Department for Transport

Understanding, preventing and mitigating suicides on the rail network: A rapid evidence assessment

September 2025

Department for Transport

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This report was commissioned by the Department for Transport (DfT) to the National Centre for Social Research (NatCen). The authors of this report are Katy Robertson, Stacey Link, George Leeder, Yasmin Spray, Beth Graham and Caterina Branzanti.

Content Warning: Suicide

This report contains sensitive content related to suicide, including:

- Statistics and data related to suicides on the railway
- Descriptions of factors related to rail suicides
- Descriptions of suicide prevention strategies and their effectiveness
- Discussion of the impacts of rail suicides on drivers, rail staff, and passengers

Some readers may find this content distressing or triggering. If you are experiencing suicidal thoughts or need support, please contact a mental health professional or a suicide prevention helpline. More detail on support is provided below.

This report complies with Samaritans' media guidelines for reporting suicide. If you are a journalist or author covering a suicide-related issue, please consider following the guidelines because of the potentially damaging consequences of irresponsible reporting.

Support

Samaritans

Samaritans is a charity which provides emotional support to anyone in emotional distress, struggling to cope, or at risk of suicide throughout Great Britain and Ireland. Their helpline is available 24 hours a day, 365 days a year, for free.

- Visit: https://www.samaritans.org/
- Call: 116 123 (free)
- Email: jo@samaritans.org
- The response time is typically 24 hours.
- Self-help App: https://selfhelp.samaritans.org/

Mind

Mind is a mental health charity in England and Wales that offers information, advice and support to people with mental health problems.

The Infoline provides an information and signposting service. It provides information about mental health problems, where to get help near you, treatment options and advocacy services.

- It is open 9am to 6pm, Monday to Friday (except for bank holidays).
- Visit: https://www.mind.org.uk/
- Call: 0300 123 3393 (Phone calls from UK landlines are charged at local rates. The charge for your call will depend on your mobile phone provider and the contract that you have with them.)
- Email: info@mind.org.uk
- Webchat service: available on the website

Shout

Shout is a free, confidential, and 24/7 text messaging service for anyone who is struggling to cope.

- Visit: https://giveusashout.org/
- Text: 85258

Hub of Hope

Hub of Hope is a national mental health database and signposting tool run by the charity Chasing the Stigma. It brings together organisations and charities from across the UK who offer mental health advice and support, making it easy for people to find the help they need in their area.

- Visit: https://hubofhope.co.uk/
- App: Available for free on iOS and Android devices

NHS help for suicidal thoughts

The NHS provides guidance for individuals experiencing suicidal thoughts, offering a range of support options and resources. This includes:

- 24/7 helplines and text services for immediate support
- Advice on contacting healthcare professionals and emergency services
- Tips for coping with suicidal feelings
- Guidance for those concerned about others
- Information on creating safety plans

For detailed information and access to these resources, visit:

https://www.nhs.uk/mental-health/feelings-symptoms-behaviours/behaviours/help-for-suicidal-thoughts/

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Foreword

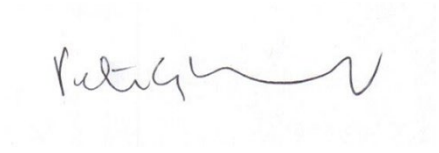
Every death by suicide is a tragedy, and suicides that happen on the railway are tragedies with profound and devastating effects for the lives of the loved ones left behind.

We know too that there can also be a long-lasting impact on the rail staff involved, with research from the Rail Safety and Standards Board finding that those witnessing a fatality are twice as likely to develop symptoms of post-traumatic stress disorder than rail staff who did not witness a fatality.[1] There are also impacts on rail passengers, including potential emotional distress for those who may witness an incident, and by those affected by significant disruption to their journeys.

Preventing rail suicides is crucial, and the Department for Transport has commissioned this research to bring change. First, we want to learn from evidence from within the UK rail industry and further afield to provide the best support we can for people in times of mental health crisis, and encourage others in the rail industry to do the same.

Second, we want to ensure the wellbeing of our rail staff and passengers. This research investigates how to support rail staff experiencing work-related trauma due to their involvement in a fatality, and also investigates the impacts on passengers and how they can be supported after experiencing a fatality on the rail network.

We hope that the evidence brought together in this report will help to identify priorities for rail suicide prevention and mitigation of its impacts, leading to a safer railway for us all.



Lord Peter Hendy of Richmond Hill CBE, Minister of State (Minister for Rail)

[1] Rail Safety and Standards Board (2021) The Rail Industry Mental Wellbeing Survey

Executive Summary

Background

Railway suicides account for around 4% of all suicides in the UK (RSSB, 2014), with recent data from the Office of Rail and Road (ORR) indicating that there were 274 fatalities due to suicide on the mainline in the year ending March 2024 (ORR, 2024). Each of these deaths represents a significant and tragic loss of life, with far-reaching impacts on families, friends, rail staff, and the broader community.

In 2024, the Department for Transport (DfT) commissioned the National Centre for Social Research (NatCen) to conduct a Rapid Evidence Assessment (REA) and qualitative interviews with a range of stakeholders, including central government, the rail industry, charities, and other public sector bodies. The aim of the research was to better understand the determinants of rail suicide, the effectiveness of prevention measures, the impacts of rail suicide on staff and passengers, and mitigation strategies to reduce impacts. The research aims to support the DfT in designing future policies, developing guidance, and prioritising research efforts in rail suicide prevention.

Methods

This report presents findings from 50 pieces of academic and grey literature that were selected following a process of systematic searching, screening, prioritising and extraction of evidence, alongside insights from stakeholder interviews. The literature that was reviewed consisted of a mix of evidence reviews, and primary and secondary research.

It is important to acknowledge that this REA does not capture all available evidence. Rail suicide prevention is an active area of research with new evidence regularly emerging, including ongoing projects by academics and other organisations. The intention was for this research to capture and synthesise the most relevant evidence at the time of writing, building on and complementing previous work in the field.

Although the focus of the research is the UK, the REA included evidence from other countries where it was felt that the evidence may have applicability to the UK context. Moreover, whilst the primary focus of the REA is rail suicides, where relevant, it also considered fatalities caused by trespassing and at level crossings given that these types of

fatalities share some common prevention interventions and impacts on staff and passengers.

Main limitations of the reviewed evidence

There were limited evaluation studies that used randomised control trials, quasi-experimental designs or theory-based designs, which made it difficult to draw definitive conclusions about 'what works'. It is however worth noting that adopting such evaluation designs when investigating rail suicide prevention interventions present some fundamental challenges. Firstly, the simultaneous implementation of multiple measures makes it difficult to assess the effectiveness of individual interventions. Secondly, while the use of a control group is crucial to ensure the robustness of intervention evaluation, it also raises ethical issues. These revolve around withholding potentially beneficial interventions from control group participants. Additional complexities include the transient nature of suicidal feelings, potential displacement to other stations and the relatively low number of incidents, which can lead to statistical challenges.

Key findings

The determinants of rail suicide

The review found evidence suggesting that rail suicides in the UK tends to cluster around specific locations and that a range of environmental factors increased the risk of rail suicide:

- Individuals who died by rail suicide tended to choose **locations near their home** or place of residence;
- **Tracks and smaller stations** were the most common location for rail suicides in England, as opposed to larger stations, foot crossings, level crossings or bridges;
- Evidence from outside of the UK suggested that **commuter areas and areas with high population density** were associated with higher rates of rail suicide. However, factors such as train traffic density, speed of trains, and accessibility of tracks could affect and confound this association.

There was evidence exploring the timing of rail suicide, including time of day, day of the week, and season:

- Most rail suicide incidents in the UK occurred during **daylight hours;**
- Rail suicide rates were higher on **Mondays and Tuesdays**;
- **Seasonal patterns** were less clear, with some evidence suggesting increased risk in autumn, while others pointing to higher frequency in spring and summer.

The review found strong evidence suggesting that certain demographic and individual characteristics could be associated with a higher risk of rail suicide:

- **Men aged between 18-44, unemployed, single and living alone** were more likely to die by rail suicide than women, older people and people who were employed and in a relationship;

- **Mental health problems** were prevalent among those who died by rail suicide, with many having received psychiatric care or being inpatients at the time of death;

- International evidence suggested an association between **substance use** and rail suicide, particularly among younger individuals.

There was consistent evidence that suggested an association between **media reporting** of notable rail suicide cases and subsequent increases in rail suicide incidents. The evidence reviewed also found that in the UK and Ireland, news articles about rail suicides tended to focus more on fatal incidents and include more details on the methods compared to reports on other forms of suicide. This may reinforce the lethality of rail suicide and influence imitation behaviours.

Interventions with strong evidence

The review found strong evidence on the effectiveness of **physical barriers** in preventing rail suicides:

- **Platform Screen Doors** (PSDs) were highly effective in underground stations but had limited applicability in the UK's open rail network. Full-length PSDs showed the greatest impact, while half-sized PSDs demonstrated lower effectiveness;

- **Fencing along tracks** showed significant promise and were particularly relevant as tracks were the second most common location for rail suicides in the UK.

The review also found international evidence on the effectiveness of other types of **interventions**:

- **Media reporting guidelines** reduced rail suicides and attempts, though these have not been formally evaluated on social media;

- **Security personnel in stations and surveillance systems** on tracks and railway bridges were effective in reducing rail suicide and trespassing.

Interventions requiring further research

- The review found weak evidence suggesting that **broader public awareness campaigns,** aimed at creating a more friendly, supportive and compassionate railway environment, might be more effective than suicide-specific campaigns in preventing rail suicide;

- **Blue lights** refer to blue light-emitting-diode lamps and are believed to have a calming effect. They were found to reduce suicide rates at night in Japan but their

effectiveness has been questioned and their applicability in the UK requires further investigation;

- **Mid-platform fencing** showed potential in reducing rail suicides on 'fast lane' platforms, relevant to the UK's high-speed rail networks, but the evidence was preliminary;

- There was some evidence to suggest that **staff training programmes** increased staff confidence in identifying and intervening in suicide attempts;

- **AI-powered CCTV systems** showed potential for early detection and intervention, though their practical implementation requires further research.

Impact on staff

The review found evidence to suggest that rail suicides and accidental fatalities can have significant **psychological effects** on train drivers. These included:

- **Severe psychological distress**, leading to symptoms of post-traumatic stress disorder (PTSD), anxiety, and depression;

- **Occupational impacts** for drivers witnessing rail suicide, such as having to take sick leave, having to adapt their work practices and, in some cases, leaving the profession altogether.

Although this study found little evidence regarding the impacts on **other staff, some** evidence indicated that rail suicides and accidental fatalities increased levels of stress among other rail staff including railway engineers, train crew members and rail industry employees who stopped or intervened in a suicide attempt.

The review found evidence to suggest that a range of **mitigation measures** can be implemented to help staff cope with the impacts of rail suicides and fatalities:

- There was strong and consistent evidence indicating that **psychotherapy programmes** and **eye movement desensitisation and reprocessing therapy** (EMDR)[2] reduced the effects of post-traumatic symptoms in rail staff. However, there was variation in individual responses and long-term outcomes;

- **Trauma support training** was rated very highly by rail staff, who felt it reduced stress post event.

Impact on rail passengers

This study found little evidence on the impact of rail suicide on rail passengers. However, some evidence explored the emotional responses and reactions generated by specific

[2] Comprehensive psychotherapy that helps to process and recover from past experiences that may affect mental health and wellbeing. It involves using side to side eye movements combined with talk therapy in a specific and structured format.

railway announcements. These included **sadness, sympathy, fatigue and frustration as a result of the disrupted journey**.

Mitigation strategies to support passengers included:

- Providing **safe spaces** for those who have intervened in suicide attempts;
- Using **less graphic terminology in announcements**;
- Offering more **detailed information** about the transport disruption and alternative routes.

Introduction

Policy context

Railway suicide accounts for around 4% of suicides across the United Kingdom (RSSB, 2024). The most recently published statistics by the Office for Rail and Road (ORR) (2024) show that in the year ending March 2024, there were 274 fatalities due to suicide on the mainline. Each of these deaths represent significant and tragic loss of life, with far-reaching impacts on families, friends, rail staff, and the broader community.

To prevent rail suicide, there is a need to better understand the phenomenon, the profound and life-altering impacts it produces, and which prevention measures are most effective. This research aims to support the Department for Transport (DfT) in the design of future policy, the development of guidance, and the prioritisation of future research efforts.

Key organisations

In Great Britain, the key organisations involved in suicide prevention on the railways include (House of Commons Library, 2024):

- **British Transport Police (BTP)**: they are typically the first to respond to suicide incidents on the rail network.
- **Network Rail**: as a public sector arm's length body of the Department for Transport, it owns and manages all railway infrastructure throughout Great Britain.
- **Train Operating Companies**: these organisations employ staff who run passenger and freight services across the rail network.
- **Third-sector organisations**: they play a crucial role in suicide prevention on the railway (e.g. Samaritans, the OLLIE Foundation, the Jordan Legacy and Chasing the Stigma)

The Department for Transport (DfT) works with their agencies and partners to support the rail network in Great Britain, including planning and investing in infrastructure, and setting requirements for Train Operating Companies (TOCs) in their contracts to run rail services.

TOCs are required to have a suicide prevention plan as a condition of their contract with the DfT. The DfT delegates the management of track infrastructure to Network Rail (NR).

In Northern Ireland, railway policing is handled by the Police Service of Northern Ireland (PSNI) through its specialised Safe Transport Team, rather than the British Transport Police. This team works in partnership with Translink, the main state-owned public transport provider in the region.

While this report primarily references Samaritans as they were frequently mentioned in the evidence reviewed, other charitable organisations are also actively involved in suicide prevention, including the OLLIE Foundation, the Jordan Legacy and Chasing the Stigma.

Research objectives

In 2024, the Department for Transport (DfT) commissioned the National Centre for Social Research (NatCen) to conduct a Rapid Evidence Review (REA) assessment and qualitative stakeholder interviews to explore the determinants of rail suicide, the effectiveness of prevention measures, and the impacts of rail suicide on staff and passengers, as well as mitigation strategies.

This study is primarily concerned with exploring rail suicide. However, some included evidence examines rail suicide alongside fatalities from trespassing and at level crossings. This was included because, despite having different motivations, rail suicides and fatalities from trespassing and at level crossings are likely to share some common prevention interventions and impacts on staff and passengers.

The study attempts to answer the following research questions:

Research question 1: Which types of interventions are most effective at preventing rail suicides, fatalities due to rail trespassing, and fatalities at level crossings?

- What are the determinants of rail suicides?
- What types of interventions are already in use?
- How effective is each type of intervention?
- How does the effectiveness of interventions vary?
    - Across contexts, including at stations/platforms vs. elsewhere; in the UK vs. other countries; during the day vs. at night; at rush hour vs. other times.
    - Across demographic groups, including people with severe mental health conditions; men and women; older and younger people.

Research question 2: What are the impacts of rail suicides, fatalities due to rail trespassing, and fatalities at level crossings?

- What are the impacts on staff, including both drivers and other staff?

- What are the impacts on passengers?
- What are the most effective ways of mitigating these impacts?

Report overview

The report is structured as follows:

- **Executive summary**, which provides a high-level summary of key findings.
- **Introduction**, which provides background to this rapid evidence assessment and describes the research questions and objectives.
- **Methodology**, which provides a summary of the methodology used for identifying and synthesising relevant evidence.
- **The determinants of rail suicide**, which discusses environmental, societal, and individual factors influencing rail suicide.
- **Interventions and their effectiveness**, which discusses evidence of what types of interventions are in use, how effective the interventions are and how their effectiveness varies in different contexts and for different groups.
- **Impact on staff and passengers**, which explores evidence of what impacts rail suicides and fatalities have on drivers, other rail staff and passengers, and the most effective ways of mitigating these impacts.

