the case. As many behavioural and cognitive models have demonstrated, there are two main mental mechanisms behind behaviour: automatic and deliberate (Orbell & Verplanken, 2010; 2015).

Deliberate processing refers to the more rational method of decision, which requires individuals to have the cognitive capacity and motivation to make a decision. Habits on the other hand are one of the types of automatic processing, which can often override deliberate processing (Bargh, 1997). Therefore it is important to remember when interpreting findings from stated preference surveys that they are generalisable to choices in the real-world only to the extent that individuals' decisions result from deliberation rather than automaticity.

In addition, while choice experiments can, to some extent, account for the role of habit in the decision making process (through the Alternative Specific Constants, or ASCs, estimated by the model), they cannot account for it entirely. For some people (especially those who only ever use one travel mode), habit may still have been an influencer. For example, if someone only ever drives, their inherent bias towards cars may still completely outweigh all of the attributes presented (e.g. time, cost etc.).

In order to conduct a choice experiment it is necessary to specify a particular context or scenario. For this research the questions were limited to town-to-town travel, and specified that this was a novel journey to try and remove the role of habit in the decision making process. While the town-to-town journey enabled comparison between the three travel modes selected, it did exclude all other journey types and didn't take into account the possible confounding variables that might influence the decision making process (e.g. proximity to the nearest town; accessibility of transport modes; concessionary rates). Future research could look at different types of journey, including more habitual journeys such as commuting.

Journey purpose was not specified in the survey questions (again to try and eliminate the influence of habitual behaviour as people tend to tie habits to travel purposes.) However, this may have influenced the values people placed on the different journey attributes. For example, someone making the journey to do come casual shopping may not view a potential delay as very important, and thus not consider it in their choice making process. On the other hand, someone thinking about traveling to attend a meeting or appointment may have placed a high value on this journey attribute. Future work should investigate the differences between the values placed on these attributes across different journey purposes.

Journey length was limited to the general amount of time it takes to travel between two nearby towns. Some participants' quantitative responses suggested that there may be a tolerance for uncomfortable or stressful travel situations (such as overcrowding or driving an unknown route) when considering short journeys. Future work could look at the effect of increasing the journey duration on inter-group differences in the value they place on various journey attributes.

The maximum delay attribute was included in order to account for journey time variability and potential delays. This was included to attempt to replicate its effect on anxiety and stress; however, it may be perceived as slightly unrealistic. Current transport systems do not always provide delay information, or this information isn't provided during the decision making process but after the transport choice has been made (for example, at the bus stop or en route). As mentioned previously, people do not always go through deliberate processing when making a decision, and do not always research their choice options ahead of travelling.

The attributes included in the survey design were guided by the findings of the focus groups and the experiences of road users. However, due to the highly subjective nature of these influences many could not be included in the survey. For example, intolerance of uncertainty was frequently mentioned throughout the qualitative research. Intolerance of uncertainty is often experienced by people with anxiety. It is described as 'the way an individual perceives information in uncertain or ambiguous situations and responds to this information with a set of cognitive, emotional and behavioural reactions' (p216, Dugas et al, 1998). Intolerance of uncertainty can often translate into a need for control and its absence can lead to intrusive 'what-if' thoughts which can impact the ability to focus on tasks. Instances of 'what if' thoughts were described by participants in relation to both modes of public transport (bus and train). In the focus groups, participants explored the coping mechanisms that they have developed to avoid these intrusive thoughts and minimise the negative impacts. These included total avoidance of certain modes of transport, prioritising car use in situations where uncertainty might be higher or at times of intense emotive reaction. While intolerance of uncertainty may have been a particularly important factor it is difficult to include such subjective factors as attributes in a choice experiment design. This is also the case for other subjective factors such as perceived safety, or how other people's behaviours are experienced.

However, while a number of attributes could not be explored in more detail through the stated preference survey, these findings support the wider research literature (Posner, 2017). The findings highlighted the extent to which factors that influence travel mode choice are subjective (e.g. perceived control and control beliefs (Sposato et al, 2012; Evans & Stecker, 2002; 2004), perceived safety (Chataway et al, 2014); perceived crowding (Mahudin et al, 2012; Le Masurier & Wilson, 2010); previous experience and habits (Verplanken & Orbell, 2010; 2015)) and therefore in the ways in which mental health influences travel behaviour can differ from person to person. In addition, it highlights that certain aspects of transport systems can have significantly different impacts on people's mental health. As explored throughout the focus groups and survey, while some transport factors, such as crowding for example, could have negative impacts on some individuals such as panic attacks, others described feelings of safety and found crowded environments safer. More work could help to improve current transport systems (both roads and public transport), making it more accessible, supporting those with mental health difficulties and minimising the negative impacts that travel can have on mental health. Participants in the focus groups suggested a number of ways in which this could be done, including increased and improved information and joined-up thinking across networks to provide more support and solutions for travellers. Participants suggested that the current information systems should be redeveloped to become more accessible to all those who have any kind of special needs and that they should be redeveloped in collaboration with those who have mental health difficulties. Another solution put forward was a need for an improved understanding of mental health difficulties by members of the general public, and also staff involved in operating transport systems and interacting with their users. Participants believed that the lack of staff presence, and staff with little awareness of mental health difficulties were barriers to using certain modes of transport.

5 Recommendations and next steps

Our research highlights the extent to which more work is required to improve the current transport systems to make them more accessible, support those with mental health difficulties and minimise the negative impacts that they can have on mental health. Potential solutions include:

- Improved information provision ensuring its accessibility and increased joint-up thinking to provide more support and solutions for travellers. This could be achieved by reviewing the current information provision tools in partnership with individuals with experience of mental health difficulties.
- Improved awareness and understanding of mental health difficulties and the barriers they pose to the accessibility of certain travel modes (e.g. buses and trains) by members of the general public and staff.
- Future research should compare the impact of different types of journeys on mental health (e.g. the impact of various commuter modes on stress and anxiety)
- Future research should look at the role that mental health difficulties could play in the uptake of autonomous and connected technologies, and how CAV-enabled services could be designed to meet the needs of those with mental health difficulties
- Future research should look at the possible benefits to mental health that autonomous technologies could offer to transport users in the longer term (e.g. better access to MH services, and better retention of social capital).

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Appendix A Initial survey

Mental health, wellbeing and transport

1. Survey information

Thank you for showing an interest in our research looking at the relationship between mental health and transport.

What is the survey about?
The aim of this research is to develop a better understanding of the relationships between mental health and transport. By this we mean the influence mental health has on travelling behaviour and also the influence transport and travel can have on mental health and wellbeing.

The survey will involve answering questions relating to recent and current experiences of mental health difficulties.

Who can take part?
We are looking for adults with a driving licence to take part.

Who is it for?
The research is being undertaken by TRL (the Transport Research Laboratory) and for TRL.

How long will it take?
They survey should take around 10-15 minutes to complete.

What do I receive for taking part?
As a thank you for completing the survey you will be entered into a prize draw for a chance to win one of 18 Amazon vouchers, ranging from £10 to £100. Once you have completed the survey you will be asked if you wish to be entered into the prize draw, and asked to provide us with your email address. The prize draw will take place once the survey has been closed on the 25th of May 2018.

You can find more details on the prize draw and the terms and condition by clicking on the following link:
https://trl.co.uk/mental-health-and-transport-survey

What if I want to drop out?
You can leave the survey at any time without giving a reason by closing the web browser. If you do this we won't use any of the data that you provided. If you drop out, you can

email contact@trl.co.uk with the subject line "mental health and transport prize draw" to enter your details (name and email address) into the prize draw.

What else do I need to know?
All your responses will be completely confidential and stored securely. Your data will not be shared with any third parties and will be deleted at the end of the project.

If you need to ask further questions about the survey, please contact the lead researcher Rebecca Posner at rposner@trl.co.uk.