Methods

The study used a REA methodology. An REA sits between a literature review and systematic review: it follows rigorous and transparent methods for searching, screening, assessing and synthesising evidence, whilst making informed compromises on aspects of the systematic review process in order to deliver findings quickly. This chapter provides a summary of the methodological approach of the REA including stakeholder interviews, the criteria and processes for the search strategy, screening, data extraction and reporting, and limitations of the research design. A detailed description of the methodology can be found in Appendix A: Detailed methodology.

Stakeholder interviews

NatCen conducted eight online qualitative interviews, each lasting an hour, with stakeholders representing a diverse range of organisations, including central government, the rail industry, charities, and other public sector bodies. These interviews aimed to:

- Ensure the research team was well-informed about the current policy and research landscape;
- Familiarise the team with relevant terminology; and
- Facilitate access to otherwise hard-to-reach grey literature.

Relevant insights gained from these interviews are incorporated throughout this report.

Search strategy

The search strategy involved separate searches for academic and grey literature:

- Peer-reviewed academic literature was first searched for, using a combination of search strings in academic databases. Citation tracking was then undertaken, which involved reviewing the list of referenced papers in selected papers to establish their relevance for inclusion in the REA.

- Grey literature was searched for by identifying a list of relevant organisations and searching their websites using key terms, alongside consulting key stakeholders for relevant sources. Further details on the search strategy can be found in Appendix A: Detailed methodology.

To be included, the sources had to meet the following criteria:

- Being academic or grey literature, both published and unpublished;
- Written in English;
- Based on data collected from 2000 onwards; and
- Focusing on the UK.

Studies exploring the phenomenon in Europe, North America and Australia were also added due to their similarity and relevance to the UK context. The geographical scope was later expanded to include Japan, Hong Kong and South Korea due to a significant number of relevant studies from these countries. The included papers featured systematic reviews, as well as primary or secondary research on the determinants of rail suicide, trespassing and fatalities at level crossings, prevention measures and their effectiveness, impacts on staff and passengers, and related mitigation interventions.

Screening

The academic and grey literature papers were screened at two stages: at the title and abstract screening stage, and at the full text screening stage. A total of 1001 papers were screened at title and abstract and 192 of these were selected for full text screening. On completion of full text screening, 171 papers met the inclusion criteria. A systematic prioritisation process was undertaken, based on assessing the relevance and quality of each paper, to determine which 50 would be included for final data extraction. Fifty papers were selected as this struck a balance between comprehensive coverage of the topic and the practical constraints of an REA. Prioritisation criteria included:

1. Studies that draw on multiple evidence sources such as systematic or evidence reviews;
2. Studies that obtained a higher quality score[3] for the research methods used;
3. Studies that answered more than one REA research question;
4. Studies that were more recent (post 2018);
5. UK evidence over international evidence.

[3] The quality score was determined by the evidence quality assessment methodology that NatCen uses to review evidence for rapid evidence assessments. For each evidence type, there are certain factors that should be looked at when making an assessment, to then evaluate each evidence source based on a quality ranking from A (highest) to C (lowest).

Further sense checks were carried out for each source to ensure they were fit for purpose and to maintain an optimal balance of sources for each research question. This process meant that not all the initially top-ranked 50 papers were selected. For example, we found limited evidence addressing research question 2.[4] To address this gap, we included some papers that, while scoring lower in our prioritisation assessment, provided evidence on this specific topic.

The PRISMA flowchart in Figure 1 outlines the results of the search, screening and selection process. A detailed overview of this process can be found in Appendix A: Detailed methodology.

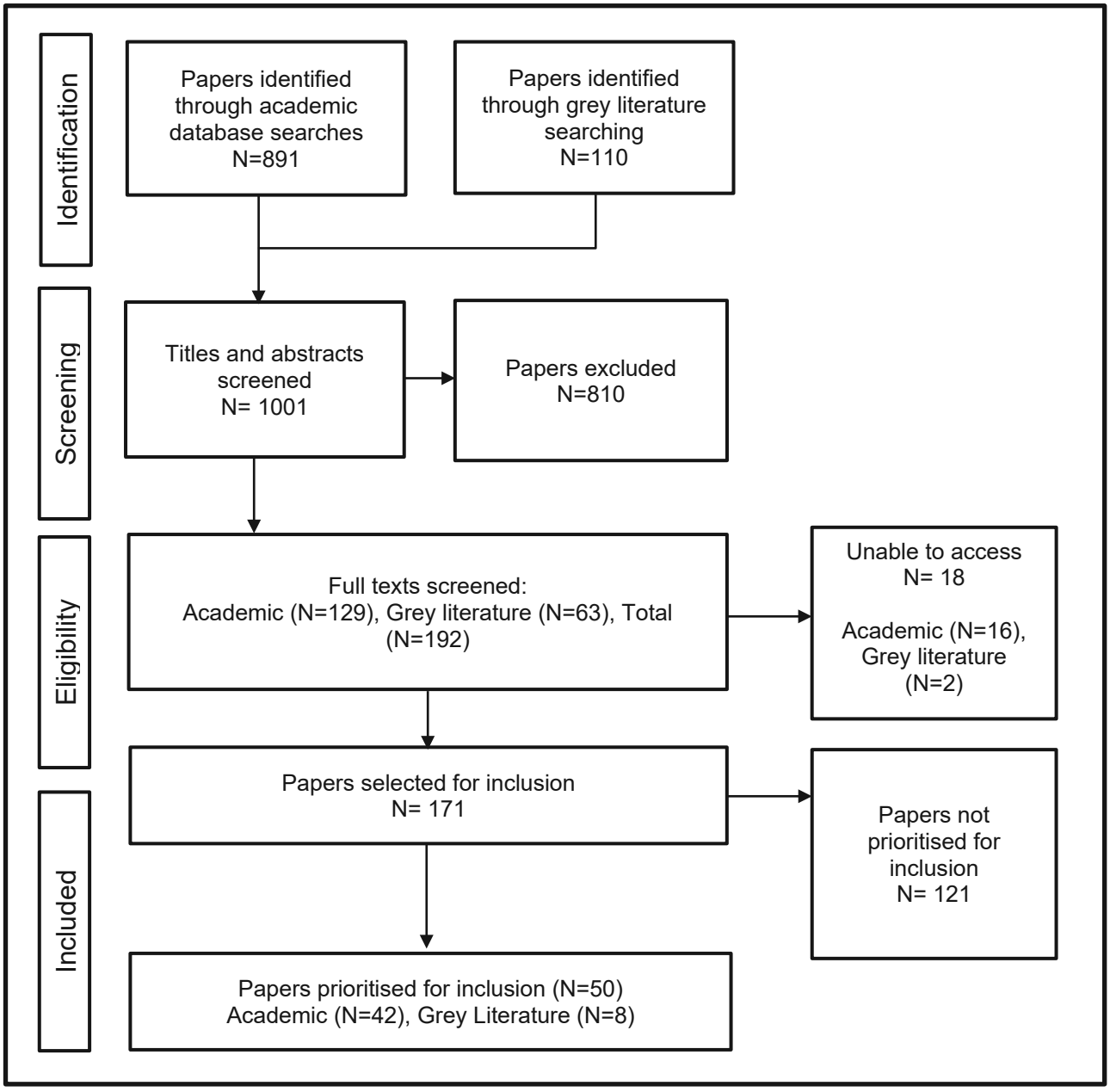


Figure 1 PRISMA flow diagram

[4] Research question 2: What are the impacts of rail suicides, fatalities due to trespassing, and at level crossings?

Data extraction and reporting

Based on an initial review of a subset of the prioritised papers, a thematic framework was developed. The framework was structured by the key themes included in the research questions and additional themes emerging from the selected prioritised papers. Members of the research team read the 50 prioritised papers in full and extracted relevant evidence for each theme. Evidence extracted was then used to populate the framework. This approach links summarised evidence to specific thematic areas. A comprehensive quality assessment was also conducted for each paper, using criteria outlined in greater detail in Appendix A: Detailed methodology. Justifications were documented for each score assigned.

The report is structured in line with the thematic framework, including a narrative summary of evidence addressing each research question.

Limitations of the research design

This study is a focused REA. It draws on a limited number of sources to answer the research questions, using a systematic screening and prioritisation process. To draw more exhaustive conclusions, a systematic evidence review would be required.

The determinants of rail suicide

This chapter discusses evidence on the determinants of rail suicide. These include differences in the geographical distribution of rail suicides across and within countries; socio-environmental factors; characteristics of the railway environment; timings of rail suicide; individual characteristics of those dying by rail suicides; and the impact of media reporting.

Geographical distribution

This section outlines the evidence on how rail suicide rates vary across countries. It also explores the presence of rail suicide clusters within countries. These are broadly defined as locations where there is a relatively high number of rail suicides.

Differences across countries

The evidence reviewed highlighted variations in rail suicide rates across countries. Mishara and Bardon's systematic review (2016) found that rail suicide incidents were lower in the UK (2% to 5% of all suicides) than in other European countries (3% to 12% of all suicides), but higher than in North America (1% of all suicides) and Australia (2% of all suicides).[5] The authors drew similar conclusions in a subsequent study (Mishara & Bardon, 2017) based on secondary analysis of railway and coronial data in Canada. Their study found that Canada had similar rates of rail suicide (1% of all suicides) to Australia (2% of all suicides), but lower than Europe (5% to 14% of all suicide).

The authors speculated that such variations might be due to a lack of consistent methods of reporting and classifying deaths across countries. They also suggested that rates could vary due to substantial differences in accessibility to trains across countries. For example, in European countries trains are more readily accessible than in Canada as there are more train crossings, denser railway traffic and more passenger trains. The same is likely to be true of other countries such as Australia and the USA.

[5] Studies reviewed by Mishara and Bardon (2016) found different proportions of rail suicides. These were summarised as ranges.

Clusters

There was evidence to suggest that rail suicides in the UK tend to occur in clusters, namely specific areas or stations, which account for a small proportion of the rail network.

There is no unanimous definition of suicide clusters. The National Institute for Mental Health Institution in England (NIMHE) defines them as physical locations where there is a relatively high number of suicides among the resident population. Public Health England identifies a suicide cluster as a physical location where three or more deaths have occurred. However, two suicides taking place in a specific community or setting (e.g. school) over a short period of time may also be considered a cluster, particularly when young people are involved (Public Health England, 2019). In the context of rail suicide, the evidence reviewed defines clusters as delimited physical locations where two or more rail suicides occurred within 2km of the railway tracks (Mishara & Bardon, 2016). It is however important to note that when statistically analysing low frequency events, such as rail suicides, apparent clustering at specific locations may be due to random chance rather than indicating real location-specific patterns.

Notwithstanding this, the evidence suggested that rail suicide clusters present specific characteristics (Mishara & Bardon, 2016) including:

- An easily accessible location;
- A location within walking distance to a level crossing;
- An area near a mental health institution (less than 2km away/walking distance);
- A location offering privacy;
- A location with limited visibility for train drivers;
- A location with media publicity around rail suicides.

Tseloni et al. (2011, cited by Mishara and Bardon, 2016) found that, between 2000 and 2010, 37 stations in the UK accounted for 8.5% of all railway suicides and 22% of in-station railway suicides. The source identified 20 stations where more than one attempt took place over seven years of monitoring. Moreover, the authors found that some larger areas (Districts and Unitary Authorities) in the UK recorded higher rates of rail suicide, suggesting that there could be regional clusters in some areas of the country. However, the source does not provide specific details on these broad regional trends.

Strauss et al. (2017) analysed suicide cases on the railway network in Austria and found 15 clusters spread throughout the country. These 15 clusters represented only 0.9% of the country's total track length. In contrast, two studies by Mishara and Bardon (2016; 2017) found that most of the clusters identified in Canada only accounted for two rail suicides. However, the authors noted that the low number of rail suicides, though meeting the definition of a cluster, might limit the significance of the findings.

Conclusion

There was strong evidence to suggest that rail suicides in the UK account for 2% to 5% of all suicides, a rate lower than in other European countries but higher than in North America and Australia, where railway networks are more limited. Incidents in the UK tended to cluster around specific locations, with an example being 37 stations that accounted for 8.5% of all railway suicides and 22% of in-station suicides between 2000 and 2010.

Socio-environmental factors

This section describes the evidence on the association between rail suicide and a range of socio-environmental factors including socio-economic factors, population density and railway traffic, proximity to rail tracks, proximity to commuter areas, proximity to home, and to psychiatric facilities.

Socio-economic factors

With the exception of Wales, evidence suggested that the socio-economic characteristics of an area in UK nations do not influence rates of rail suicide.

Tseloni et al (2011a cited in Mishara and Bardon, 2016) found that, in England, Scotland and Northern Ireland, areas with higher levels of deprivation were not more likely to present higher rates of rail suicide than areas with lower levels of deprivation. Norman et al. (2022) indicated that rates of rail suicide in England were distributed evenly across areas with different socio-economic levels, measured by the index of multiple deprivation. By contrast, more deprived areas in Wales recorded higher rates of rail suicide (Mishara & Bardon, 2016). The authors did not offer an explanation as to why Wales could be an outlier.

Population and train traffic density

There was evidence to suggest that, in the UK, more densely populated areas, e.g. cities, presented higher rates of rail suicide. However, there was variation across countries, with evidence indicating that areas with lower population density (e.g. rural and suburban areas) presented greater rates of rail suicide due to easier access to trains, higher railway traffic density and higher speed of trains.

The relationship between population density and rail suicide rates appears to be complex and varies across countries. Mishara and Bardon's systematic review (2016) found that a higher population density was associated with an increased risk of rail suicide. In the UK, railway suicide rates were typically higher in major cities, with high population densities (Mishara & Bardon, 2016). Conversely, Abbott et al. (2003, cited in Strauss et al., 2017) found that, in the Netherlands, the least populated, rural regions presented the highest rates of rail suicides, while the most populated, urban regions presented the lowest. The authors concluded that tracks in the Netherlands may be less accessible in areas with high population density therefore reducing the risk of rail suicide. Similarly, Strale et al.'s secondary analysis (2018) found that rail suicide rates in Belgium were greater in suburban areas with lower population density than in urban areas.

These mixed findings may be explained by considering additional factors beyond population density. Strale et al. (2018) explained that suburban areas tend to have high train traffic density[6], crossings, tunnels and bridges, and trains running at higher speed, which may contribute to increased rail suicide rates. They concluded that, despite presenting a higher population density, urban areas may have lower rail suicide rates due to greater social control, reduced accessibility to tracks, and trains running at lower speed. This range of factors may mediate or confound the impact of population density on rail suicide rates.

Proximity to railway tracks

There was inconsistent evidence on the association between place of residence and proximity to rail tracks and higher rates of rail suicide. No evidence was found exploring this association in the UK context.

Based on a secondary analysis of coronial data in Australia, Too et al. (2017a) found that individuals who lived in an area with railway tracks were more likely to choose rail suicide as a method compared to those who lived in an area without railway tracks. Conversely, van Houwelingen et al. (2013) found that increased availability of tracks was not a relevant predictor of rail suicide. Instead, the authors argued that rail suicide rates were higher in areas characterised by high train traffic density.

Proximity to commuter areas

There was evidence indicating that proximity to commuter areas and commuter trains was associated with high rates of rail suicide. However, there was a lack of evidence on this association in the UK context.