Please remember that if at any time you feel distressed, or feel that you require support that you can seek mental health support via your GP, contacting mental health organisations or by identifying a local psychotherapist or counsellor through the following links:
British Association for Counselling and Psychotherapy register: http://www.bacpregister.org.uk/public/
The Health and Care Professions Council register: http://www.hpc-uk.org/check/
Samaritans: By phone: 116 123; By email: jo@samaritans.org; Online: http://www.samaritans.org/
Saneline: By phone: 03003 047000;
Online: http://www.sane.org.uk/what_we_do/support/helpline
The Mix: By phone: 08088 084994; online: www.themix.org.uk/get-support

2. Consent form
Before we can begin the survey we need to check a few things with you. Please answer the following questions:

Are you aged 18 or over? *

☐	Yes
☐	No

Do you have a valid driving licence? *

☐	Yes
☐	No

Do you own a car or have regular access to a car? *

☐	Yes

☐	No

Have you read and understand the background information for the study and had the opportunity to ask questions? (Remember you can email rposner@trl.co.uk if you have any questions.) *

☐	Yes
☐	No

Do you understand that your participation is voluntary and that you are free to withdraw at any time, without giving a reason? *

☐	Yes
☐	No

Do you agree to the use of anonymised quotes in reports? *

☐	Yes
☐	No

Do you consent to take part in this survey *

☐	Yes
☐	No

You responded that you have not read the background information about this project.

We need to make sure that all of our participants are informed about the research they are taking part in.

If you would like to go back to the information page please click HERE.

Alternatively, if you have read the information, click NEXT to start the survey.

Thank you for consenting to take part in this survey. We will not use any of your quotes from your responses in any of our reporting.

Click NEXT to continue with the survey.

5. About you

Thank you for consenting to take part in this survey.

First, a few questions about you.

Please remember that you can leave the survey at any time without giving a reason by closing the web browser. If you do this we won't use any of the data that you provided.

How often do you use the following types of transport? *

	Never	Less than once a month	About once a month	About once a fortnight	1-3 days a week	4-6 days a week	Everyday
Car	☐	☐	☐	☐	☐	☐	☐
Bus	☐	☐	☐	☐	☐	☐	☐
Train/Tube	☐	☐	☐	☐	☐	☐	☐
Taxi	☐	☐	☐	☐	☐	☐	☐
Cycling	☐	☐	☐	☐	☐	☐	☐
Walking	☐	☐	☐	☐	☐	☐	☐
Motorcycling	☐	☐	☐	☐	☐	☐	☐

6. About you

Over the last two weeks, how often have you been bothered by any of the following problems? *

	Not at all	Several days	More than half the days	Nearly everyday
Little interest or pleasure in doing things	☐	☐	☐	☐
Feeling down depressed or hopeless	☐	☐	☐	☐

Trouble falling or staying asleep, or sleeping too much	☐	☐	☐	☐
Feeling tired or having little energy	☐	☐	☐	☐
Poor appetite or overeating	☐	☐	☐	☐
Feeling bad about yourself - or that you are a failure, or have let yourself or your family down	☐	☐	☐	☐
Trouble concentrating on things, such as reading the newspaper or watching television	☐	☐	☐	☐
Moving or speaking so slowly that other people have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual	☐	☐	☐	☐
Thoughts that you would be better off dead or of hurting yourself in some way	☐	☐	☐	☐

7. About you

Over the last 2 weeks how often have you been bothered by the following problems? *

	Not at all	Several days	More than half the days	Nearly everyday
Feeling nervous, anxious or on edge	☐	☐	☐	☐
Not being able to stop or control worrying	☐	☐	☐	☐

Worrying too much about different things	☐	☐	☐	☐
Trouble relaxing	☐	☐	☐	☐
Being so restless that it is hard to sit still	☐	☐	☐	☐
Becoming easily annoyed or irritable	☐	☐	☐	☐
Feeling afraid as if something awful might happen	☐	☐	☐	☐

8. Travel choices

The next set of questions is about your travel choices.

PLEASE READ THIS INFORMATION CAREFULLY.

Imagine that you are planning to make a single journey that you don't make very often. You are planning to take this journey on your own. The journey is between two town centres and around 15 miles long.

There are three possible transport modes you could choose from: train, car, or bus.

EXAMPLE QUESTION:

	Train	Car	Bus
Cost	£4	£8	£4
Journey time	20 minutes	40 minutes	40 minutes
Journey could be delayed by up to….	8 minutes	No delay	No delay
Level of crowding	Crowded	N/A	Not crowded
Number of changes	No changes	N/A	1 change

For each journey option you will be given the following information:

journey cost

the journey time without any delays, and

the amount of time the journey could be delayed by.

Looking at the train journey example above, the journey time without delays is 20 minutes but the journey could be delayed by up to 8 minutes. This means that your journey may be anywhere between 20 and 28 minutes long.

For the train and bus options you will also be given information on the number of changes required and the level of crowding. The level of crowding in each scenario is described as either not crowded or crowded.

Not crowded: There are vacant seats and very few people standing in the aisle.

Crowded: All seats are occupied and a lot of people are standing in the aisle.

For the car journeys options, the cost given takes into consideration any toll or parking fees as well as the fuel cost (car maintenance, tax, and insurance costs are not included).

For each scenario you will be asked "Which mode of transport would you choose?"

Following each scenario you will also be asked to give a brief description explaining why you made the choice.

9. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£4	£4	£8
Journey time	40 minutes	20 minutes	40 minutes
Journey could be delayed by up to….	No delay	8 minutes	No delay
Level of crowding	Not crowded	Crowded	N/A
Number of changes	1 change	No changes	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

10. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£4	£6	£4
Journey time	20 minutes	20 minutes	40 minutes
Journey could be delayed by up to….	8 minutes	8 minutes	16 minutes
Level of crowding	Not crowded	Not crowded	N/A
Number of changes	No changes	1 change	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

11. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£4	£8	£4
Journey time	20 minutes	30 minutes	20 minutes

Journey could be delayed by up to….	No delay	6 minutes	4 minutes
Level of crowding	Not crowded	Crowded	N/A
Number of changes	No changes	1 change	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

12. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£6	£4	£4
Journey time	40 minutes	40 minutes	30 minutes
Journey could be delayed by up to….	16 minutes	No delay	6 minutes
Level of crowding	Crowded	Not crowded	N/A
Number of changes	1 change	No changes	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

13. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£6	£6	£6
Journey time	30 minutes	20 minutes	20 minutes
Journey could be delayed by up to….	6 minutes	No delay	4 minutes
Level of crowding	Crowded	Not crowded	N/A
Number of changes	No changes	1 change	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

14. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£8	£8	£6
Journey time	20 minutes	30 minutes	40 minutes
Journey could be delayed by up to….	4 minutes	No delay	No delay
Level of crowding	Not crowded	Crowded	N/A
Number of changes	1 change	No changes	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

15. Travel choices

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£8	£8	£8
Journey time	30 minutes	40 minutes	30 minutes
Journey could be delayed by up to….	No delay	16 minutes	12 minutes
Level of crowding	Crowded	Not crowded	N/A
Number of changes	No changes	No changes	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£6	£6	£6
Journey time	40 minutes	30 minutes	20 minutes
Journey could be delayed by up to….	16 minutes	6 minutes	No delay
Level of crowding	Crowded	Not crowded	N/A

Number of changes	1 change	No changes	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

To see the information about this question again, click here (this will open a new tab). *

	Bus	Train	Car
Cost	£8	£4	£8
Journey time	30 minutes	40 minutes	30 minutes
Journey could be delayed by up to….	6 minutes	8 minutes	12 minutes
Level of crowding	Not crowded	Crowded	N/A
Number of changes	No changes	1 change	N/A
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