In Australia, Too et al. (2017a) found that living in an area with a high proportion of people who travelled to work by train[7] was a stronger predictor of death by rail suicide, compared to availability and access to trains, as opposed to other suicide methods. Supporting this finding, Mishara and Bardon (2017) found that fatalities[8] on the rail network in Canada classified as rail suicides occurred more frequently with commuter trains (54%) and passenger trains (46%), compared to fatalities classified as accidents[9] which occurred more frequently with freight trains (63%).

[6] Defined by van Houwelingen et al. (2013) as number of trains passing per day in a given geographic area.
[7] Percentage of employed people aged 15 years and above who travel to work by train in each postcode, calculated as a ratio to the total employed persons.
[8] Defined by Mishara & Bardon (2017) as deaths on the rail network classified as suicides, accidents or undetermined according to the coroner's classification of manner of death and a careful examination of the data.
[9] Defined by Mishara & Bardon (2017) as situations where there was no indication of suicide risk from the person's history and behaviours, as well as events from eyewitness accounts.

Proximity to home

Overall, the evidence consistently showed that individuals who died by rail suicide in the UK tended to choose locations near their home or place of residence.

In England, Norman et al.'s (2024) secondary research found significant variation in the distance between individuals' place of residence and their place of death. However, the median distance was 2.1 miles, suggesting that individuals who died by rail suicide tended to travel short distances. Similarly, Martin and Rawala (2017) found that 84% of individuals who died by rail suicide on the London underground lived in London at the time of the event.

Relatedly, using secondary data from psychosocial autopsies in the Netherlands, Balt et al. (2024) found that individuals who died by rail suicide were likely to choose locations that were part of their daily routine (e.g., commuting to work or school). Albeit less common, other settings included locations with personal meanings, and remote and quiet locations (Balt, et al., 2024).

Proximity to psychiatric hospitals/mental health institutions

There was some evidence to suggest a relationship between rail suicide rates and proximity to mental health institutions. However, evidence on the subject exploring the UK context was outdated.

Based on rail suicide data in London, between 1940 to 1990, Farmer et al. (1991, cited in Mishara & Bardon, 2016) and O'Donnell & Farmer (1994, cited in Mishara & Bardon, 2016) found rail suicide clusters near London underground stations that were close to psychiatric hospitals. The geographical locations of many psychiatric institutions in London have likely not substantially changed since the study was carried out. Therefore, while it is important to note that these findings are significantly outdated, these observations may still hold some relevance to the current circumstances. In contrast, evidence reviewed by Bhui et al. (2013) found that psychiatric inpatients that died by rail suicide in South England did not always choose the station or railway line closest to their unit.

Strale et al. (2018) found that in Belgium, rail suicides were higher in areas closer to psychiatric facilities. These findings were consistent with research conducted in Australia, Netherlands and Canada which also found that the proximity to psychiatric facilities was associated with greater rail suicide rates (Mishara & Bardon, 2016; Too, et al., 2017b).

Conclusion, evidence gaps and future research

The review found several areas where there were strong and consistent findings on rail suicide in the UK. Notably, the socio-economic characteristics of an area did not influence rates of rail suicide in most of the UK, with Wales being an exception. There was also strong evidence that individuals who died by rail suicide tended to choose locations near their home or place of residence. Consistently, international evidence suggested that commuter areas and commuter trains were associated with higher rates of rail suicide.

The evidence indicated that the relationship between population density and rail suicide rates is complex and mediated by factors such as train traffic density, speed of trains, and accessibility of tracks. There was also some indication that proximity to psychiatric hospitals may be associated with higher rail suicide rates, though UK evidence on this was mixed and outdated.

Against this backdrop, further up-to-date and comprehensive evidence on the geography of rail suicide in the UK is warranted. This should consider multiple factors such as railway infrastructure, traffic density, and urban/rural locations. More recent research on the association between rail suicide and proximity to mental health institutions in the UK was lacking. This gap is particularly important, as understanding this relationship could inform targeted interventions involving collaboration with mental health institutions near high-risk railway areas.

Railway environment

This section discusses the evidence on the most common railway locations for suicides, availability of tracks and trains, as well as rail usage and distance of travel.

Railway location

The evidence suggested that, in England, station platforms and tracks away from stations were the most common locations for rail suicide, with station platforms being slightly more common. Other less common locations for rail suicides in England were foot crossings, level crossings or bridges. However, trends varied across countries, with some presenting higher rates of railway suicide on railway tracks away from stations.

Norman et al. (2024) found that, between 2019 and 2021, 43% of rail suicides in England occurred at station platforms, with an additional 4% on tracks accessed via stations. The second most common location were tracks away from stations, accounting for 34% of cases. Following this, 8% took place at foot crossings, 7% at level crossings and 4% from bridges over the tracks. These findings broadly aligned with UK-based research by Duddin and Raynes (2022), which identified stations or platforms as the most common locations mentioned in the 75 suicide notes the authors reviewed, followed by tracks.

Notwithstanding this, there was evidence to suggest that railway location patterns varied across countries. For example, in Canada, the USA, Australia and the Netherlands, rail suicide incidents were more frequent on open tracks and away from stations (Mishara & Bardon, 2016). Several factors may explain these differences, including population density, physical geography, railway infrastructure and rail suicide prevention interventions implemented (Mishara & Bardon, 2016).

Furthermore, sources indicated that location patterns for railway suicides may vary by gender, although the underlying reasons for these differences remain unexplored. Evidence in England and the UK consistently found that women were more likely to choose stations as locations for rail suicide (Norman, et al., 2022; Norman, et al., 2024). Conversely, men were more likely to choose tracks away from stations (Norman, et al., 2022; Norman, et al., 2024).

Availability of tracks, trains and stations

This section discusses the evidence on the association between rail suicide and track length, and station size, as well frequency of train services and train speed. Within the evidence reviewed, these have been used as indicators for availability of tracks, trains and stations.

Track length and station size

The evidence reviewed found no association between railway track length and rail suicide. There was evidence to suggest that, in England, smaller stations were more likely to record higher rates of rail suicide. However, this association varied by countries.

Van Houwelingen et al. (2013) found no relationship between track lengths and rail suicide rates in the Netherlands and Germany. For the Netherlands specifically, the authors argued that higher train frequency explained the higher rates of rail suicide, as discussed in more detail below. The study did not provide a similar explanation for Germany, suggesting that factors influencing rail suicide rates may vary between countries.

There was inconsistent evidence on the relationship between station size and rail suicide rates across countries. In England, Norman et al. (2024) found that nearly two-thirds of station-related rail suicide deaths occurred at smaller stations with only one or two platforms. Conversely, Sueki (2022, cited in Norman et al., 2024), found that rail suicides in Japan were more frequent at larger stations. Norman et al. (2024) speculated that in England, fast trains might be more likely to pass through smaller stations without stopping. This could potentially increase both the ease of access for suicide attempts and the lethality of the method, which are key motivating factors for those contemplating or attempting suicide by rail (Norman, et al., 2024). Furthermore, there may be a lack or limited presence of staff and bystanders at smaller stations who could intervene in a suicide attempt, which is discussed in more detail in the Staff and bystander support section.

Train frequency and speed

The evidence consistently suggested that higher frequency of train services and faster trains were associated with increased rail suicide rates. However, this association was not explored in the UK context.

Too et al.'s systematic review (2014) found that higher train frequency and speed increased the risk of railway suicide. In a subsequent study, Too et al, (2017a) similarly found that individuals living in areas with more frequent train services were more likely to die by rail suicide compared to those in areas with less frequent services. However, the authors noted that the association varied by railway type: train frequency was primarily associated with suicides on the main rail network, while train speed was more closely linked to suicides in subway systems (Too, et al., 2014).

Rail usage

Rail usage refers to both passenger journeys and number of passengers. The Office for National Statistics (ONS) defines a passenger journey as a count of the total number of boardings of each train. For example, a trip which requires a change from a train to another would be counted as two journeys (Department for Transport, 2022). The evidence on the relationship between rail usage and suicide rates was inconsistent and varied across countries. In the UK, this was only explored in the context of the London Underground, making the findings difficult to generalise more widely.

Martin and Rawala (2017) found that the association between number of passenger journeys and risk of rail suicide varied across countries. For example, positive correlations were observed in both Sweden and the Netherlands (Ceccato and Uittenbogaard, 2016; Van Houwelingen et al., 2010 cited in Martin and Rawala, 2017), whereas no association was found in Vienna (Sonneck et al., 1994 cited in Martin and Rawala, 2017). In London, Waterloo station did not rank among the top 20 stations for suicide attempts on the London Underground between 2000 and 2010, despite being the busiest station in terms of passengers entering, exiting, and interchanging (Delta Rail, 2011 cited in Martin & Rawala, 2017).

Further illustrating this inconsistency, Too et al. (2014) found that greater numbers of passengers increased the risk of railway suicide in Austria, but not in the Netherlands and Germany. Van Houwelingen et al. (2013) suggested that any apparent relationship between passenger numbers and suicide rates might be attributable to train traffic intensity, such as the frequency of train services, rather than passenger volume alone.

Conclusion, evidence gaps and future research

The evidence reviewed provided a range of consistent findings on the rail suicide locations in England. Stations and tracks were the most common sites, as opposed to crossings or bridges, with stations being slightly more frequent. A consistent gender pattern showed that women were more likely to choose stations, while men tended to choose tracks away from stations. However, there was a lack of evidence exploring such pattern across other socio-demographic characteristics. Some evidence suggested smaller stations in England were associated with higher rates of rail suicide, possibly due to fast trains passing through without stopping, ease of access, and limited staff presence. Strong international evidence linked higher train frequency and speed with increased rail suicide rates. The relationship between rail usage and suicide rates was inconsistent across countries, with limited UK-specific evidence outside of London.

Future research should prioritise examining the relationship between rail suicide and factors such as train usage, station size, train frequency, and speed within the UK. Further quantitative research is required to explore the extent to which socio-demographic characteristics affect location choices. This should be combined with qualitative research to understand the reasons behind any potential differences.

Timing of rail suicides

This section explores the evidence on the association between rail suicide and time of the day, day of the week, season and weather.

Time of day

There was evidence to suggest that, in the UK, rail suicides were more frequent during daylight hours. However, there was variation across countries, with some presenting greater risk of rail suicide at nighttime. There was also non-UK evidence suggesting that gender and age affected timing of rail suicide.

Krysinska and De Leo's systematic review (2008) found that daylight visibility was associated with a higher frequency of rail suicide. Consistently, Norman et al.'s (2024) secondary analysis found that 66% of rail suicides in the UK occurred during 6am to 6pm, with 53% taking place during broad daylight. This pattern is likely to be influenced by the greater availability of train services during the day as compared to the night (Krysinska & De Leo, 2008). However, more sunlight in the days prior to the incident was associated with less frequent rail suicide attempts (Mishara & Bardon, 2016).

Two studies conducted in Finland and Germany produced mixed findings. Silla and Luoma (2012) found that rail suicide and fatalities from level crossings or trespassing in Finland were most common after midnight, as well as during the afternoon and evening. Lukaschek et al. (2014) found that rail suicides in Germany were more likely to occur between 6am and noon, and between 6pm and midnight.

The evidence also suggested that gender and age could affect timing patterns of rail suicide. Van Luipen et al.'s secondary analysis (2002, cited by Mishara and Bardon, 2016) found that rail suicide in the Netherlands occurred more commonly 1.5 to three hours after sunset for men, and seven to eight hours before sunset for women. Silla and Luoma (2012) found that rail suicide in Finland was more common during the evening and night for those under the age of 30 but more common between noon and midnight for those over the age of 30.

Day of the week

There was mixed evidence exploring weekly patterns of rail suicide. Some evidence suggested that rail suicide rates were higher on Mondays and Tuesdays, and lower on weekends compared to other days of the week. Other studies found no weekly patterns.

In the UK and other countries[10], rail suicides occurred most frequently on Mondays and Tuesdays and were less common on the weekend (Norman, et al., 2024; Mishara & Bardon, 2016; Krysinska & De Leo, 2008). Krysinska and De Leo (2008) and Lukaschek et al. (2014) suggested that the peak of rail suicides on Mondays and Tuesdays could be the result of the 'broken promises' effect. This was described as the emotional letdown that can occur when positive expectations associated with the weekend are not fulfilled. This

[10] Including Netherlands, Germany, Finland, and Sweden.

disappointment can lead to a significant drop in mood at the beginning of the new week, accompanied by feelings of personal failure or isolation, particularly in vulnerable people (Lukaschek, et al., 2014).

Notwithstanding this, some evidence found stable rates of railway suicide and accidental fatalities throughout the week, with only small variations (Mishara & Bardon, 2016; 2017). For example, a study on the Montreal Metro by Bardon et al. (2013, cited in Mishara and Bardon, 2016) found no stable pattern of rail suicide by day of the week.

It is worth noting that there was variation in the scope of the sources reviewed, with some focusing on both rail suicide and accidental fatalities, and others solely on rail suicide. This variation may explain some of the inconsistencies observed in the temporal patterns.

Season

There was mixed evidence examining seasonal patterns of rail suicide in the UK. Some sources found that the risk of rail suicide increased in the autumn, while others suggested that the risk increased in the spring and summer. Moreover, there was variation across countries.

Tseloni et al. (2011a cited in Mishara & Bardon, 2016) found that rail suicides in the UK tend to be more frequent in the autumn, between September to November. However, the study noted significant variation across the years. Martin and Rawala (2017) found small increases in Person Under Train (PUT) accidents[11] on the London Underground from May to August, with a small peak in June. The authors speculated that this could be the result of higher levels of tourism in the summer months but noted that the link between tourism and rail suicide is unclear. Moreover, the findings might not be applicable to the wider railway network.

The seasonal variation in railway suicides, with higher rates observed during summer months, could also be attributed to weather conditions. There was evidence suggesting that rates tended to be higher when the weather was warmer, probably due to the outdoor nature of rail suicide (Mishara & Bardon, 2016; 2017). For example, Mishara and Bardon (2013, cited in Mishara & Bardon, 2016) found that around 70% of rail suicide in Canada took place on a clear day and 18% on a cloudy day with no rain.

However, research by Bardon et al. (2013, cited in Mishara and Bardon, 2016), exploring rail suicide patterns in the Montreal Metro, found that a moderate majority (35%) of rail suicides occurred in the winter months. Moreover, no consistent seasonal pattern was found in the New York Subway, which instead presented great monthly variation (Lin & Gill, 2009 cited in Mishara & Bardon, 2016).

Conclusion, evidence gaps and future research

The evidence reviewed indicated some temporal patterns in UK rail suicides. Most incidents occurred during daylight hours, with higher rates on Mondays and Tuesdays. Gender and age appeared to influence timing, although UK-specific evidence on this was

[11] An incident caused by a person who has accidently or intentionally fallen in front of a moving train

lacking. Seasonal patterns were less clear in the UK, with some evidence suggesting increased risk in autumn, while others pointed to a higher risk in spring and summer.

Further evidence is required to strengthen understanding of temporal patterns in UK rail suicides. Firstly, future research should seek to explore potential gender and age-related differences in the timing of rail suicide in the UK, investigating the underlying reasons for any patterns observed. Regular, up-to-date data on weekly patterns of rail suicide would be beneficial to ensure the evidence consistently reflects recent trends and any changes in timings. Secondly, future research should investigate the relationship between seasonal variations and rail suicides and the impact of specific weather conditions. Thirdly, future research should seek to accurately differentiate between rail suicides and accidental fatalities in data collection and analysis. Lastly, comparative analyses between rail suicides and general suicides would provide valuable context for understanding if rail-specific temporal patterns exist. This evidence would provide valuable insights to refine prevention strategies, based on more effective and time-sensitive interventions aimed at reducing rail suicides.

Individual characteristics

This section discusses individual characteristics of those dying by rail suicide. Specifically, it explores demographic characteristics (e.g. age, gender and ethnicity), mental health, life circumstances, previous exposure to rail suicide, and patterns of substance abuse.

Age

There was broadly consistent and strong evidence to suggest that, in England, individuals under the age of 44 were more likely to die by rail suicide than those over the age of 44. This was in line with patterns of rail suicides across other countries.

Norman et al. (2022) found that 51% of rail suicide cases in England were aged 18-44. Similarly, Martin and Rawala (2017) found that 59% of those who died in the London Underground were aged 15-44. This finding contrasts with the most recent data (2023) on overall suicide statistics in England and Wales (Office for National Statistics, 2024), where in 2023 people aged 50 to 54 years were more likely to die by suicide than other age groups. This difference suggests that individuals under the age of 44 are more likely to die specifically by rail suicide and that this trend is not the result of this group being more likely to die by suicide more generally.

Outside of the UK, a systematic review found young adults were overrepresented in two metro systems (Mishara & Bardon, 2016). In Montreal, approximately 66% of cases involved individuals under 40 (Mishara, 1999, cited in Mishara & Bardon, 2016). In Munich, individuals aged 20-29 (24%) were consistently overrepresented among the cases of rail suicide (Ladwig & Baumert, 2004, cited in Mishara & Bardon, 2016).

Gender

Overall, there was consistent evidence to suggest that, in England, men were more likely to die by rail suicide than women. However, this may be due to the consistently higher suicide rate for men than for women.

Norman et al. (2024) found that, in England, 78% of those who died by rail suicide were men. However, they noted that this was in line with the national average of suicide in England and Wales, where 75% of those who died by suicide were men (Norman, et al., 2024). This may indicate that men are more likely to die by rail suicide than women because they are more likely to die by suicide more generally. Similarly, Martin and Rawala (2017) found that men were 67% more likely to die by rail suicide than women.

Ethnicity

There was evidence to suggest that white people were more likely to die by rail suicide than black and Asian people. However, the categorisation of ethnic groups was, in some cases, inconsistent across the reviewed evidence, hindering comparisons across sources.

Martin and Rawala (2017) found that white Northern Europeans represented over 75% of all rail suicides in the London Underground, despite individuals from white ethnic backgrounds making up less than 60% of the London population. This was followed by 20% of black and Asian individuals, despite making up 34% of the London population (Census, 2021a). However, no definition was provided for white Northern European, which makes it difficult to fully understand what this group encompasses. Norman et al. (2024; 2022) found that 83% of those who died by rail suicide in England where white European and 13% were black and Asian. This is broadly consistent with 2021 Census data, which shows that 82% of people in England and Wales are white and 13% are black and Asian (Census, 2021b).

Level of education

There was some evidence to suggest that, in England, people dying by rail suicide may be more likely to have a secondary (GCSE or equivalent) or tertiary (A level or equivalent) qualification as their highest qualification, than either no qualification or a higher education qualification (such as a university degree). However, there was variation across countries.

Norman et al. (2022) found that, in England, 13% of individuals dying by rail suicide had no qualification, 33% had a secondary qualification as their highest level, 22% had a tertiary qualification as their highest level, and 31% had a higher education qualification. 2021 Census data[12] shows that 18% of adults England have no qualification, 23% have secondary qualification as their highest level, 17% have tertiary qualification as their highest level, and 34% have a higher education qualification. This suggests that people dying by rail suicide may be more likely to have secondary or tertiary education as their highest level of qualification than those who either have no qualification or a higher education qualification, rather than simply reflecting the UK population distribution.

[12] These figures were calculated from ‘Highest level of qualification’ dataset from UK Census (2021c)

Notwithstanding this, information on education levels was only available for 38% of the cases in Norman et al. (2022) and mainly in relation to young people still in education. Thus, these proportions may just reflect individuals' age, rather than highest educational achievement.

Furthermore, Norman et al. (2022) did not offer a comparison between level of education of those dying by rail suicide and those dying by other methods of suicide. This makes it difficult to ascertain if those with a secondary education are more likely to die by rail suicide because they are more likely to die by rail suicide more generally.

Research on rail suicide in Poland conducted by Makara-Studzinska et al. (2021) found that 42% of cases had a primary-level education - presumably as their highest level of education. Strauss et al. (2017) used a principal component analysis to assess the relationship between the average education level of an area and the locations of rail suicides in Austria. Thirteen out of 15 spatial clusters of rail suicides were in areas where the population was more likely to have higher education qualifications. However, all but two of these clusters were in urban areas, leading the authors to suggest that urbanisation, rather than education, may explain the higher rate of rail suicide (Strauss, et al., 2017).

Mental Health

The evidence reviewed suggested that, in the UK, individuals who died by rail suicide tended to have a mental health problem, although this pattern varied by country. There was also evidence to suggest that individuals who died by rail suicide were more likely to have a history of psychiatric care or were inpatients at the time of the rail suicide.

Abbot et al. (2003, cited in Krysinska & De Leo, 2008) found that 60% of those who died by rail suicide in the UK had been diagnosed with a mental health problem. Similarly, Norman et al. (2024; 2022) found that 57% of those who died by rail suicide in England had a diagnosed mental health problem. In the UK general population, 26% of all people who died by suicide between 2011-2021 had been in contact with mental health services within 12 months before their death (The National Confidential Inquiry into Suicide and Safety in Mental Health, 2024). The higher percentage of mental health diagnoses among rail suicides may therefore reflect the broader relationship between mental health conditions and suicide risk, rather than indicating that people with mental health conditions are specifically more likely to choose rail as a method.

Notwithstanding this, there was evidence to suggest that the association between rail suicide and mental health problems differed across countries. A summary of this variation is shown in Figure 2. Bardon et al. (2013, cited by Mishara & Bardon, 2016) found that 77% of those who died by rail suicide in Montreal, Canada, had a diagnosed mental health problem. In their analysis of police reports, Silla and Luoma (2012) found that 39% of those who died in Finland had a mental health problem. The reasons for these differences remain unclear, particularly if specific prevention measures and support to mental health in each country may play a role.

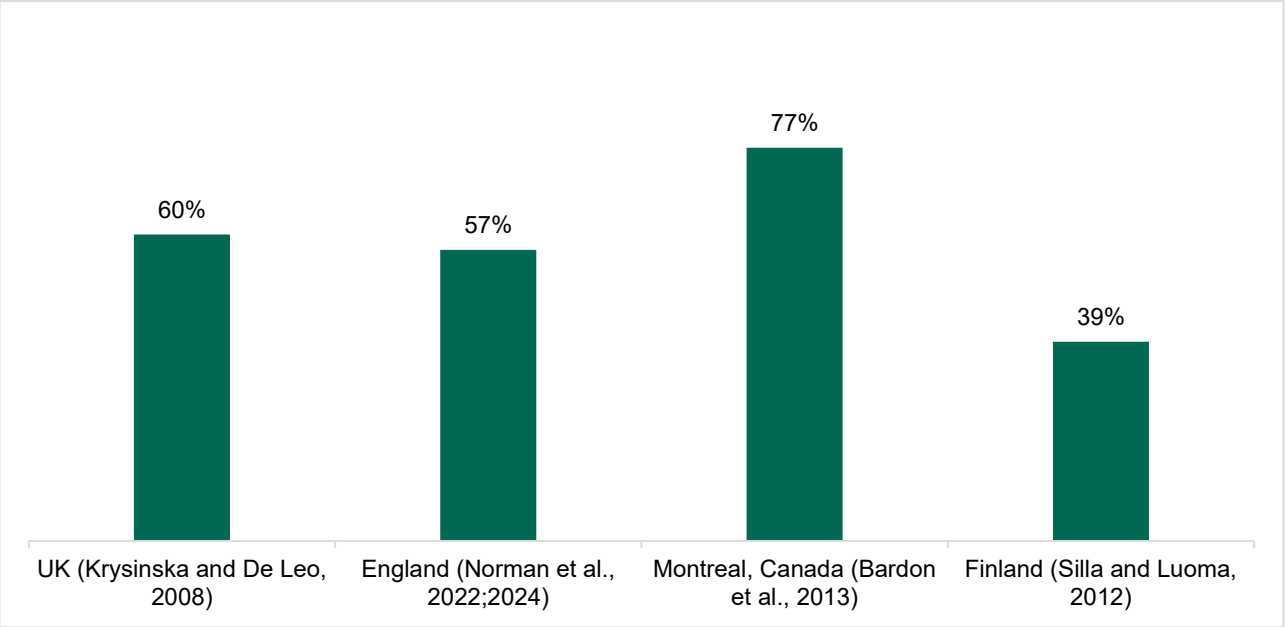


Figure 2 Proportion of individuals who died by rail suicide with a mental health problem, by country and source.

According to the evidence reviewed, most individuals who died by rail suicide had previously received psychiatric care or were psychiatric inpatients at the time of their death. However, there was a lack of UK-based research exploring the subject. Lindekilde and Wang (1985, cited in Krysinska and De Leo, 2008; Mishara and Bardon, 2017) highlighted that 81% of those who died by rail suicide in Denmark had previously been hospitalised for psychiatric care. Similarly, a study reviewed by Mishara (2007) found that 73% of those who died by rail suicide on the Montreal metro had received psychiatric care before their death. Of these, 27% died by rail suicide while they were inpatients. This further highlights the potential association between rail suicides and proximity of psychiatric hospitals, which is discussed in more detail in the Proximity to psychiatric hospitals/mental health institutions section.

Life circumstances

There was consistent evidence to suggest that, in England, those who died by rail suicide were often unemployed, single and living alone. The evidence suggested little variation across countries.

Norman et al. (2022) found that 58% of those who died by rail suicide in England were unemployed, compared to 5% of the general population in 2021. Mishara and Bardon's (2016) systematic review reached similar conclusions on the association between unemployment and rail suicide in relation to Canada, USA and Australia. For example, in Canada, 42% of those who died by rail suicide were unemployed compared to 6.6% of the general population.

Norman et al. (2022) found that, between 2019-2021, 59% of individuals who died by rail suicides in England were single and 23% lived alone. This is comparatively higher than the

proportion of people living alone in England overall (12%) (Norman, et al., 2022)[13]. Mishara and Bardon (2016) reviewed three sources which drew consistent conclusions. Focusing on Australia, USA, and Montreal, Canada, the sources found that between 56-60% of those who died by rail suicide were single. The authors did not compare these findings to the demographic characteristics of the population in the respective countries.

History of and exposure to rail suicide attempts

There was some evidence to suggest that individuals who died by rail suicide in the UK were likely to have known someone who died or attempted rail suicide or were likely to have previously attempted rail suicide themselves.

O'Donnell et al. (1994, cited in Krysinska & De Leo, 2008) found that almost half of survivors of attempted suicide (from a total of 94 individuals) on the London Underground knew someone personally in some capacity or had been psychiatric patients in the same ward. In the UK, Duddin and Raynes (2022) found that, out of 75 suicide notes reviewed by the authors, five mentioned the loss of a loved one, in some cases due to rail suicide. However, the general lack of evidence looking at the UK railway system, coupled with the use of relatively small sample sizes make it difficult to generalise these findings more broadly.

Norman et al. (2024; 2022) found that 38% (N=166/436) of individuals who died by rail suicide in England had previously attempted suicide. Within this group, 38% (N=60/166) previously attempted suicide on a railway. However, there was evidence suggesting that those who survived rail suicide were less likely to attempt suicide again than those who survived other methods (Krysinska & De Leo, 2008).

Alcohol and substance abuse

There was evidence suggesting that individuals who died by rail suicide frequently had alcohol or drugs in their system at the time of death or abused substances in the past. It was also found that older individuals were less likely to die with alcohol in their system. However, evidence focusing on the UK was limited and inconclusive.

Sources exploring rail suicide in Australia, Europe and North America found that between 14% and 51% of cases had either drugs or alcohol in their system at the time of death (Mishara & Bardon, 2016). Krysinska and De Leo (2008) speculated that drugs and alcohol may increase someone's impulsiveness and suicide risk in general.

However, evidence focusing on the UK was limited and inconclusive. Norman et al. (2024) found that, among those who died by rail suicide in England, around 28% had 'current substance' and around 4% had 'past substance use'. However, the authors did not offer a clear definition for substance use, making these findings unclear. Potentially, current abuse refers to excessive substance use at the time of the rail suicide, while past abuse

[13] Normal et al. (2022) compared this to ONS figures for families and households in the UK (ONS, 2021)

refers to a historic pattern of excessive substance use. Further, data on substance use used by Norman et al. (2024) was only available for 33% (n=142) of the cases.

There was also some evidence, albeit not extensive, on how alcohol and substance varied by demographic groups such as gender and age. In their analysis of rail suicide cases in Warsaw, Poland, Lasota et al. (2020) found that older individuals were more likely to be sober at the time of death. The authors also found that men and women who died by rail suicide were just as likely to have alcohol in their system.

Conclusion, evidence gaps and future research

Albeit with country variation, there was consistent UK-based evidence exploring the characteristics of those dying by rail suicide. Men aged between 18-44 were more likely to die by rail suicide than women and older people. Moreover, mental health problems were prevalent among those who died by rail suicide, with many having received psychiatric care or being inpatients at the time of death. However, in some cases, it was not possible to establish if certain individual characteristics where specifically associated with a higher risk of rail suicide or just suicide more generally. The evidence suggested an association between substance use and rail suicide, particularly among younger individuals, though UK-specific data remains limited and inconclusive. Being unemployed, single, and living alone were consistently associated with higher risk of rail suicide. Evidence on ethnicity was inconsistent, with white individuals overrepresented in London but reflecting the general population in England overall.

However, significant evidence gaps remain. Future research should seek to more accurately compare the individual characteristics of those dying by rail suicide (e.g. demographic characteristics) with those dying by suicide more broadly. This would allow more meaningful conclusions to be drawn on rail suicide-specific risk factors. Further up-to-date, UK-specific research is warranted on the association between psychiatric care history and rail suicide, as well as the relationship between substance abuse and rail suicide. The impact of previous exposure to rail suicide attempts also requires further investigation. These findings could inform targeted policy interventions, such as improved coordination between mental health services and rail operators, targeted prevention strategies near psychiatric facilities, and integrated substance abuse prevention programmes.

Impact of media reporting

There was consistent evidence suggesting that news reports of notable deaths by rail suicide were associated with a subsequent increase in rail suicide cases. However, this was not explored in the UK context. There was also evidence that news articles in the UK and Ireland could reinforce the narrative around lethality of rail suicide.

Too et al. (2014) and Havârneanu et al. (2015) found that the volume of media reporting and the popularity of the suicide cases play a crucial role in influencing suicidal behaviours. For example, after the death by rail suicide of a popular German football player the rate of rail suicide deaths and attempts rose by 120% (Too, et al., 2014; Havârneanu, et al., 2015). Other sources found that, in the two months following the death of three people killed by a train while investigating a suspected rail suicide, daily rail

suicide deaths and attempts increased by 44% (Too, et al., 2014; Havârneanu, et al., 2015).

Rail suicides were found to increase even after fictional depictions in the media. A study reviewed by both Too at al. (2014) and Mishara (2007) explored the impact of a German TV show depicting the fictional death of a 19-year-old male by rail suicide. The study found that during the first 70 days after the episode was aired, rail suicides of males of a similar age increased by 175% (Too, et al., 2014; Mishara, 2007).