18. Mental health and emotions when travelling

How much do you agree or disagree with the following statements? *

	Strongly Disagree	Disagree	Neither agree nor	Agree	Strongly Agree

				disagree		
I find other people's driving behaviour distressing	☐	☐	☐	☐	☐	
I don't mind travelling when there are lots of other people using the same transport system	☐	☐	☐	☐	☐	
I enjoy driving because I have my own space	☐	☐	☐	☐	☐	
I avoid travelling on public transport as I may be re-routed	☐	☐	☐	☐	☐	
I don't get anxious or stressed when there are multiple changes involved in my journey	☐	☐	☐	☐	☐	
As a driver I don't get stressed or anxious when I get diverted	☐	☐	☐	☐	☐	
I find other people's behaviour on public transport distressing	☐	☐	☐	☐	☐	

19. Mental health and emotions when travelling

Do you tend to be more or less anxious when you are driving with passengers (compared to when you are driving alone) when the passengers are... *

	Much less anxious	A bit less	Neither	A bit more	Much more anxious	I don't drive with passengers
People you don't know very well?	☐	☐	☐	☐	☐	☐
People you are close to?	☐	☐	☐	☐	☐	☐

20. Mental health and emotions when travelling

if you were travelling alone, how lonely and isolated (if at all) would you feel using the following types of transport? *

	Not at all	A little bit	Somewhat	Quite a bit	Very
Train	☐	☐	☐	☐	☐
Pedal cycle	☐	☐	☐	☐	☐
Tube	☐	☐	☐	☐	☐
Bus	☐	☐	☐	☐	☐
Walking	☐	☐	☐	☐	☐
Car	☐	☐	☐	☐	☐

21. Mental health and emotions when travelling

If you were travelling alone, how safe or unsafe would you feel using the following type of transport? *

	Not at all safe	Not very safe	Neither safe nor unsafe	Quite safe	Very safe
Train	☐	☐	☐	☐	☐
Pedal cycle	☐	☐	☐	☐	☐
Tube	☐	☐	☐	☐	☐
Bus	☐	☐	☐	☐	☐
Walking	☐	☐	☐	☐	☐
Car	☐	☐	☐	☐	☐

22. A few final questions about you

What is your...

Gender? *

☐	Male
☐	Female
☐	Non-binary/other

☐	Prefer not to say

Age? *

☐	18-24
☐	25-29
☐	30-39
☐	40-49
☐	50-59
☐	60-69
☐	70+

Employment status? *

☐	☐ Employed, full time
☐	☐ Employed, part time
☐	☐ Not employed, looking for work
☐	☐ Not employed, not looking for work
☐	☐ Retired
☐	☐ Disabled, not able to work
☐	☐ Full time student

23. A few final questions about you

Do you have a disability or any additional travel needs? *

☐	Yes
☐	No

24. A few final questions about you

How would you describe your disability? *

☐	☐ Wheelchair user

☐	☐ Mobility impaired
☐	☐ Blind or partially sighted
☐	☐ Deaf or hard of hearing
☐	☐ Learning disability
☐	☐ Prefer not to say
☐	Other (please specify):

25. End of survey

You have finished the survey!

Thank you for taking the time to take part.

To enter the prize draw click HERE.

The terms and conditions for the prize draw can be found here: https://trl.co.uk/mental-health-and-transport-survey

If you have questions about anything contained in this survey or are interested in receiving a summary of the research please email the lead researcher Rebecca Posner at rposner@trl.co.uk.

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Please remember that if at any time you feel distressed, or feel that you require support that you can seek mental health support via your GP, contacting mental health organisations or by identifying a local psychotherapist or counsellor through the following links:
British Association for Counselling and Psychotherapy register: http://www.bacpregister.org.uk/public/
The Health and Care Professions Council register: http://www.hpc-uk.org/check/
Samaritans: By phone: 116 123; By email: jo@samaritans.org; Online: www.samaritans.org
Saneline: By phone: 03003 047000;
Online: http://www.sane.org.uk/what_we_do/support/helpline
The Mix: By phone: 08088 084994; online: www.themix.org.uk/get-support

Appendix B Focus group Topic Guide

Introduction

Researcher(s) to introduce themselves.

Focus group purpose

The aim of this focus group is to gain a better understanding of the relationships between mental health and transport. In other words, we are interested in how mental health may affect travelling behaviour, as well as how travel may affect mental health.

Topics that will be discussed in the focus group include your experiences of transport systems, factors that influence your transport decisions, and the reasons why. Outcomes of the discussions could help us to identify and reduce negative impacts of transport systems on mental health, so your input would be greatly appreciated.

Just to clarify when we talk about transport systems we are referring to all transport modes including public car use, bicycle use, walking, public transport and trains.

Information for participants

- This focus group is entirely voluntary and you are free to leave at any time without providing a reason.
- The discussion should last 1-2 hours. To ensure we cover all topics, we may need to ask that we move the conversation on.
- Please feel free to request a break at any time.
- Even if you do not have strong opinions, please feel free to provide your thoughts on all the questions, and please remember that there are no right or wrong answers.
- We would greatly appreciate it if everyone could refrain from sharing other people's experiences that were discussed today outside of the group to ensure that the information remains confidential.
- You do not have to discuss anything that makes you uncomfortable. If at any point you do feel uncomfortable, please let us know and remember that you can stop the discussion at any time.
- If you have any concerns about your mental health, we recommend that you seek support from your GP or other mental health organisations, whose contact details we can pass onto you.
- Your information is treated as confidential and will not be shared with any third party.
- We would like to record the discussion so that we can refer back to the recording in the future. If you are happy for us to record the discussion, the audio recording will be destroyed when the research has been completed and all transcripts will be completely anonymised (there will be no direct reference to you in the final report).

Pre-discussion preparation

1. Does anyone have any questions they would like to ask?
2. Are you happy to proceed with the focus group discussions?
    a. ***If no, allow participant(s) to leave the group.***
3. ***Researcher to hand out consent form for participant(s) to complete.***
4. ***Researcher to check consent form(s).***
    a. ***If no to any questions, allow participant(s) to leave the group.***
5. ***Researcher to start the recording (if appropriate).***
6. The discussion is now being recorded. For the tape, please confirm that you have given permission for this interview to be recorded.

Discussion questions

<u>Introductory questions</u>

1. Which factors influence your decision to travel (e.g. past experiences, expectations, practical factors)?
    a. *Why?*
2. What do you expect to achieve from travelling?
    a. *What helps you to achieve these outcomes?*
    b. *What prevents you from achieving these outcomes?*
    c. *How often do you feel you achieve these outcomes?*
3. Which mode(s) of transport do you typically use?
    a. *Why? (e.g. speed/ease/cost of travel, level of perceived control/safety, level of crowding, physical/emotional effects etc.)*
    b. *What are the positive/negative aspects?*
    c. *Does it offer something that other modes of transport don't?*
        i. *If so, what?*
4. Which mode(s) of transport do you typically avoid, if any?
    a. *Why? (e.g. speed of travel, ease of travel, cost of travel, level of perceived control/safety, level of crowding, physical/emotional effects etc.)*
    b. *How do you manage to avoid it?*
        i. *Can you give an example of a time when you avoided it?*
5. How would you describe your overall experience of the current transport system?

Effects of mental health on travel behaviour

The focus in this section will be on the role of mental health on travel behaviour, so we would like you to think about your experiences and time where your mental health may have impacted your travel behaviour. We would like you to consider all modes of transport including car use, public transport, rail, walking and cycling.

6. What do you think is the impact of mental health on travel behaviour?
7. Has your mental health (mood, emotions, mental health illness etc.) ever *positively* affected your travel behaviour?
    a. *How?*
        i. *Can you give an example of a time when your mental health positively affected your travel behaviour?*
        ii. *How did you behave?*
    b. *How could the positive effect(s) be enhanced?*
8. Has your mental health (mood, emotions, mental health illness etc.) ever *negatively* affected your travel behaviour?
    a. *How?*
        i. *Can you give an example of a time when your mental health negatively affected your travel behaviour?*
        ii. *How did you behave?*
    b. *How could the negative effect(s) be reduced?*

Effects of transport on mental health

The focus in this section will be on the impact that our transport systems have on our mental health, by transport systems we are referring to all transport modes including public car use, bicycle use, walking, public transport and trains. So we would like you to think about your experiences and times where transport may have impacted your mental health, both positively and negatively.