Marzano et al. (2016) found that news articles on rail suicide, in the UK and Ireland, were more likely to report fatal suicides as opposed to non-fatal accidents than articles reporting suicide by other methods (Marzano, et al., 2016). Further, news articles about rail suicides were more likely to include details about the method than articles about other suicide methods. The authors suggested that this may reinforce the lethality of rail suicide, which could play a part in influencing imitation behaviours.

Conclusion, evidence gaps and future research

There was consistent evidence suggesting a link between media reporting of rail suicide cases and subsequent increases in rail suicide incidents. In the UK and Ireland, research indicated that news articles about rail suicides tended to focus more on fatal incidents and included more method details compared to reports on other forms of suicide. This reporting pattern may inadvertently reinforce perceptions about the lethality of rail suicide, potentially influencing imitative behaviours.

However, the direct impact of media reporting on rail suicide rates in the UK has not been thoroughly explored. Further evidence is required to explore the extent to which media reporting of notable rail suicide deaths in the UK are similarly followed by an increase in rail suicide rates. Future research should also seek to investigate what characteristics of this reporting are associated with an increase in rail suicides.

Interventions and their effectiveness

This chapter provides an overview of rail suicide prevention interventions and their effectiveness, as well as how this may differ across different contexts and demographic groups.

Interventions described in this chapter were divided into what Marzano et al. (2016) defined as the three stages of the suicide process: the early stage (stage 1), the contemplation stage (stage 2), and the planning stage (stage 3). Interventions within each stage were further grouped into the six different categories below, which have been adapted from Marzano et al. (2016) and expanded based on the evidence of this review. These classifications are shown in Figure 3 and are further discussed in the following sections:

- Improving the railway environment
- Reducing perceived lethality and imitation behaviour
- Support targeted at vulnerable individuals
- Detection and surveillance
- Interventions by staff and bystanders
- Physical interventions

It is important to note that there was often significant overlap across the different categories of interventions as well as across the stages of the suicidal process. Moreover, due to the many factors contributing to rail suicide, the interventions presented in this chapter are likely to be more effective if adopted in combination and across all three stages of the rail suicide process (Marzano, et al., 2016).

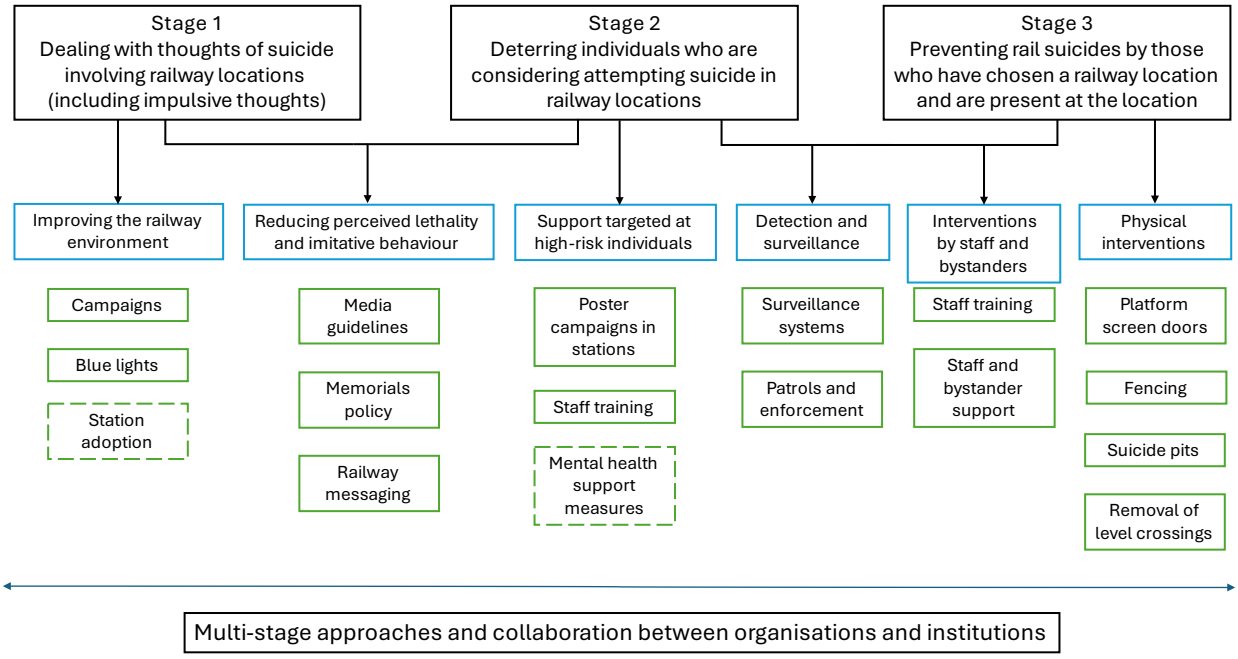


Figure 3: Visual representation of the six intervention categories across the three stages of the suicidal process, as adapted from Marzano et al. (2016). The diagram illustrates the broad range of interventions identified through both the evidence review and stakeholder interviews. The interventions vary in terms of the strength of evidence supporting their efficacy. The dashed line indicates the interventions that were identified through stakeholder interviews rather than the reviewed evidence.

Stage 1

Stage 1 of the railway suicide process refers to the initial formation of suicidal thoughts in an individual's mind (Marzano, et al., 2016). The evidence reviewed in this REA identified two types of interventions that were relevant to this stage: improving the railway environment to deter suicidal behaviours; and reducing the perceived lethality of railway suicide, while preventing imitation behaviour. These interventions are potentially effective not only in Stage 1 but also as the individual progresses into Stage 2, the contemplation stage.

Improving the railway environment

This section discusses the evidence about the effectiveness of interventions aimed at improving the railway environment. It focuses on awareness campaigns and blue light technology which aims to reduce the attractiveness of the railway as a suicide location and create a calmer environment.

Campaigns

Rail suicide prevention campaigns often engage the general public, highlighting the role that they can have in preventing suicide. They aim to:

- Raise awareness about the importance of engaging with vulnerable individuals;
- Encourage friendly and empathetic behaviour among all passengers;
- Create a more compassionate railway environment.

The evidence reviewed found that UK campaigns were positively received by passengers. However, there was a lack of evidence demonstrating if and how they directly affect rail suicide rates.

A qualitative study by Majava and Nicholls (2015) explored UK campaigns aimed at creating a more compassionate and friendly environment at railway stations among the general public. The authors suggested that these broader campaigns might be more effective in reducing the risk of rail suicide than suicide-specific campaigns. The study found that passengers viewed this approach positively and recognised their role in fostering a more compassionate atmosphere, including looking out for vulnerable individuals. Moreover, passengers did not see suicide prevention as their primary responsibility. Therefore, campaigns aimed at improving the overall atmosphere, without explicitly emphasising suicide, were found to be more suitable. However, Majava and Nicholls' conclusions (2015) were largely speculative and not based on direct evidence of the effectiveness of campaigns in reducing rail suicide rates.

Blue lights

Blue lights refer to blue light-emitting-diode lamps installed at stations or crossings. Blue lights are believed to have a calming effect and have the potential to reduce impulsive behaviours (Too, et al., 2017b; Ryan, et al., 2018). They are not currently adopted in the context of the UK railway system; therefore, no evidence was found on their effectiveness in reducing rail suicides in the UK. There was evidence suggesting blue lights were effective in reducing rail suicides in Japan. However, the degree of their effectiveness was challenged and found to be inconsistent across different contexts.

Matsubayashi et al.'s impact evaluation (2013) compared rail suicides rates in Japan before and after blue lights were installed. The sample included 11 stations with blue lights and 60 without them. The study found that the intervention reduced the suicide rate by 84%. Notably, the authors found no increase in rail suicides at non-blue light stations, suggesting that there was no displacement effect.

Notwithstanding this, Ichikawa et al. (2014) argued that blue lights were more effective at night and within station premises, when lights are more visible. Against this background, they found that only 14% of suicide attempts, taking place in Japan between 2002 and 2011, matched these criteria. The authors concluded that Matsubayashi et al.'s findings (2013) could be misleading, arguing that the suggested 84% reduction in suicides rates, due to blue lighting, was likely a substantial overestimation.

The time-dependent effectiveness of blue lights presents a potential limitation to the intervention, as rail suicides in the UK were found to be more common during daylight hours (as discussed further in the Time of day section).

The perspective of stakeholders

Stakeholders interviewed as part of this study discussed two additional interventions that warrant further investigation:

1) Small Talk Saves Lives, a campaign launched by Samaritans aimed at empowering and encouraging passengers to start a simple conversation if they see someone vulnerable who may be at risk of suicide;

2) Station adoption, an initiative that aims to transform the perception and environment of unmanned or isolated stations, which may be perceived as potential suicide locations. The approach involves engaging community members to help improve the spaces and the overall atmosphere though, for example, better maintenance and the installation of artwork and plants.

Conclusion, evidence gaps and future research

It is possible that broader campaigns aimed at creating a friendlier railway environment may be more effective than suicide-specific campaigns in preventing rail suicides, but further research is required. The evidence reviewed was based on passengers' perceptions collected through focus groups. Further impact evaluation, such as theory-based evaluation and quasi-experimental designs, are required to draw more definitive conclusions on the extent to which broader campaigns influence rates of rail suicide. However, it is important to note that such studies would present ethical challenges that arise from the involvement of participants who are at increased risk of suicide and with lived experience of suicide.

Blue lights in Japanese stations have shown potential in reducing suicide rates, particularly at night, but the extent of their impact is debated. Further research is required to explore the applicability of blue lights in the UK context. This should consider the UK railway infrastructure and the specific characteristics of rail suicide in the UK, including that most rail suicides in the UK occur during daylight hours.

Reducing perceived lethality and imitation behaviour

This section discusses the role of interventions aimed at reducing perceived lethality and imitation behaviour in preventing rail suicide. These interventions are designed to address how rail suicide is communicated to and perceived by society. They include media guidelines, railway messaging and memorials policy.

Media guidelines

Media guidelines aim to provide advice on responsible and sensitive reporting, to reduce the risk of copycat suicides and the perceived lethality of rail suicide methods. As

discussed in more detail in the Impact of media reporting section, the evidence reviewed in this REA suggested that news reports of death by rail were associated with subsequent increases in rail suicide rates. Moreover, they were found to reinforce the idea the high lethality of rail suicide. The evidence suggested that media reporting guidelines can reduce rail suicides and attempts. However, more up-to-date research is needed exploring such interventions in the UK context.

As part of their effort to reduce the risk of copycat suicides and the perceived lethality of rail suicide methods, Samaritans designed and distributed media guidance (Samaritans, 2020). The guidance provides practical recommendations on how to report suicides. These include:

- Be mindful of the impact of reporting on audiences, e.g. include trigger warnings, ensure that help-seeking information is readily available;
- Avoid mentioning specific details, e.g. suicide methods, location, references to how quick, easy or painless the suicide was;
- Carefully consider headlines, e.g. avoid mentioning suicide methods; avoid sensationalising or oversimplifying;
- Avoid melodramatic descriptions of suicide and its aftermath;
- Treat high profile suicide cases with extra care.

There was extensive evidence exploring the association between responsible reporting of rail suicides and a reduction in rail suicide and attempt rates (Havârneanu & Topel, 2019; Too, et al., 2017a; Krysinska & De Leo, 2008; Cox, et al., 2013). Ryan et al. (2018) suggested that media guidance can be effective for physical and online news as well as social media. However, the authors noted that the application of media guidelines can be challenging as new media forms emerge.

Etzersdorfer and Sonneck's impact evaluation (1998, cited in Cox, et al. 2013) compared underground railway suicides and attempts in Vienna before (1980-1987) and after (1987-1996) the implementation of media guidelines. The authors found that subway suicides and attempts decreased by 84%, from 20 to 3 incidents. The study also found evidence of long-term and broader societal benefits, including:

- **Long-term benefits**: in the years following implementation, rail suicide levels remained low, with a maximum of 5 incidents per half-year in subsequent years. This suggests a potentially enduring positive impact.
- **Broader societal benefits:** the authors suggested a wider societal effect, noting 81 fewer suicides by other methods nationally in the post-intervention period. However, this claim remains speculative and requires further investigation.

Despite the promising findings of this study, several limitations should be considered. The absence of a control group makes it difficult to isolate the specific effect of the media guidelines from other potential factors, such as other suicide prevention initiatives. Perhaps most significantly, the study was conducted in the 1980s and 1990s and the

findings may therefore be outdated. Over the past 20 years, the rise of social media and online news have radically changed media consumption patterns. This could affect the applicability of these findings to the current UK context.

Railway messaging

There was UK-based evidence suggesting that appropriate railway messaging about rail suicide incidents may be effective in reducing perceptions of lethality. However, there was a lack of evidence on the effectiveness of messaging in reducing rail suicide rates.

Majava and Nicholls (2015) examined the current 'person hit by a train' messaging in the UK. The study found that rail industry stakeholders perceived this messaging as clear and honest. In contrast, passengers felt that it could evoke graphic images and reinforce the association of railways with suicide. Passengers preferred an alternative phrase, 'Emergency services dealing with an incident', which they felt provided an appropriate level of information without being as graphic or upsetting. However, there was no evidence exploring the extent to which the new messaging could reduce rail suicides.

Memorials policy

Network Rail introduced a memorial policy to guide station managers on handling memorials for rail suicide victims. The policy aims to respectfully remove or relocate these memorials, typically consisting of flowers, candles, and photos at incident sites, in order to reduce the risk of imitation behaviours. The evidence found that rail staff considered the memorials policy to be ineffective in practice. Moreover, its direct impact on deterring rail suicide was not evaluated.

A study, based on a survey targeting 456 rail staff from different locations in the UK, examined awareness and perceptions of the National Rail memorial's policy (Tavistock Institute of Human Relations, 2013). The study found that that very few staff were aware of the policy's existence, highlighting a potential gap in communication or implementation. Only 35% of staff believed the policy was helpful in reducing suicide attempts, suggesting low confidence in its effectiveness as a suicide prevention measure. However, 48% of staff thought that it might help reduce staff distress, suggesting that the policy could be more effective in supporting staff wellbeing than as a suicide prevention intervention. Critically, there was a lack of evidence on the extent to which memorials policy could reduce rail suicides.

Conclusion, evidence gaps and future research

There was strong international evidence to suggest that media reporting guidelines can reduce rail suicides and attempts. Further evidence is warranted to evaluate the impact of media guidelines on rail suicide in the UK, across the landscape of new media and formats targeted at different population groups, particularly young people.

There was a lack of evidence to suggest that appropriate railway messaging about rail suicide may reduce suicide rates. While it appears that appropriate railway messaging could reduce the association of railways with suicide, the study relied on qualitative

interviews with passengers. Further evaluation is warranted to explore the direct impact of railway messaging on suicide rates. Informed by an ethics review, this should also explore perceptions of individuals with suicidal thoughts or those who have attempted suicide.

There was limited evidence regarding the effectiveness of Network Rail's memorial policy in reducing rail suicides, with only a minority of staff believing it could be effective. While impact evaluations could provide more definitive evidence of any direct effect on rail suicide rates, it is unclear whether such studies are currently warranted given the lack of preliminary positive evidence.

Stage 2

Stage 2 of the railway suicide process, known as the contemplation stage, individuals begin to consolidate their suicidal thoughts into plans (Marzano, et al., 2016). Initiatives at this stage tend to involve targeted support to vulnerable individuals.

Support targeted at vulnerable individuals

This section explores evidence on interventions aimed at providing support to individuals who may be experiencing suicidal ideation and are at risk of suicidal behaviour but have not yet acted on their thoughts. These interventions include poster campaigns to encourage help-seeking behaviour and staff training programs to recognise warning signs and support vulnerable individuals.

Poster campaigns in stations

Poster campaigns feature targeted messages and provide information about support services available. The evidence reviewed explored some examples of poster campaigns in UK stations and how they were perceived by rail staff. However, their effectiveness in reducing rail suicides remains unclear.

Samaritans developed a poster campaign involving the distribution of posters featuring the Samaritans' logo and helpline (Tavistock Institute of Human Relations, 2013). These were initially placed in priority locations on the rail network and subsequently in lower priority stations. A rail staff survey was then conducted to measure awareness and perceptions of this initiative. The main findings included:

- **Visibility:** 62% of staff in priority locations and 45% in non-priority locations reported seeing the posters, indicating a relatively successful deployment.
- **Perceived effectiveness:** 63% of staff believed the posters led to a decrease in suicide attempts.

The study, however, did not offer details on the exact location of the posters within stations and for how long they remained in place. This is relevant as differences in poster visibility between stations might have affected the findings and could limit potential replicability in future studies. Moreover, the study focused on staff perception, warranting further research to explore the direct impact on rail suicide.

Marzano et al. (2016) further explored suicide preventions posters in UK railway settings and identified potential improvements that could make them more effective. The authors argued that offering discreet communication options on posters for vulnerable individuals, such as text, email, or webchat, could prove effective in facilitating help-seeking behaviour. The research also suggested that information on potential survival outcomes and resulting disabilities, as well as harm to others, could act as additional deterrents. However, it is important to note that the use of potentially distressing content in public spaces has ethical implications, warranting careful consideration. Moreover, there is a risk that such material could reinforce the narrative around the lethality of rail suicide, as discussed in the section Impact of media reporting. The potential for unintended consequences highlights the complexity of designing effective suicide prevention messaging and the need for an evidence-based approach.

Staff training

Suicide prevention training aims to provide frontline rail staff with the skills and confidence to engage and intervene with a person potentially at risk of suicide. The evidence suggested that, in the UK, suicide training is positively received by rail staff and increases their confidence, but its direct impact on rail suicides remains unclear. Staff intervening in potential suicide attempts is discussed in more detail in the section Staff and bystander support.

For example, the Managing Suicidal Contacts course (MSC) run by Samaritans was designed to train rail staff on suicide prevention and related measures. Widely implemented in the UK railway sector, the course covers recognition of warning signs, communication techniques, intervention strategies, and procedures aimed at ensuring the safety of at-risk individuals, while also addressing the emotional impact on rail staff members.

Evidence exploring the experiences of rail staff taking part in the MSC course (Katsampa, et al., 2022; Marzano, et al., 2020) found that the primary barrier to staff intervention in potential rail suicide situations was lack of confidence. This outweighed concerns about personal safety or the limited time to intervene. Against this backdrop, rail staff attending the course felt greater confidence in their ability to identify and intervene in high-risk situations (Katsampa, et al., 2022; Marzano, et al., 2020). Specifically, rail staff felt that the course had enhanced both their preparedness to act when encountering distressed individuals and their ability to recognise suicide risk. The authors concluded that staff training is the most effective approach to addressing the lack of confidence among staff.

Additionally, a survey conducted by Rail Safety and Standards Board (RSSB) found that 68% of rail staff involved in the study believed the training could reduce distress among rail personnel and 63% expected a decrease in suicides as a result of the training (cited in Havârneanu et al., 2015). The majority of rail staff expressed willingness to use the strategies learned as part of the course, and 14% of staff reported using the skills with potentially suicidal individuals.

Notwithstanding this, the reviewed studies mostly relied on cross-sectional studies and self-reported/subjective measures of confidence and skills acquired. The limitation to these approaches is that they can be imprecise and prone to bias. Moreover, no evidence was found assessing the direct impact of rail staff training on rail suicide rates.

The perspective of stakeholders

Stakeholders interviewed as part of this study highlighted the importance of measures involving the support of mental health specialists, such as the All on Board initiative.[14] It was suggested that police officers could act as the first point of contact with the vulnerable individual in the station and as a bridge between the individual and a mental health nurse. The officer would collect the individual's contact details and share them with the mental health nurse. The nurse would then engage with the individual to develop personalised safety plans and provide crucial follow-up care. However, this approach was not formally evaluated. This gap is significant because rail suicide attempt survivors indicated that such personal support measures could be more effective than posters in deterring further attempts (Marzano, et al., 2016).

Stakeholders also emphasised the importance of community work. They suggested working with local communities and introducing safe spaces, where rail staff can direct individuals in crisis and vulnerable individuals can find targeted support. Specific examples mentioned in the interviews were crisis cafes and mental health triage hubs located outside of priority stations. Further investigation of this measure is warranted to draw robust conclusions on its effectiveness.

Conclusion, evidence gaps and future research

There was limited evidence to suggest that poster campaigns targeting vulnerable individuals may encourage help-seeking behaviours. Further impact evaluation is required to test how poster design, placement, visibility, and content could affect the effectiveness of the intervention in supporting help-seeking behaviours and in reducing suicide rates in the UK.

Staff training, such as Samaritans' MSC course, was found to increase staff confidence in identifying and intervening in suicide attempts. This training can be valuable as it enhances preparedness and confidence among rail staff in crisis situations. However, the reviewed evidence exploring staff training was based primarily on staff perceptions from cross-sectional surveys and qualitative interviews, limiting the strength of the findings on suicide prevention effectiveness. Future research should seek to use more robust impact evaluation approaches, such as randomised control trials or quasi-experimental designs, and include perspectives from individuals with lived experiences of rail suicide attempts to better evaluate the actual effectiveness of staff training in reducing rail suicides. However, it is important to note that such studies in the context of suicide prevention may present significant ethical challenges, such as withholding potentially beneficial interventions from control groups.

Future research could also look at the interventions highlighted by stakeholders, including mental health support measures such as the All on Board initiative, safe spaces such as crisis cafes, and mental health triage hubs at priority stations. These interventions merit

[14] All on Board is a partnership between Network Rail and the NHS to deliver services within communities to reduce suicide and promote help seeking behaviours.

formal evaluation to determine their effectiveness in preventing rail suicides and supporting vulnerable individuals.

Stage 3

The last stage of the railway suicide process is when an individual acts on their plans or impulsive thoughts, attempting to carry out a rail suicide (Marzano, et al., 2016). At this critical point, evidence found as part of this REA identified a range of interventions that could prevent or interrupt a suicide attempt:

- Detection and surveillance systems;
- Interventions by staff and bystanders;
- Physical interventions.

Detection and surveillance

This section discusses how detection and surveillance can act as a suicide prevention measure. Specifically, it explores evidence on the role of patrols and enforcement, and surveillance systems in deterring and preventing individuals from trespassing and attempting rail suicide.

Patrols and enforcement

Patrols and enforcement involve trained security personnel, such as police or rail operator staff, regularly monitoring railway areas to deter suicide attempts and trespassing. These measures aim to provide a visible presence, quickly identify potential risks, and facilitate immediate intervention in crisis situations. The evidence suggested that patrols and enforcement could reduce rail suicide and trespassing. However, further research is needed to explore the effectiveness of these measures in preventing rail suicide in the UK.

Findings from a quasi-experimental study in Austria indicated that the presence of site security personnel within stations reduced both railway suicides and attempts (Niederkrotenthaler et al., 2012 cited in Havârneanu, et al., 2015). Additionally, the presence of staff at stations may discourage both suicide and trespassing, acting as a deterrent per se (Havârneanu, et al., 2015). CCTV systems may also facilitate the intervention of staff at stations, enabling them to act promptly and offer support to vulnerable individuals (Agarwal, 2021). This is further discussed in the Staff and bystander support section.

Havârneanu and Topel (2019) offered recommendations to increase the effectiveness of patrols in reducing railway trespassing, which may be applicable to rail suicide prevention. These included:

- Patrols should be visibly identifiable (not in plain clothing);
- Patrolling should be carried out on foot;

- Patrolling should be deployed during peak times.

Surveillance systems

Detection and surveillance systems include CCTV cameras combined with other technology, such as audio warnings. By providing early warning, they aim to deter and persuade individuals to leave a place of danger. These include AI-powered CCTV systems that can identify pre-suicidal behaviours and notify staff, potentially enabling timely intervention. The evidence suggested that surveillance systems can reduce rail suicide and trespassing. However, no UK-based evidence was identified exploring the association between surveillance systems and rail suicides. Moreover, no evidence was found differentiating between the impact of surveillance systems on rail suicide and trespassing.

Kallberg and Silla (2015, cited in Havârneanu and Topel, 2019) evaluated an automatic alarm system implemented in Finland, which detected trespassers and played warning messages on tracks. The research found significant reductions in trespassing incidents, with one site reporting a 44% decrease over a 60-day period. Similarly, Havârneanu et al. (2015) assessed the impact of an automated security system on a New York railway bridge. The system consisted of a video camera, infrared illuminator, speaker and motion detector. The authors found that trespass rates decreased by 60% from the first to the second year of implementation, with a 17% reduction maintained in the third year.

However, there were limitations to these studies. Firstly, the detection system in the Finnish pilot triggered a high number of false positives. Secondly, research suggested these measures may be more effective for children than adults (Havârneanu & Topel, 2019; Havârneanu, et al., 2015). Lastly, there was a lack of distinction between the effectiveness of the systems on trespassing and rail suicide.

AI-powered CCTV systems have recently emerged as a technological solution to prevent rail suicide. These systems utilise real-time image analysis and computer vision on CCTV feeds to identify potential suicidal behaviours in stations. If a risk is detected, rail staff are alerted to ensure timely intervention. By reducing reliance on human judgment, this approach could minimise errors from bias (Agarwal, 2021).

Using CCTV recordings of suicide attempts and non-suicide attempts in stations, Agarwal's experimental study (2021) demonstrated the potential effectiveness of this technology. Based on a range of parameters of suicidal intentions, the study estimated the probability of a suicide attempt. The method achieved around 88% accuracy across three different sets of parameters[15] with varying response times (2-8 seconds). While longer processing times improved predictions for actual suicide attempts, they also increased false alarms. The author noted that better quality CCTV recordings and longer observation periods could improve response times and predictions. Crucially, this creates a trade-off between data accuracy and how quickly staff can be alerted and respond to potential rail suicide or trespassing (Agarwal, 2021).

[15] Each set had different values for various indicators of suicidal intentions and their contribution to the overall probability of a suicide attempt occurring.

The perspective of stakeholders

Stakeholders interviewed as part of this study highlighted that behaviours prior to the attempt tend to vary and can therefore be challenging to identify. They noted that while some individuals may display signs commonly associated with rail suicide attempts, others may show no outward signs of distress. This suggests that relying on observable behaviours can have limitations and warrants further investigation.

Conclusion, evidence gaps and future research

There was strong evidence suggesting that site security personnel in stations and surveillance systems on tracks and railway bridges can reduce rail suicide and trespassing. The effectiveness of security personnel at UK stations was particularly promising, given a high incidence of station-based suicides. However, some studies focused on both trespassing and rail suicide rather than suicide specifically. Moreover, there was a lack of UK-based evidence on the impact of these measures on rail suicides. Further research is needed to explore the effectiveness of these measures in preventing rail suicide specifically in the UK context, and to determine optimal strategies for deploying security personnel and implementing surveillance systems in stations.

Experimental research based on analysis of recordings of rail suicides in stations suggested that AI-powered CCTV systems may be able to identify suicide attempts. While these systems showed potential, the implications in terms of response times and critical interventions warrants further investigation. Furthermore, it is crucial to evaluate the system's effectiveness in real-world settings and its impact on actual rail suicide rates.

Interventions by rail staff and bystanders

This section discusses interventions by rail staff and bystanders aimed at preventing rail suicide. Specifically, it explores evidence on the active role that both staff and bystanders can play.

Staff and bystander support

UK-based evidence suggested that rail staff and bystanders can play a role in interrupting suicidal thoughts or attempts through engaging with vulnerable individuals or alerting authorities. While qualitative evidence from interviews with survivors indicates that even simple interactions from strangers can interrupt suicidal thoughts, the impact of these interventions on rail suicide rates has not been evaluated.

Katsampa, et al (2022) interviewed rail commuters and rail staff who had intervened to stop rail suicides in the UK. The authors found that vulnerable individuals may find lay bystanders less threatening than uniformed staff, particularly police officers. The findings included a wide range of helpful techniques (summarised in Table 1) to improve the effectiveness of interventions by rail staff and bystanders. Techniques were grouped

based on three main criteria: intervening at close range, intervening from a distance, and working as a team.

Up close and personal	Interventions from afar	Teamwork
Small talk, active listening, asking questions, remaining calm, being reassuring, and trust building.	Train drivers alerting colleagues at the upcoming station, calling emergency services and bringing train to an immediate stand.	Multiple people coordinating different tasks, such as calling emergency services, alerting colleagues, or speaking to the suicidal individual. This may make the intervention more manageable.
Non-verbal distractions, such as eye contact, smiling, or standing close to someone allows them to start conversation.	Passengers calling for professional help.	
Being a physical obstacle to getting to the track. However, physical restraint should be avoided.	Emergency infrastructure points, such as emergency phones and buttons, to encourage bystanders to seek professional support.	

Table 1 Summary of Katsampa et al.'s techniques (2022) to improve the effectiveness of interventions by rail staff and bystanders

As noted in Table 1, verbal interventions were perceived as preferable to and more effective than physically restraining individuals (Katsampa, et al., 2022). A UK-based study, interviewing individuals with lived experience of rail suicide attempts, found that simple gestures like a smile or question from a stranger could be sufficient to interrupt suicidal thoughts (Marzano, et al., 2020). Conversely, physical interventions involving force were perceived as unhelpful and inappropriate, increasing feelings of guilt, and isolation for the vulnerable individual (Marzano, et al., 2020). Moreover, evidence of displacement and substitution was found among individuals who were physically restrained, with some of these individuals attempting rail suicide elsewhere or considering different suicide methods (Marzano, et al., 2020).

There was UK-based evidence suggesting that rail staff should be mainly responsible for intervening in preventing rail suicide, with bystanders playing a supportive role (Katsampa, et al., 2022). This suggests the importance of having clear and visible emergency infrastructure points, such as emergency phones and buttons, that can encourage members of the public to seek professional assistance when witnessing a potential rail suicide attempt. Moreover, the lack of or limited presence of staff at stations could negatively affect the effectiveness of bystander support (Katsampa, et al., 2022).

Conclusion, evidence gaps and future research

The effectiveness of staff training, including conclusions, evidence gaps, and recommendations for future research, is discussed in detail within the Stage 2 Section.

Qualitative evidence indicated that while bystanders can play a supportive role in preventing rail suicides, rail staff should bear primary responsibility for interventions. Further quantitative research is warranted to assess the effectiveness of bystander actions. Future research should also evaluate the impact of visible emergency infrastructure on rail suicide prevention, assess how the public uses these measures, and determine the most effective ways to communicate emergency strategies to bystanders.

Physical interventions

This section discusses the role of physical interventions in preventing rail suicide. These are physical barriers and safety features to prevent access to high-risk areas and mitigate the severity of outcomes in case of an incident. Specifically, this section explores the evidence on platform screen doors, fencing, and the removal of level crossings to limit someone's ability to access tracks. Additionally, it examines the use of suicide pits, which aim to reduce fatalities in the event of an attempt.