9. Are there particular needs, feelings, or emotions that you seek to satisfy by travelling?
    a. *Why are these important?*
    b. *What happens when they are not satisfied?*
    c. *Which mode(s) of transport satisfy these?*
        i. *How?*
10. How do you think transport can affect mental health?
11. Has a mode of transport ever *positively* affected your mental health (mood, emotions, mental health illness etc.)?
    a. *How?*

i. *Can you give an example of a time when a mode of transport positively affected your mental health?*
ii. *What did you think or feel?*
iii. *Was there a specific trigger or event?*
iv. *Did this event affect your subsequent travel behaviour?*

b. *Which mode of transport?*
c. *How could the positive effect(s) be enhanced?*

12. Has a mode of transport ever *negatively* affected your mental health (mood, emotions, mental health illness etc.)?
    a. *How?*
        i. *Can you give an example of a time when a mode of transport negatively affected your mental health?*
        ii. *What did you think or feel?*
        iii. *Was there a specific trigger or event?*
        iv. *Did this event affect your subsequent travel behaviour?*
    b. *Which mode of transport?*
    c. *How could the negative effect(s) be reduced?*

Final questions

13. In your opinion, what can be done to improve the current transport system?
    a. *Should the improvement(s) be applied to a specific mode of transport or the whole transport system?*
    b. *What would the improvement(s) add to the transport system?*
        i. *What effect would/might this have on your mental health?*
    c. *If these improvements were made, would it change the way you use the current transport system?*
        i. *If so, how?*
        ii. *If not, why not?*
14. Is there anything else you would like to add about mental health and transport that we haven't already covered?

Researcher to thank participant(s) for taking part in the discussion and stop the recording.

Appendix C Community survey

[The order the transport modes was presented to participants was pseudo randomised. Only one ordering is shown here.]

Mental health and transport community survey

Page 1. Survey information

Thank you for showing an interest in our research looking at the relationship between mental health and transport.

What is the survey about?
The aim of this research is to develop a better understanding of the relationships between mental health and transport. By this we mean the influence mental health has on travelling behaviour and also the influence transport and travel can have on mental health and wellbeing.

The survey will involve answering questions relating to recent and current experiences of mental health difficulties.

Who can take part?
We are looking for adults with a driving licence to take part.

Who is it for?
The research is being undertaken by TRL (the Transport Research Laboratory) and for TRL.

How long will it take?
They survey should take around 10-15 minutes to complete.

What do I receive for taking part?
As a thank you for completing the survey you will be entered into a prize draw for a chance to win one of 18 Amazon vouchers, ranging from £10 to £100. Once you have completed the survey you will be asked if you wish to be entered into the prize draw, and asked to provide us with your email address. The prize draw will take place once the survey has been closed on the 25th of May 2018.

You can find more details on the prize draw and the terms and condition by clicking on the following link:
https://trl.co.uk/mental-health-and-transport-survey

What if I want to drop out?
You can leave the survey at any time without giving a reason by closing the web browser. If you do this we won't use any of the data that you provided. If you drop out, you can email contact@trl.co.uk with the subject line "mental health and transport prize draw" to enter your details (name and email address) into the prize draw.

What else do I need to know?
All your responses will be completely confidential and stored securely. Your data will not be shared with any third parties and will be deleted at the end of the project.

If you need to ask further questions about the survey, please contact the lead researcher Rebecca Posner at rposner@trl.co.uk.

Please remember that if at any time you feel distressed, or feel that you require support that you can seek mental health support via your GP, contacting mental health organisations or by identifying a local psychotherapist or counsellor through the following links:
British Association for Counselling and Psychotherapy register: http://www.bacpregister.org.uk/public/
The Health and Care Professions Council register: http://www.hpc-uk.org/check/
Samaritans: By phone: 116 123; By email: jo@samaritans.org; Online: http://www.samaritans.org/
Saneline: By phone: 03003 047000;
Online: http://www.sane.org.uk/what_we_do/support/helpline
The Mix: By phone: 08088 084994; online: www.themix.org.uk/get-support

Page 2. Consent form

Before we can begin the survey we need to check a few things with you. Please answer the following questions:

6 Are you aged 18 or over? *

- [ ] Yes
- [ ] No

7 Do you have a valid driving licence? *

- [ ] Yes
- [ ] No

8 Do you own a car or have regular access to a car? *

- [ ] Yes
- [ ] No

9 Have you read and understand the background information for the study and had the opportunity to ask questions? (Remember you can email rposner@trl.co.uk if you have any questions.) *

- [ ] Yes
- [ ] No

10 Do you understand that your participation is voluntary and that you are free to withdraw at any time, without giving a reason? *

- [ ] Yes
- [ ] No

11 Do you agree to the use of anonymised quotes in reports? *

- [ ] Yes
- [ ] No

12 Do you consent to take part in this survey *

- [ ] Yes
- [ ] No

You responded that you have not read the background information about this project.

We need to make sure that all of our participants are informed about the research they are taking part in.

If you would like to go back to the information page please click HERE.

Alternatively, if you have read the information, click NEXT to start the survey.

Thank you for consenting to take part in this survey. We will not use any of your quotes from your responses in any of our reporting.

Click NEXT to continue with the survey.

Page 5. About you

Thank you for consenting to take part in this survey.

First, a few questions about you.

Please remember that you can leave the survey at any time without giving a reason by closing the web browser. If you do this we won't use any of the data that you provided.

13 How often do you use the following types of transport? *

	Never	Less than once a month	About once a month	About once a fortnight	1-3 days a week	4-6 days a week	Everyday

	Never	Less than once a month	About once a month	About once a fortnight	1-3 days a week	4-6 days a week	Everyday
Car	☐	☐	☐	☐	☐	☐	☐
Bus	☐	☐	☐	☐	☐	☐	☐
Train/Tube	☐	☐	☐	☐	☐	☐	☐
Taxi	☐	☐	☐	☐	☐	☐	☐
Cycling	☐	☐	☐	☐	☐	☐	☐
Walking	☐	☐	☐	☐	☐	☐	☐
Motorcycling	☐	☐	☐	☐	☐	☐	☐

Page 6. About you

14 Over the last two weeks, how often have you been bothered by any of the following problems? *

	Not at all	Several days	More than half the days	Nearly everyday
Little interest or pleasure in doing things	☐	☐	☐	☐
Feeling down depressed or hopeless	☐	☐	☐	☐
Trouble falling or staying asleep, or sleeping too much	☐	☐	☐	☐
Feeling tired or having little energy	☐	☐	☐	☐
Poor appetite or overeating	☐	☐	☐	☐
Feeling bad about yourself - or that you are a failure, or have let yourself or your family down	☐	☐	☐	☐
Trouble concentrating on things, such as reading the newspaper or watching television	☐	☐	☐	☐
Moving or speaking so slowly that other people have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual	☐	☐	☐	☐
Thoughts that you would be better off dead or of hurting	☐	☐	☐	☐

	Not at all	Several days	More than half the days	Nearly everyday
yourself in some way				

Page 7. About you

15 Over the last 2 weeks how often have you been bothered by the following problems? *

	Not at all	Several days	More than half the days	Nearly everyday
Feeling nervous, anxious or on edge	☐	☐	☐	☐
Not being able to stop or control worrying	☐	☐	☐	☐
Worrying too much about different things	☐	☐	☐	☐
Trouble relaxing	☐	☐	☐	☐
Being so restless that it is hard to sit still	☐	☐	☐	☐
Becoming easily annoyed or irritable	☐	☐	☐	☐
Feeling afraid as if something awful might happen	☐	☐	☐	☐

Page 8. Travel choices

The next set of questions is about your travel choices.

PLEASE READ THIS INFORMATION CAREFULLY.

Imagine that you are planning to make a single journey that you don't make very often. You are planning to take this journey on your own. The journey is between two town centres and around 15 miles long.

There are three possible transport modes you could choose from: train, bus, or car.

EXAMPLE QUESTION:

For each journey option you will be given the following information:

journey cost

the journey time without any delays, and

the amount of time the journey could be delayed by.

Looking at the train journey example above, the journey time without delays is 20 minutes but the journey could be delayed by up to 8 minutes. This means that your journey may be anywhere between 20 and 28 minutes long.

For the train and bus options you will also be given information on the number of changes required and the level of crowding. The level of crowding in each scenario is described as either not crowded or crowded.

Not crowded: There are vacant seats and very few people standing in the aisle.

Crowded: All seats are occupied and a lot of people are standing in the aisle.

For the car journeys options, the cost given takes into consideration any toll or parking fees as well as the fuel cost (car maintenance, tax, and insurance costs are not included).

For each scenario you will be asked "Which mode of transport would you choose?"

Following each scenario you will also be asked to give a brief description explaining why you made the choice.

Page 9. Travel choices

16 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 10. Travel choices

17 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 11. Travel choices

18 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 12. Travel choices

19 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 13. Travel choices

20 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 14. Travel choices

21 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 15. Travel choices

22 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 16. Travel choices

23 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would	☐	☐	☐

	Train	Bus	Car
you choose?			

In a few words, describe why you made this choice

Page 17. Travel choices

24 To see the information about this question again, click here (this will open a new tab). *

	Train	Bus	Car
Which journey would you choose?	☐	☐	☐

In a few words, describe why you made this choice

Page 18. Mental health and emotions when travelling

25 How much do you agree or disagree with the following statements? *

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I don't mind travelling when there are lots of other people using the same transport system	☐	☐	☐	☐	☐
I avoid travelling on public transport as I may be re-routed	☐	☐	☐	☐	☐
As a driver I don't get stressed or anxious when I get diverted	☐	☐	☐	☐	☐
I find other people's behaviour on public transport distressing	☐	☐	☐	☐	☐
I don't get anxious or stressed when there are multiple changes	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
involved in my journey					
I enjoy driving because I have my own space	☐	☐	☐	☐	☐
I find other people's driving behaviour distressing	☐	☐	☐	☐	☐

19. Mental health and emotions when travelling

26 Do you tend to be more or less anxious when you are driving with passengers (compared to when you are driving alone) when the passengers are... *

	Much less anxious	A bit less	Neither	A bit more	Much more anxious	I don't drive with passengers
People you don't know very well?	☐	☐	☐	☐	☐	☐
People you are close to?	☐	☐	☐	☐	☐	☐

20. Mental health and emotions when travelling

27 If you were travelling alone, how lonely and isolated (if at all) would you feel using the following types of transport? *

	Not at all	A little bit	Somewhat	Quite a bit	Very
Train	☐	☐	☐	☐	☐
Walking	☐	☐	☐	☐	☐
Tube	☐	☐	☐	☐	☐
Pedal cycle	☐	☐	☐	☐	☐
Car	☐	☐	☐	☐	☐
Bus	☐	☐	☐	☐	☐

21. Mental health and emotions when travelling

28 If you were travelling alone, how safe or unsafe would you feel using the following type of transport? *

	Not at all safe	Not very safe	Neither safe nor unsafe	Quite safe	Very safe
Train	☐	☐	☐	☐	☐

	Not at all safe	Not very safe	Neither safe nor unsafe	Quite safe	Very safe
Walking	☐	☐	☐	☐	☐
Tube	☐	☐	☐	☐	☐
Pedal cycle	☐	☐	☐	☐	☐
Car	☐	☐	☐	☐	☐
Bus	☐	☐	☐	☐	☐

22. A few final questions about you

What is your...

29 Gender? *

- ☐ Male
- ☐ Female
- ☐ Non-binary/other
- ☐ Prefer not to say

30 Age? *

- ☐ 18-24
- ☐ 25-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60-69
- ☐ 70+

31 Employment status? *

- ☐ Employed, full time
- ☐ Employed, part time
- ☐ Not employed, looking for work
- ☐ Not employed, not looking for work
- ☐ Retired
- ☐ Disabled, not able to work
- ☐ Full time student

23. A few final questions about you

32 Do you have a disability or any additional travel needs? *

- [ ] Yes
- [ ] No

24. A few final questions about you

33 How would you describe your disability? *

- [ ] Wheelchair user
- [ ] Mobility impaired
- [ ] Blind or partially sighted
- [ ] Deaf or hard of hearing
- [ ] Learning disability
- [ ] Prefer not to say
- [ ] Other (please specify):

25. End of survey

You have finished the survey!

Thank you for taking the time to take part.

To enter the prize draw click HERE.

The terms and conditions for the prize draw can be found here: https://trl.co.uk/mental-health-and-transport-survey

If you have questions about anything contained in this survey or are interested in receiving a summary of the research please email the lead researcher Rebecca Posner at rposner@trl.co.uk.

Future opportunities to be involved in TRL research are advertised on the TRL News page: https://trl.co.uk/news.

You can also complete our participant registration form so we can contact you directly about research you may be interested in. To complete the form or see more information, use the following link: https://simulatortrials.trl.co.uk/.

Please remember that if at any time you feel distressed, or feel that you require support that you can seek mental health support via your GP, contacting mental health

organisations or by identifying a local psychotherapist or counsellor through the following links:
British Association for Counselling and Psychotherapy register: http://www.bacpregister.org.uk/public/
The Health and Care Professions Council register: http://www.hpc-uk.org/check/
Samaritans: By phone: 116 123; By email: jo@samaritans.org; Online: www.samaritans.org
Saneline: By phone: 03003 047000;
Online: http://www.sane.org.uk/what_we_do/support/helpline
The Mix: By phone: 08088 084994; online: www.themix.org.uk/get-support

26. End of survey

Thank you for your interest in our research!

Unfortunately you are not eligible to take part in this survey.

If you have questions about anything contained in this survey or are interested in receiving a summary of the research please email rposner@trl.co.uk.

Future opportunities to be involved in TRL research are advertised on the TRL News page: https://trl.co.uk/news.

You can also complete our participant registration form so we can contact you directly about research you may be interested in. To complete the form or see more information, use the following link: https://simulatortrials.trl.co.uk/.

Please remember that if at any time you feel distressed, or feel that you require support that you can seek mental health support via your GP, contacting mental health organisations or by identifying a local psychotherapist or counsellor through the following links:
British Association for Counselling and Psychotherapy register: http://www.bacpregister.org.uk/public/
The Health and Care Professions Council register: http://www.hpc-uk.org/check/
Samaritans: By phone: 116 123; By email: jo@samaritans.org; Online: www.samaritans.org
Saneline: By phone: 03003 047000;
Online: http://www.sane.org.uk/what_we_do/support/helpline
The Mix: By phone: 08088 084994; online: www.themix.org.uk/get-support

Appendix D MNL model results for Depression

Table 17 presents the results from a MNL model for participants with high scores on the mental health scale for depression, i.e. those who might suffer depression and not anxiety (N=13). However, due to the small sample size in this group results from the MNL model must be interpreted with caution and cannot be fully explored in this study.