Platform screen doors

Platform screen doors (PSDs) consist of glass barriers lining platform edges, designed to restrict access to the track at stations. The evidence suggested that this intervention often involves significant infrastructural changes and implementation costs. However, there was limited evidence exploring PSDs and their effectiveness in the UK. Moreover, they are mainly applicable to underground railways and less so to open railway networks.

The evidence suggested that PSDs were effective in reducing rail suicides at platforms in underground stations, with large reductions after the installations ranging from 60% to 91% (Havârneanu, et al., 2015). Law et al. (2009) compared incidents in 30 Hong Kong underground stations before and after PSD implementation. The findings showed that rail suicides decreased by 60% after the implementation, despite a 27% increase in suicide rates in the general population during the same period. The study also found that rail suicides among individuals with a history of mental health problems decreased by 84%. Notably, the authors found no observable displacement effect to other stations, as suicide rates in comparison areas remained stable or decreased. However, the study did not examine the potential substitution to other suicide methods. Law et al. (2009) identified additional benefits to PSDs, including reductions in disability-adjusted life years[16] (from 1168 to 287 years) and in service disruption (from 1739 to 531 minutes).

There was evidence to suggest that half-sized PSDs were an effective measure for reducing railway suicides, albeit to a lesser extent than full-length PSDs. Martin and Rawala (2017) found that the partial PSD implementation on the Jubilee line may

[16] Disability-adjusted life years (DALYs) are a statistical measurement that researchers and policymakers use to calculate how diseases and medical conditions affect the quality and length of life for a population. DALYs are the sum of years of life lost to premature mortality and years lived with a disability.

contribute to lower suicide attempts on this line compared to the rest of the London underground network. Moreover, a study conducted in Japan found that, after the installation of half-sized PSDs, suicide rates decreased by 76% (Barker, et al., 2017). Half-size PSDs are easier to install and tend to be cheaper than full-length barriers, making them a more accessible option for many railway systems. For instance, full-length doors on the Seoul underground were reported to be 120-150% more expensive to install compared to their half-sized counterparts (Martin & Rawala, 2017).

PSDs however present implementation challenges in the UK railway context. Unlike the more enclosed systems in Hong Kong, the UK railway network is characterised by long stretches of exposed track (Barker, et al., 2017). This structural difference makes full network installation of PSDs on tracks practically unfeasible. Moreover, the high costs associated with platform installation represents a substantial barrier to widespread implementation (Martin & Rawala, 2017).

Despite these challenges, the evidence recommended considering PSD installation as part of future network renovations or expansions (Martin & Rawala, 2017). This approach could help mitigate costs by integrating PSD installation into broader infrastructural projects. Furthermore, the evidence suggested to prioritise the installation of PSDs at identified cluster locations where the risk of railway suicides is highest (Martin & Rawala, 2017).

Fencing

Fencing serves as an alternative to Platform Screen Doors (PSDs) for restricting access to railway tracks. It can be implemented both within stations and in areas outside of stations. The evidence suggested that longer fencing outside of stations was effective at reducing rail suicides. However, no evidence was found exploring this in the UK context. Fencing inside of UK stations appeared to also be effective, but this evidence was weaker.

To note, the UK Railway Regulation Act 1842 mandates that all railway companies must erect and maintain good and sufficient fencing along their lines, whilst the Railway Safety (Miscellaneous Provisions) Regulations 1997 include provisions to prevent unauthorised access to railway infrastructure, which can involve lineside fencing. This means the UK differs from many other countries which do not have legislation or regulation requiring fencing along tracks.

Fencing outside of stations

The effectiveness of track fencing depends on the length of the fencing installed, with longer fencing being more effective than shorter fencing in reducing rail suicides. Clapperton et al. (2022) compared rail suicide incidents before and after fencing was installed in 36 locations in the state of Victoria, Australia. The study found that, following the installation of fencing, there was a 57% reduction within a 1000m radius if the fencing was at least 100 metres long. The authors attributed the limited effectiveness of short fencing to the insufficient restriction of access to the track. They suggested that fencing on tracks should perhaps be prioritised to sites where longer fencing can be installed.

There was evidence to suggest that fencing was more effective in reducing trespassing than landscaping and signage. A pilot study exploring rail trespassing prevention measures in Finland compared three interventions: 1) fences approximately 1m high on

both sides of the railway extending roughly 100m; 2) landscaping interventions including steepening the sides of the track or planting trees and bushes to form natural barriers; 3) and prohibitive signs installed at key trespassing locations along railway lines (Silla and Louma, 2011 cited in Havârneanu, et al., 2015). Fencing was found to be the most effective measure, reducing trespassing by 95%. Landscaping followed with a 91% reduction, while prohibitive signs showed a modest impact, reducing trespassing by 37%. However, the applicability of these findings to rail suicide prevention may be limited as the motivations and behaviours associated with trespassing may differ from those associated with suicide attempts.

Fencing inside of stations

Mid-platform fencing separates platforms where high-speed trains often run without stopping. When the platforms are also used for passenger boarding, the fencing can include lockable gates.

Plaza et al. (2014) found that mid-platform fencing could act as an effective preventative measure to reduce rail suicide. The study was conducted in 52 stations located in three areas in and around London (West London, North West London, and Sussex). Findings indicated a general reduction in rail suicides, attempts and accidental fatalities on the 'fast lane' platforms protected by fencing. Notwithstanding this, the study was conducted early in the monitoring process, which the authors noted could affect the reliability of the findings.[17] Plaza et al. (2014) also found that fencing improved staff ability to identify unauthorised platform access. However, the authors indicated that the gates allowing access to high-speed platforms were often left unlocked and open, potentially compromising the effectiveness of the intervention.

Removal of level crossings

The removal of level crossings prevents ground access to the tracks, thereby restricting pedestrian access. International evidence suggested that removing level crossings proved effective in reducing railway suicides. However, no evidence was found exploring the measure in the UK.

Clapperton et al. (2022) examined areas within 500m and 1000m radius of removed level crossings in Australia, along with matched stations acting as controls, and compared monthly suicide rates before and after crossing removal. Within a 500-meter radius of removed crossings, there was a 68% decrease in railway suicides. This effect extended further, with a 61% decrease observed within a 1000-meter radius. Moreover, in the post-intervention period, removal sites presented a 53% lower suicide rate compared to control sites. The research found no increase in suicides at nearby control sites, suggesting that no displacement effect to other crossings took place.

However, the applicability of these findings to the UK context may be limited due to differences in rail suicide patterns between the two countries. In the UK, a smaller

[17] This early evaluation may not fully capture long-term trends, potential seasonal variations, or delayed effects of the intervention. This highlights the need for continued monitoring and evaluation over an extended period to establish more definitive conclusions about the effectiveness of mid-platform fencing.

proportion of railway suicides occur at level crossings compared to Australia (discussed in more detail in the Railway location section).

Suicide pits

Suicide pits are hollowed out areas that run the length of the platform beneath the tracks. They are designed to reduce the chance of impact with the train if someone were to jump off the platform. The purpose of suicide pits is primarily to reduce mortality, rather than prevent rail suicide attempts. The evidence reviewed suggested that suicide pits can significantly reduce mortality rates but does not indicate a reduction in suicide attempts.

A study by Coats and Walter (1999, cited in Bhui et al., 2013) found that, between 1996 and 1997, mortality rates were significantly lower at stations with pits (44%) compared to those without pits (76%). Similarly, another study by O'Donnell and Farmer (1994, cited in Barker et al., 2017) found that, between 1973 and 1990, suicide pits reduced mortality from 66% to 45%. However, the study did not control for train speed or frequency, making it difficult to attribute the difference in fatalities solely to the presence of suicide pits. Most importantly, the evidence presented is likely outdated and may not be representative of the current circumstances.

Conclusion, evidence gaps and future research

There was strong evidence to suggest that physical interventions are among the most effective rail suicide prevention measures. Internationally, Platform Screen Doors (PSDs) proved highly effective in reducing rail suicides at underground stations. However, their effectiveness and applicability in the UK might limited due to the open nature of much of the rail network and high implementation costs. Further UK-based evidence is required to assess the feasibility, alongside costs and benefits of integrating PSD installation into broader infrastructural projects, particularly at high-risk locations. Future research should also explore the impact of half-sized PSDs as a more cost-effective alternative.

Fencing along tracks was positively associated with a reduction in rail suicides. This is particularly relevant for the UK, as tracks were found to be the second most common location for rail suicides. However, UK-specific evidence is lacking. Future research should evaluate the effectiveness of fencing in the UK railway system, focusing on identifying optimal locations and lengths for implementation.

Mid-platform fencing showed potential in reducing rail suicides on 'fast lane' platforms, which is relevant to the UK's high-speed rail networks. However, the evidence is limited and preliminary. Further research is warranted to assess the long-term effectiveness of mid-platform fencing in the UK, addressing practical issues such as proper gate locking.

International evidence suggested that removing level crossings can significantly decrease railway suicides. However, this intervention may have limited impact in the UK, where a small proportion of rail suicides occur at level crossings.

Impacts on staff and passengers

This chapter discusses evidence on the impacts that rail suicides and accidental fatalities may have on rail staff and passengers, and the most effective ways of mitigating these impacts. It begins by summarising the overall evidence relating to train drivers and then moves on to discussing the evidence on other rail staff and passengers.

Impacts on train drivers

This section outlines the psychological and occupational impacts of rail suicides on train drivers. It also explores potential mitigations to support train drivers in the aftermath of the event.

Psychological impacts

There was consistent evidence indicating that rail suicide and accidental fatalities have psychological impacts on train drivers and can cause post-traumatic stress disorder symptoms (PTSD) and poor psychosocial functioning.

Drivers were likely to experience short-term impacts, and these symptoms were found to reduce between 3 months and one year in most cases. However, there was evidence suggesting that some drivers suffered from long-term psychological impacts although these were generally less severe.

Short-term impacts

Short term impacts refer to impacts which occur immediately after to three months from witnessing death by rail suicide or suicide attempt. According to the evidence reviewed, train drivers experienced post-traumatic and acute stress disorder symptoms over this period as well as lower psychosocial functioning.

Abbott et al. (2003, cited in Bardon & Mishara, 2015) found that after a Person Under Train (PUT) accident, UK train drivers experienced shock, numbness and horror immediately after the incident. Similarly, underground drivers in Germany experienced post-traumatic symptoms immediately after a critical incident including nightmares, intrusive memories of the event, flashbacks and numbness (Giupponi, et al., 2019). Limosin et al. (2006)

recruited train drivers from 30 depots in France. Train drivers who had experienced PUT accidents were compared with a control group of matched drivers. Their psychological state was assessed 15 days, three months and one year after the event. Fifteen days after the event, drivers who had experienced a PUT accident had higher General Health Questionnaire (GHQ-28) scores[18] than the control group. They also reported more somatic symptoms[19], anxiety/insomnia and social dysfunction. Nearly one quarter of the drivers were prescribed psychotropic drugs[20] in the first 24 hours due to their distress.

Train drivers who witnessed rail suicide and accidental fatalities also showed signs of lower psychosocial functioning. Cothereau et al.'s quasi-experimental study (2004) compared the mental health and occupational outcomes of French train drivers who experienced a PUT accident to those who did not. The group who experienced a PUT accident had lower psychosocial functioning scores immediately after the event compared to those who did not.

Medium-term impacts

Medium term impacts refer to impacts which occur between three months to one year after witnessing death by rail suicide or suicide attempt. There was mixed evidence identified by this REA as to whether train drivers experienced post-traumatic symptoms over this period.

Evidence suggested that the more severe symptoms were short-term and tended to reduce from three months onwards. Two longitudinal studies in Clarner et al.'s systematic review (2015) concluded that the frequency of PTSD decreased over time following exposure to an accident. There were also no significant differences in GHQ-28 scores between drivers who had experienced a PUT accident compared to the control group at two time points: three months and one year after the accidents (Limosin, et al., 2006). In addition, Cothereau et al. (2004) found that the initial distress identified in train drivers returned to normal within one year. Conversely, Bardon and Mishara (2014, cited in Bardon & Mishara, 2015) found that out of 40 train drivers in Canada, 5% were still affected by PTSD after 6 months. They observed that those who had symptoms after one month were more likely to experience long-term negative impacts. It is important to note that such inconsistency of findings might be due to the use of different methods, varying sample sizes and other contextual factors, such as the nature or frequency of PUT accidents.

[18] The General Health Questionnaire – 28 (GHQ-28) is a self-report screening measure used to detect possible psychological disorder. The GHQ-28 identifies two main concerns: (1) the inability to carry out normal functions; and (2) the appearance of new and distressing phenomena. The GHQ-28 consists of 28 questions designed to identify whether an individual's current mental state differs from his/her typical state. Higher scores indicate a greater possibility of psychological distress.

[19] Somatic symptoms are one of the components that the GHQ-28 assesses. They refer to exaggerated and disrupted physical symptoms in multiple areas of the body that a person experiences, which may or may not have an identifiable medical cause.

[20] Psychotropic drugs treat a variety of conditions, from sleep disorders and pain to anxiety, depression, and psychosis. They can affect a person's mood, behaviour, perception, and thoughts.

Long term impacts

Long term impacts refer to impacts which occur one year after witnessing death by rail suicide or suicide attempt. There was limited evidence to suggest that some drivers experienced long-term psychological impacts, although these were less severe. However, no evidence was found exploring the long-term impact on train drivers in the UK.

In their systematic review, Bardon and Mishara (2015) identified one study that examined long-term impacts on train drivers. The study was based on interviews with 16 Swedish drivers who had experienced a PUT accident (Briem et al., 2007, cited in Bardon & Mishara, 2015). The authors found that the most common long-term effect was mild PTSD symptoms which did not meet the criteria for the diagnosis of PTSD but still had an impact on the drivers. Although the drivers generally did not feel that their work was affected, they felt the events were permanently etched in their memory. Notwithstanding this, the absence of quantitative research on the longer-term impact on drivers of witnessing rail suicide makes it difficult to generalise the findings at the population level.

Occupational impacts

Occupational impacts relate to the effect that witnessing PUT accidents has on work and employment. There was consistent evidence indicating that rail suicide and accidental fatalities had occupational impacts on train drivers due to the time taken off work. There was mixed evidence as to whether this affected their work practice, with some evidence indicating that drivers had to change job completely and others showing no affects at all.

Time off work

Presently, UK train drivers experiencing PUT accidents are automatically remitted to their company's' medical service where they are examined by a doctor who decides when drivers can return to work. There was evidence suggesting that most train drivers tended to take sick leave after witnessing a rail suicide or accidental fatality. However, more up-to-date evidence is required to evaluate the current state of play.

The Tavistock Institute of Human Relations (2013) evaluated the 'Tackling Suicide on the Railways Programme' delivered by Network Rail and Samaritans. The study found that, between 2008 and 2012, UK train drivers collectively took an average of 5,265 days of sick leave per year as a result of witnessing death by rail suicide or a suicide attempt. Two sources explored the effect on French train drivers (Limosin, et al., 2006; Cothereau, et al., 2004). A longitudinal study by Limosin et al. (2006) found that around 68% of drivers took sick leave after the event. Similarly, Cothereau et al.'s quasi-experimental study (2004) found that 70% of drivers were given temporary sick leave after the PUT accident for an average of 4 days. However, these findings could be outdated, warranting further research to examine the current use of sick leave by train drivers who experienced rail suicides or attempts.

Changes to work practice

There was mixed international evidence suggesting that some train drivers changed their work practice or profession altogether as a result of experiencing a PUT accident. No evidence was found exploring changes to work practice among UK train drivers.