Table 17: Full MNL model results for depression

Mode of transport	Attribute	Coefficient	t value	Significance[29]
Bus	ASC	1.21	0.49	Not significant ($p > 0.05$)
	Journey time	-0.18	-1.32	Significant ($p < 0.05$)
	Journey cost	0.24	0.58	Significant ($p < 0.05$)
	Maximum potential delay time	-0.02	-0.65	Not significant ($p > 0.05$)
Train	ASC	3.44	0.93	Not significant ($p > 0.05$)
	Journey time	-0.10	-1.96	Significant ($p < 0.05$)
	Journey cost	-0.48	-1.91	Significant ($p < 0.05$)
	Maximum potential delay time	-0.01	-0.31	Not significant ($p > 0.05$)
Car	Journey time	-0.05	-0.94	Significant ($p < 0.05$)
	Journey cost	0.20	0.75	Not significant ($p < 0.05$)
	Maximum potential delay time	-0.03	-1.59	Significant ($p < 0.05$)
	Number of changes	-1.18	-1.64	Significant ($p < 0.05$)
	Crowding	-0.07	-0.08	Not significant ($p < 0.05$)

The results from the model show that the ASC coefficients are not significant, suggesting there was no overarching preference for one mode over another. Of all the attributes included in the model, journey time and cost for bus and train, journey time for car, and number of changes were statistically significant.

[29] Based on two-tailed t-value of 2.16 and one-tailed t-value of 1.77.

Appendix E Qualitative engagement ethics application

TRL Ethical Approval Checklist and Application Form for projects involving human participants

Title of project and job number: Exploration of Mental Health and Transport, 11224687

Project funded by: Internal reinvestment project

Details of the Project Team:

Rebecca Posner: Lead Researcher

Rosie Sharp: Researcher

Kristen Fernández-Medina: Researcher

Lauren Durrell: Survey design and data analysist

Caroline Wallbank: Statistician

Sritika Chowdhury: Statistician

Su Buttress/Becca Jenkins: Project Manager

Stephen Skippon: Technical Reviewer

Division/Group: TRL Academy (9RS)

Details of Other Collaborators:

Please tick the appropriate box	Yes	No
Does the project potentially involve any increased risk of harm to participants? • Is pain or more than mild discomfort likely to result from the study? • Could the study induce psychological stress or anxiety? • Are drugs, placebos or other substances (e.g. food substances, vitamins, alcohol) to be administered to the study participants? Could the study increase the risk of physical harm to participants or others either during the study or afterwards? Health & Safety and Environmental Risk Assessment Guide and Form Privacy Impact Assessment (PIA)	x	
Is there any use of deception or withholding of information?		x
Does the research involve persons who may be unable to give their real consent?		X

(e.g. vulnerable older people; those with a learning disability or cognitive impairment; individuals in a dependent or unequal relationship?		
Does the research involve sensitive topics? (e.g. Illegal behaviour and contact with criminal justice system; experience of violence, abuse or exploitation; health (including behaviours detrimental to health, mental health, and cognitive impairment)?	x	
Are there any difficulties or doubts about compliance with other aspects of the TRL ethics guidelines (e.g. data protection)?		x
Is Criminal Records Bureau (CRB) Disclosure required?		x
Does the project need to be submitted for external research ethics approval? (e.g. study involves NHS patients, staff, carers or premises, blood samples, etc.) See guidelines for more information on which projects require such approval		x
Does the project involve children under the age of 16?		x
Does the project involve groups where permission of a gatekeeper is normally required for initial access to members – for example, ethnic or cultural groups, native peoples or indigenous communities?		x

If the answers to any of these questions are "yes", the proposal must be reviewed by the TRL Research Ethics Committee. For projects where the answers are all "no", an Ethics Panel may be sufficient. All documents reviewed by the Ethics Panel will be submitted to the TRL Research Ethics Committee.

Ethical Approval Application:

1. Briefly describe the project and its aims

The project aims to explore and better understand the relationship between mental health and transport. Mental health has received increased attention over the last few years due to its significant impact on the day to day life of the general population but not in relation to transport. While to date our transport behaviour research has focused on reducing the number of killed and seriously injured on the road, as well as understanding the factors that influence road user behaviour we have not specifically investigated the role that mental health can play in road user behaviour or the potential influence that our transport systems can have on mental health.

The project will allow us to advance our knowledge in the area and understand how our current knowledge can be applied to this area of research (e.g. driver behaviour, impact of road safety, travel mode choice, design, development and evaluation of interventions).

The research is exploratory as to date TRL has no knowledge within this area, and while the literature in the area is growing it is still very sparse. The project consists of 4 broad stages:

- Stage 1:Literature review
- Stage 2: In depth face to face interviews with experts
- Stage 3: Focus groups with members of the public
- Stage 4: Choice Modelling survey

The stages were developed in a way to build knowledge based on the findings from the previous stages. The literature review aimed to understand the relationships between

mental health and transport as identified within the academic world, through the research done to date. This was completed in June 2017.The second stage consisted of 8 in-depth face to face interviews with experts in the area including policy makers, academics and mental health charities. These interviews provided insight into the current understanding of mental health and transport of experts working within the field of mental health and/or the transport industry. These interviews were conducted between January and May 2017. The third stage consists of four focus groups with members of the general public who have experienced depression and/or anxiety in their adult life (since the age of 18) to understand their personal experiences Finally a choice modelling survey will be administered to members of the public with the aim of supporting our qualitative findings with a broader quantitative survey once again aiming to understand road users' experience of transport systems. The choice modelling survey will be developed from the findings of the focus groups to enable us to validate through statistical analysis and with a greater participant pool the factors that influence travel mode choice and travel behaviour .

This application relates to Stage 3 of the project

2. Where will the project be carried out? (e.g. TRL, university, hospital, highway, etc.):

The focus groups will be held at TRL headquarters Crowthorne House). This is to ensure that at least two researschers will be present at all times in the event that a participants should wish to leave the focus group. A third designated researcher will be on call to assist if a participant wishes to leave.

3. Source of the participants to be studied (including number and age range):

Participants will be invited through TRL's participant database. They will be emailed and asked to complete the initial survey. They will be adults aged 25 or over who consider themselves to have experienced depression and/or anxiety in their adult past (when aged 18 years or more). Those invited to take part in the survey will not currently be experiencing anxiety and or depression, and will not have experienced these mental health difficulties in the last 3 years. Adults will be used as the research team are not qualified to undertake research with children, especially relating to such a sensitive topic as mental health.

Four focus groups will be conducted, each with six participants.

4. Details of payments to participants: will financial or other inducements (other than reasonable expenses and compensation for time) be offered to participants?

Participants will be given £20 cash for taking part in the focus groups. This £20 will be given to all participants who are present at the start of the focus group even if for any reason they choose to withdraw during the focus group. Even if they do not remain for the entire duration of the discussion we still wish to thank them for the time and effort they have invested in the project so far.

5. What are the time, or other burdens, on participants? Have these been minimised (consistent with the aims of the research)? Will the burden be explained to potential participants before they agree to help?

The interviews will last up to two hours and a range of time slots will be offered including evening slots to minimise time constraints.

The researchers will travel to TRL's regional offices, which are all central locations within their respective cities, making it easier for participants to access the facility. In addition, it will be in their local towns, an environment that they are familiar with. This will aim to reduce any stress that could be caused by having to travel to a new and unknown location. The interviews will be held in secure and private meeting rooms within TRL's.

The room will be booked for longer than 2 hours to ensure that focus groups are not disturbed.

The interviewees will be made aware of the length of the focus groups and will be given 5 dates and four time slots per day to choose from. This will include an evening session to work around other commitments they may have.

6. What are the potential adverse effects, risks or hazards for:

- Research participants?

Individuals who will be taking part in the focus groups will have in their past adult life experienced anxiety and/or depression. While they will not be experiencing either anxiety or depression at the time of the interview, discussing their experiences could still lead to symptoms of anxiety, stress or even emotional distress.

While we are measuring for anxiety and/or depression through the PHQ-SADS scores, and have selected this scale as it components are used as part of many NHS services, including the IAPT programme (Improving Access to Psychological Therapies), to measure the current levels of anxiety and or depression, it does not allow us to identify any potential comorbidities. Both anxiety and depression have been identified as being associated with other mental health difficulties (e.g. PTSD, social phobia, substance abuse). These individuals may be at a higher risk of experiencing distress, or provoking intense emotional reactions by other members of the group who may be sensitive.

While TRL researchers are experienced qualitative researchers and facilitators they are not mental health practitioners and might not be able to provide the support they require.

Explanations of the steps taking to mitigate and minimise these risks are presented in section 7.

- Researchers?

To minimise the inconvenience and time burden for participants, individuals wishing to take part in the focus groups will be offered a number of time slots from which to choose from. While this minimises burdens on the participants it creates a number of risks to researchers. Focus groups could be finishing as late as 8pm and could lead to fatigue impacting the facilitators and their ability to lead a discussion group on a sensitive topic with a vulnerable group of individuals.

For this reason all focus groups will be run by three researchers to minimise any risks associated with lone working and working outside of core hours (two researchers running the focus group, and a third researcher on call).. In addition, researchers will debrief following the discussion providing an opportunity to discuss if they experienced any difficulties or distressing moments during the discussion. If one of the researchers felt that they were no longer able to facilitate the remaining focus groups due to the emotions experienced during previous discussion, another experienced researcher from the project team would conduct the remaining discussion, and this distress would be escalated to their line manager to ensure that they received the appropriate support. They will also both have access to TRL's independent work/life partner 'Unum LifeWorks' which provides private and free counselling should they require it.

By having at least two researchers (a third researcher will be present on call, not necessarily always present in the focus group itself) this will ensure that at least one researcher is focusing on participants' verbal and non-verbal cues that might suggest emotional distress. By working as a group we will be able to take the appropriate actions in the event that an individual should wish to end their participation in the focus group while ensuring that other participants are still being seen too.

TRL researchers are not experienced mental health practitioners and are not trained to support individuals who may experience emotional distress. While the questions in the initial survey are designed to detect and minimise any potential risks to participants, they will also minimise risks to the researchers (e.g. a participant experiencing emotional distress and having to manage it; individuals currently experiencing mental health difficulties).

- Members of the public or others

None

7. What provisions are there for monitoring to detect adverse effects and for halting the research if there is cause for concern?

The project team recognises that TRL staff do not have specific competence in assessing mental health difficulties or intervening therapeutically; the focus therefore is on ensuring that participants in the focus groups are not currently suffering from such difficulties through screening at recruitment. Recruitment criteria will be applied to ensure that participants are not currently suffering from any mental health difficulties (this will not specify any specific mental health difficulties to account for any possible comorbidities), and are sufficiently grounded in their prior experiences of depression and/or anxiety (i.e. they have integrated and come to terms with those experiences) that they will not become distressed in discussing their experiences. This will take the shape of a number of self-reported questions, which will act as a consent form.

The recruitment questionnaire will include the PHQ-SADS scale, which comprises of the GAD-7 (a measure of current level of anxiety), the PHQ-9 (a measure of current level of depression) and the PHQ-15 scale (a measure of current levels of somatic symptoms that might be associated with depression and/or anxiety). The PHQ-SADS provides three scores, which are each categorised into a number of different levels reflecting the severity of the difficulties experienced. For the PHQ-9 four cut off points represent the different levels of experienced depression (5; 10; 15 and 20), and for the GAD-7 and the PHQ-15 three cut off points represent the different levels of experienced anxiety and somatic symptoms (5, 10 and 15). Only those scoring below 10 on the PHQ-15 scale, below 7 on the GAD-7 scale and below 9 on the PHQ-9 scale will be invited to take part in the focus groups. These cut offs are based on the criteria used as part of the IAPT services in the UK. An individual scoring above these scores would meet the criteria to receive support for a medical professional. In addition, the PHQ-9 includes a question relating to self-harm. This will be used as an automatic screening question. If participants were to score higher than 0 on that question they would not be invited to take part in the focus group and the initial survey would be terminated following that question. TRL has an ethical obligation to inform those individual of the various helplines and options that can provide support in such hard times, and details of how participants can access mental health support will be provided (e.g. contact details for Samaritans) and they will be encouraged to contact these organisations. We acknowledge that mental health can change rapidly and as there may be a period of a few weeks between completing the initial survey and taking part in the focus group. We will therefore be re-administering the PHQ-SADS in the days before the focus group to ensure that there has been no increase in PHQ-SADS scores. If a participant's scores have increased and are now above the thresholds mentioned previously they will not be able to take part in the focus group.

While we wish to discuss the impact that mental health can have on travel behaviour and the influence of transport systems on mental health, we will only be inviting individuals who have experienced anxiety and/or depression in their adult life, but not currently

experiencing such difficulties to take part in the focus groups. As TRL researchers are not qualified mental health practitioner, individuals who are currently experiencing anxiety and/or depression will not be invited to take part in the focus groups as the researchers would not be able to provide the relevant support in the event that a participant were to experience intense emotional distress. While we will be asking individuals to report if they believe that they are currently experiencing anxiety/depression, we will also be administering the PHQ-SADS. This is to ensure that individuals who may not realise that they are experiencing a period of anxiety and/or depression are not invited to take part. Participants will also be asked whether or not they feel sufficiently grounded in their prior experiences of depression and/or anxiety to discuss them (i.e. they have integrated and come to terms with those experiences). This is to minimise the likelihood that participant will become distressed in discussing their experiences. We recognise that the response to this question may be very subjective, which is why the PHQ-SADS score will be reviewed for each participant before they are invited to take part. If the scores reveal that individuals are still experiencing anxiety and/or depression they will not be invited to take part in this stage of the research.

At the beginning of the group discussion participants will be made aware that they are able to withdraw from the group at any point without explanation. There will be three researchers present at each group discussion. Two of which will have to be present in the focus group at all time, a third researcher will be on 'standby' outside the focus group in the eventuality that one of the participants wished to leave the discussion. The two researchers present will be monitoring all non-verbal as well as verbal cues to distress. The researchers will not attempt any kind of assessment or intervention but if any participant does experience distress during the discussion and wishes to leave the third researcher will be called in and give them the opportunity to leave the group, accompany them, and draw their attention to the section in the Participant Information Sheet that indicates the ways in which they can access support if they wish to do so. If another participant decided to leave the discussion, whether in distress or not, the focus group will have to be suspended to ensure that there are always two researchers within the focus group. The Participant Information Sheet (attached) gives details of how participants can access National Health Service mental health support via their G.P., individual counsellors and psychotherapists in their area via the British Association for Counselling and Psychotherapy (BACP) Register of Counsellors & Psychotherapists (www.bacpregister.org.uk), individual Clinical or Counselling Psychologists via the Health and Care Professions Council practitioners' register (http://www.hpc-uk.org/check/), The Samaritans (by phone: 116 123; By email: jo@samaritans.org; Online: www.samaritans.org), Saneline (by phone: 03003 047000; Online: http://www.sane.org.uk/what_we_do/support/helpline), The Mix (by phone: 08088 084994, online: www.themix.org.uk/get-support) , or local counselling agencies and services (some of which may be free) using an internet search engine and search terms such as (Counselling OR Psychotherapy AND (name of their nearest town/city)). It also advises that any costs that they incur for private counselling or psychotherapy would need to be met by themselves.

Whilst the recruitment procedure is designed to ensure that those participating in the research will not experience distress during the group discussion, there remains the possibility that engaging in completing the recruitment questionnaire itself might lead to distress in those who do not meet the recruitment criteria. Accordingly the recruitment email will draw potential participants' attention to the nature of the questions in the questionnaire, seek their consent to completing it, and give the same details on how to access support as are given in the Participant Information Sheet and listed in the paragraph above.

To ensure that potential participants who do not meet the recruitment criteria are not made to feel adversely unfairly excluded the recruitment email will describe the research as consisting of two parts, an initial survey and a follow-up stage of group discussions that some participants may also be asked to join. In addition, an additional open text question will be included at the end of the initial survey which will ask people to provide feedback on their experiences of the impact of mental health and transport, and vice versa. Emails sent to those who do not meet the recruitment criteria will then be worded as a thank-you for participation.

Prior to the focus groups the members of the research team will be briefed on what is expected of them in the event of a participant becoming distressed. Researchers will be instructed that in the event of a participant feeling distressed the third researcher will be asked to escort the participant in question out of the room, provide them with a glass of water and arrange a taxi to take them home if they so require. If the participant does require a taxi the assigned researcher will remain with them until the taxi has arrived. If the participant does not require a taxi the researcher will remain with the participant until they feel ready to leave. In no instance should the researcher try and provide any sort of counselling as they are not trained to do so.

8. What are the potential benefits for research participants?

Participants will be taking part in a discussion that will provide some of the first 'non-clinical' accounts of the impact of mental health on transport, as well as the factors within the current transport systems that have an impact (both good and bad) on their mental health and wellbeing. Their contribution will help to draw attention to ways in which our transport systems could become fairer and take into consideration the difficulties caused by mental health difficulties, as well as helping to ensure that in the long term mental health is taken into consideration in the development and design of infrastructure.

This might also provide individuals with an opportunity to gain insight and understanding into the factors that they can control and are able to manage in relation to travel (e.g. transport choice).

9. What are the potential benefits of the project for the client and for society?

This stage of the research will provide TRL with a better understanding of real world experiences of road users and the impact of mental health on transport. Until now the project has been desk based to enable us to develop the necessary background knowledge to explore the interaction between mental health and transport within communities in the UK. One of the key limitations in the research is the dominance of medical model perspectives, including the use of Diagnostic and Statistical Manual of Mental Disorders (DSM) categories in recruitment of clinical samples. There has consequently been a lack of non-clinical based research, especially in the UK, and research has typically applied clinical categorisations (e.g. DSM categories) to participants' experiences rather than enabling participants' own descriptions of their experiences. These focus groups will be the first step in achieving such knowledge, and will enable us to design a well-founded stated preference survey with a much larger non-clinical based sample, positioning TRL at the forefront of this new field.

The potential benefits for society are also important. The research so far has demonstrated the pressing need for more collaboration between the sectors of mental health and transport, and the current work will provide UK evidence to reinforce the argument for such collaborations. It will also allow us to highlight the need to take into consideration mental health when designing and developing transport systems. It will provide a better insight into the factors that influence mental health, and equally which

aspects are influencing transport mode choice in individuals, allowing us to design more targeted and relevant interventions to ensure that individuals are using the most appropriate mode of transport to improve their mental health, or minimise the negative impact. In addition, this could enable us to encourage safer, healthier and greener transport choice in a more inclusive way designing a transport systems that would be more inclusive of everyone's needs.

The findings will allow us to highlight the importance of mental health within an aspect of day to day life, as well as outline the importance of research within the area in striving to end the stigma around mental health and ensure that every individual can travel without it impacting their mental health aversely. In the long-term this knowledge will allow TRL to take into consideration the impact on mental health of future road technologies.

10. What type of data collection methods will be used for this study (e.g. anonymous self-completion questionnaires, interviews, etc.)?

Focus groups

11. Will it be possible to link the data collected to identifiable individuals?

Data will be stored on excel spreadsheets within the secured data and sharepoint areas, these will be password protected but will be accessible by members of the qualitative research team and survey responses will be linked to participant names. However, all published data will be anonymised and there will be no direct reference to any of the participants and it will not be possible to link any of the published data to the individuals that took part.

12. How will participants' anonymity be preserved

Transcripts, and quotes used in the report, will be anonymised therefore preserving the anonymity of the participants.

Participants' personal data, including survey responses, will be saved in a password protected spreadsheet which will only be accessible by members of the qualitative team. The data from the first survey will be downloaded daily and) will be deleted from smartsurvey. Smartsurvey's privacy policy are such that ' the data controller for client surveys is the client who has commissioned the survey and responses are to be used and disclosed to others'. In accordance with TRL's privacy policy which conforms to the Data Protection Act of 1998 data is not shared to third parties, is stored securely and can only be accessed by relevant members of the project team.

Two password protected documents will be created to store the data: the first will contain all personal data (questions 1 to 10); the second will contain the responses to questions 11 and 12. TRL's privacy and data protection policies say that only data relevant to the project can be retained. The responses to questions one to ten for those individuals who do not meet the eligibility criteria is not relevant for the later stages of the project and therefore should be deleted. The answers to questions 11 and 12 will however assist in the development of the stated preference survey (stage 4 of this project). Therefore the first spreadsheet will only contain the data of those individuals who meet all of the eligibility criteria to be invited to the focus groups, and the second spreadsheet will include all responses to questions 11 and 12. By creating two spreadsheets this will ensure that no personal data that is not required for the project is maintained.

As part of the consent form participants will be asked not to discuss any of the experiences and accounts shared during the focus group. In the eventuality that two members of the same focus group were to know each other ahead of the discussion we would take them aside and ensure that they are still willing to take part in the focus

group. If they are, we will ask them for a verbal confirmation that they will not discuss and share any of the accounts shared outside of the focus group.

13. What are the arrangements for the collection, retention, use and disposal of research data?

Recordings of interviews will be transferred to the project's data area, which can only be accessed by members of the project team, at the earliest possible time and original files deleted from the recording device once the file transfer has been completed.

Similarly, all consent forms completed during the project will be scanned and stored in a secure data area that can only be accessed by the project team and originals destroyed using the in-house facility. TRL's scanners are linked to the network and do not save anything on the physical scanners themselves, the data will immediately be saved to the appropriate secure data area.

All data associated with the task will be held in the project's secure data area to which only the project team have access. The data set will be held securely for a period of five years, in accordance to TRL data management policy.

14. How will the project outputs or results be disseminated to the target audience?

The findings from this stage of the project will be analysed and form a report which will be made available to the public. Presentations drawing on this material may be made to interested stakeholders. If appropriate, the information may also be used in academic conference and peer-reviewed journal publication.

15. What arrangement has been made for debriefing, support and feedback to participants?

Participants will be provided with the lead researcher's contact details, who they will be able to contact if they have any further questions. A debrief note outlining the research findings in non-technical language will be emailed to all participants on conclusion of the research.

16. Are TRL employees being used as participants in the current study?

No

17. Does the project need to be submitted to an NHS Research Ethics Committee or any other external ethics committee for research ethics approval?

No

Investigators are asked to note that research proposals involving the following must be submitted to an NHS Research Ethics Committee for ethical review. ***Please indicate which of the categories below, if any, apply to your research.***	**Yes**	**No**
Patients and users of the NHS. This includes all potential research participants recruited by virtue of the patient or user's past or present treatment by, or use of, the NHS. It includes NHS patients treated under contract with private sector institutions.		X
Individuals identified as potential research participants because of their status as relatives or carers of patients and users of the NHS, as defined above.		X
Access to data, organs or other bodily material of past and present NHS patients.		X
Fatal material and IVF involving NHS patients.		X

The recently dead in NHS premises.		X
The use of, or potential access to, NHS premises or facilities.		X
NHS staff – recruited as research participants by virtue of their professional role.		X
Administration of drugs, alcohol or any other substance. (It is a TRL requirement to submit such studies to an NHS ethics committee.)		X
Collection of blood, saliva or any other samples from participants. (It is a TRL requirement to submit such studies to an NHS ethics committee.)		x

Checklist of Accompanying Documents that must be submitted

- A copy of the information sheet for participants
- A copy of the consent form for participants
- A copy of the two questionnaires used: the initial survey and the availability survey
- A copy of the topic guide
- Letters of correspondence to research participants included: Initial survey invitation email, 'Thank you' email following participation in initial survey; Availability survey invitation email; 'On hold' email following participation in availability survey; Focus group invitation email
- The research proposal

Mental Health and Transport

Other titles from this subject area

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