Limosin et al. (2006) found that, in France, only 6% of train drivers continued to drive alone after witnessing a PUT accident, 52% continued to drive but with another driver and 42% stopped driving completely. A study conducted in Germany, found that out of 50 underground drivers, four changed career path and moved on to working in traffic services, and three had to be prematurely pensioned due to chronic PTSD or depression after six months (Giupponi, et al., 2019).

Notwithstanding this, Cothereau et al. (2004) found that 95% of drivers in France were evaluated as being fit to work a few days after the incident, and no negative short-, medium-, or long-term occupational impacts were found. It is important to note that drivers were assessed between six months and one year after the event, which may have been too soon to evaluate any changes in their career trajectory.

Risk factors

There was consistent evidence suggesting that some risk factors could make train drivers more susceptible to experiencing psychological and occupational impacts. These included existing mental health conditions and witnessing multiple accidents.

Clarner et al.'s systematic review (2015) found that train drivers who had previously experienced traumatic events and/or sustained stress were more likely to experience post-traumatic disorders. Other sources highlighted that drivers who received a previous PTSD or depression diagnosis (Giupponi, et al., 2019), or experienced previous acute stress (Cothereau, et al., 2004), were more likely to relapse after witnessing death by rail suicide.

In their systematic review, Bardon and Mishara (2015) found mixed evidence on the impact of experiencing multiple accidents on train drivers. Some evidence suggested that drivers who experienced multiple PUT accidents were more likely to develop PTSD, affecting them mentally, emotionally and physically (Bardon & Mishara, 2015). Additionally, experiencing multiple accidents was associated with occupational impacts. Clarner et al. (2015) found that drivers who experienced multiple PUT accidents were more likely to leave the company or be subject to internal job rotation compared to those who had experienced one PUT accident. Conversely, other evidence suggested that levels of distress were higher after drivers' first PUT accident but decreased for subsequent ones (Bardon & Mishara, 2015). This may suggest that the experience of multiple accidents may desensitise drivers to the traumatic aspect of the events.

Other risk factors

The evidence found a range of other risk factors that could increase the likelihood of experiencing psychological and occupational impacts. These included:

- **Event-related risk factors**: these included the severity of the incident, the severity of the injury caused by the incident, and the number of people who were injured (Clarner, et al., 2015).

- **Work-related risk factors:** these included being assisted by colleagues after the incident and leaving the site accompanied or alone (Clarner, et al., 2015).

- **Individual-related risk factors**: these included poor coping strategies, suppression of emotions, perceived vulnerability of the victim and contact with the corpse (Bardon & Mishara, 2015).

Mitigations

The evidence reviewed explored two main mitigation measures: psychotherapy programmes and eye movement and desensitisation processing (EMDR). Psychotherapy programmes are usually offered to individuals soon after an incident has taken place. EDMR interventions are designed to alleviate the distress caused by traumas and are usually offered three months after the event. There was evidence suggesting that psychotherapy programmes and EMDR interventions could be effective in mitigating train drivers' psychological impacts. However, the lack of randomised experiments and control groups makes it difficult to draw definitive conclusions on the effectiveness of the measures.

Psychotherapy programmes

The evidence reviewed indicated that psychotherapy programmes could reduce post-traumatic symptoms in train drivers. However, some train drivers had to continue treatment and psychotherapy after the programme finished. There was a lack of evidence on the effectiveness of psychotherapy programmes in the UK context.

There was evidence evaluating the effectiveness of psychotherapy programmes for drivers with symptoms related to PTSD, anxiety and depression. Mehnert et al. (2012) set up a four-week rehabilitation programme for train drivers experiencing rail suicide and accidental fatalities. The programme aimed to reduce distress and regain physical, psychosocial and occupational functioning. It involved education, physical therapy and relaxation training consisting of individual psychosocial counselling and cognitive behavioural group therapy. The study group consisted of 73 male train drivers, recruited from an inpatient rehabilitation clinic in Northern Germany, and assessed symptoms at different stages of the rehabilitation programme. At the beginning of the programme, 44% of drivers had moderate to severe PTSD and 14% had severe PTSD. At the end of the programme, this reduced to 42% and 11% respectively. Six months after the programme, there was a general reduction in post-traumatic stress, anxiety, depression and overall distress. However, 29% of the drivers still experienced moderate to severe PTSD and 8% severe PTSD. These drivers had to continue treatment and psychotherapy after the programme finished.

Giupponi et al. (2019) evaluated a low-intensity stepped-care programme, in Munich, Germany, aimed at providing support to drivers in the process of post-traumatic remission and recovery. The programme consisted of emotional reassurance, psychoeducation and

support in self-management. The authors found that, out of 50 drivers, 43 had no symptoms and returned to work after six months. However, 7 drivers still suffered from post-traumatic symptoms and severe social impairment.

Notwithstanding this, the lack of randomised control trials and high-quality theory-based evaluation prevents from drawing definitive conclusions, particularly in relation to the causal effects between psychotherapy and PTSD symptoms.

Eye movement and desensitisation processing

The evidence suggested that EMDR interventions could be effective in mitigating the impact of PTSD due to a PUT accident. However, the evidence presented several limitations and there was a lack of evidence exploring this in the UK context.

As part of a randomised control trial, Högberg et al (2007) recruited employees of the public transportation system in Stockholm, who had experienced a PUT accident or had been assaulted at work, over three months but less than six years before. This included train drivers, ticket collectors and service staff on the underground, commuter trains and long-distance trains. In total, 24 participants were randomised to either EMDR therapy or the waiting list. The therapy was given in five 90-minute sessions during a two-month period, without a fixed interval, and was randomly assigned to two psychotherapists.

The study found that 67% of participants in the treatment group did not fulfil the PTSD criteria after treatment, suggesting that the EMDR programme significantly reduced participants' post-traumatic symptoms. Moreover, there were significant between-group differences after treatment in the Global Assessment of Functioning[21] and Hamilton Rating Scale for Depression scores[22]. The scores showed that there was a generally higher level of functioning in the treated group after the treatment (Högberg, et al., 2007). The authors identified three limitations to the study. Firstly, the sample size was relatively small. Secondly, genders were not evenly represented. Thirdly, long-term outcomes were not assessed.

Other mitigations

Other mitigating strategies and approaches that emerged from the evidence included:

- Support strategies: this involves support from family and peer groups (Bardon & Mishara, 2015).

- Support by employer: this involves two approaches: offering support and follow-ups and offering to participate in a critical incident response programme; not pressuring drivers to return to work, allowing them to recuperate after the accident and cope with post-traumatic symptoms (Bardon & Mishara, 2015; Cothereau, et al., 2004)

[21] The Global Assessment of Functioning, or GAF, scale is used to rate how serious a mental illness may be. It measures how much a person's symptoms affect their day-to-day life on a scale of 0 to 100.

[22] The Hamilton Depression Rating Scale (HAM-D) is a questionnaire that measures the severity of depression and the effectiveness of antidepressants in clinical trials. The scale is scored on a scale of 0–4 points, and the total score is calculated by adding the scores from each question.

- Driver guidance: this involves ensuring drivers are informed about the possibility of suicide, what happens following the event and the support available to them. An example is the driver fatality guidance developed by Samaritans in collaboration with Associated Society of Locomotive Engineers and Firemen (Aslef) (Tavistock Institute of Human Relations, 2013).

It is important to note that these approaches were not evaluated in the evidence. Therefore, it is not possible to draw definitive conclusions about their effectiveness.

The perspective of stakeholders

Stakeholders interviewed as part of this study further suggested that future research should seek to investigate the ripple effect and impact on staff such as hearing about rail suicide and how this may trigger secondary trauma.

Conclusion, evidence gaps and future research

Rail suicides and accidental fatalities have significant short-term psychological and occupational impacts on train drivers, including PTSD symptoms, reduced psychosocial functioning, and sick leave, with some experiencing long-term effects or leaving the profession. However, evidence on long-term psychological impacts and occupational changes, particularly in the UK context, is limited. Future longitudinal research is required to assess changes in UK train drivers' mental health and career progression over several years after witnessing rail suicide.

Psychotherapy programmes and EMDR therapy show promising results in reducing post-traumatic symptoms in train drivers. However, no evidence was found exploring these mitigation strategies in the UK. Further research based on rigorous randomised controlled trials and theory-based evaluations is recommended to evaluate psychotherapy programmes and EMDR therapy targeting UK rail staff and explore optimal combinations of mitigation strategies for comprehensive driver support.

Several risk factors, including pre-existing mental health conditions, previous traumatic experiences, and exposure to multiple incidents, may exacerbate train drivers' adverse impacts after witnessing rail suicides or accidental fatalities. However, the relative importance of different risk factors and their interactions are not well understood. Further evidence is warranted to develop comprehensive risk assessment tools that account for various individual-, work-, and event-related factors to identify drivers at higher risk of adverse outcomes, and which interventions would be best suited to treat different outcomes.

Other rail staff

This section discusses the impacts of rail suicides on other rail staff. It then explores potential mitigation approaches to emotionally support other rail staff witnessing rail suicide.

Impacts

There was some evidence indicating that rail suicides and accidental fatalities had an impact on other rail staff including railway engineers, train crew members and rail industry employees who stopped or intervened in a suicide attempt. Impacts included increased levels of stress and suicidal thoughts and attempts.

Bardon and Mishara's systematic review (2015) found that both railway engineers and train crew members experienced higher levels of stress as a result of witnessing a PUT accident. One source found that railway engineers in New York, who witnessed a PUT accident, generally experienced increased levels of stress as a result of the event (Margiotta, 2000 cited in Bardon & Mishara, 2015). Similarly, within a few days of witnessing a fatality, train crew members experienced higher levels of stress (Bardon & Mishara, 2015).

Research conducted in the UK (Marzano, et al., 2020) also suggested that some rail employees witnessing death by rail suicide or a suicide attempt experienced suicidal thoughts and attempted suicide themselves. The authors cautioned that the findings might not be representative of railway personnel more widely.

Mitigations

The evidence reviewed suggested a range of mitigation interventions to support other rail staff experiencing rail suicide. These included:

- **The Emotional Support Outside of Branch (ESOB) (post-incident) service:** this is an initiative delivered by Samaritans and involves volunteers visiting the station on the days following an incident, talking to staff and public, and handing out Samaritans contact cards. The service was highly rated by 75% of front-line staff who felt it helped reduce staff distress following an incident (Tavistock Institute of Human Relations, 2013).

- **Trauma support training**: this is a one-day training delivered by Samaritans that aims to provide information to driver managers and union representatives on how to recognise signs of trauma in their staff, and strategies for addressing this. Around 74% of front-line staff felt that the training reduced staff distress, 17% indicated it might increase distress and 9% believed it would have no effect at all. The training was one of the most highly rated activities in terms of its potential of reducing distress following a suicide incident, compared to other measures such as the ESOB service and driver fatality guidance. (Tavistock Institute of Human Relations, 2013).

- **EMDR:** discussed in greater detail above, EMDR interventions were found to be effective not only for train drivers but for other rail staff, including ticket collectors and service staff (Högberg, et al., 2007).

The perspective of stakeholders

Stakeholders interviewed as part of this study highlighted that staff taking time off due to trauma after witnessing an incident tend to attribute their absence to other causes. This might be due to stigma surrounding mental health or a lack of understanding from employers and employees about the long-term effects of such experiences. Stakeholders felt that the true occupational impacts on staff may be underestimated within the data, suggesting that the true impact of rail suicides on staff well-being may be underestimated within the data on occupational impacts.

Conclusion, evidence gaps and future research

Rail suicides and accidental fatalities affect other rail staff, causing increased stress levels and, in some cases, suicidal thoughts and attempts. However, the evidence is limited, and the findings may not be representative. Further evidence is warranted based on larger, more representative samples of rail staff to accurately assess the prevalence and severity of these impacts across different roles in the rail industry.

Several mitigation interventions, including the ESOB (post-incident) service, trauma support training, and EMDR therapy, show promising results in supporting rail staff affected by rail suicides. However, the evidence exploring the effectiveness of these interventions is limited as it mainly relies on cross-sectional staff surveys. Further impact evaluation is required to robustly investigate these interventions and their long-terms outcomes, as well as potential synergies between different support strategies for rail staff.

Impact on Passengers

This section discusses the impacts of rail suicides on passengers and mitigation measures to support those who experienced rail suicide as part of their journey.

Impacts

This study found little evidence on the impact of rail suicide on rail passengers. Some evidence explored the impact of specific railway announcements and the emotional responses and reactions that these generated.

Majava and Nicholls (2015) analysed social media responses to understand the extent to which ‘person hit by a train’ announcements affected passengers emotionally. Passengers showed a range of emotional responses. Some passengers focused on the implications that the event had on their journey and were fatigued and frustrated about the disruption. Other passengers were more emotionally affected by the incident and felt sadness and sympathy to all those involved, including the individual, their family and train driver.

Marzano et al. (2020) found that, in the UK, messaging about death by rail suicide can make passengers prone to thinking that death by rail suicides is more common than it is.

Mitigations

The evidence suggested a range of mitigating approaches that could ease the impact of rail suicide on passengers. These included:

- **Providing a safe space:** passengers who intervene in a suicide attempt may benefit to be directed and receive emotional support from charity organisations. Providing them with a space to talk about their feelings could help them reflect on what they experienced (Katsampa, et al., 2022).

- **Using different terminology in train announcements:** passengers prefer an announcement that does not disclose full details about the incident and provides less graphic information. As further discussed in the Railway messaging section, passengers suggested 'emergency services dealing with an incident' as it provides enough detail and honesty about the incident (Majava & Nicholls McNaughton, 2015).

- **Providing more information to affected passengers:** this could involve offering clear information about alternative routes or transport options, and severity and length of the delay, which would allow passengers to plan what to do next when their journey is affected (Majava & Nicholls McNaughton, 2015).

There was, however, a consistent lack of evaluation of the impact of these mitigating approaches, making it difficult to draw any definitive conclusions about their effectiveness.

The perspective of stakeholders

Stakeholders interviewed as part of this study described an approach to post-incident support based on geotargeted digital interventions. Following a rail fatality at a specific location, a targeted digital campaign is implemented several weeks after the incident. This is based on geotargeting technology to reach individuals using a mobile device within a certain radius of the location. Users in the area receive pop-up advertisements or social media posts directing them to the Hub of Hope, a mental health support resource. This strategy aims to provide timely support to individuals who may have been affected by the incident, either directly or indirectly. However, there has been no formal impact evaluation of the Hub of Hope's effectiveness in this context.

Conclusion, evidence gaps and future research

The evidence reviewed found that rail suicides and accidental fatalities affect passengers through journey disruptions and causing emotional responses. However, the evidence is limited, focusing mainly on social media responses, which may not fully represent the range of passenger experiences. Further evidence is needed to explore a broader range of

passenger impacts across different demographics and geographical areas, using varied methodologies. This would generate more comprehensive insights into how rail suicide affects rail users. Future research should seek to explore the impacts on passengers who witnessed a rail suicide, rather than passengers who did not specifically witness an incident.

Several mitigation approaches were suggested to ease the impact on passengers. These included: providing safe spaces for those who intervene in suicide attempts, using less graphic terminology in announcements, and offering more detailed information about incidents and alternative routes. The effectiveness of these approaches lacks rigorous evaluation, making it difficult to draw definitive conclusions about their impact. Further evidence is needed based on more systematic evaluation of these mitigation strategies, assessing their effectiveness in reducing passenger distress and improving overall rail experience in the aftermath of such incidents.

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Appendix A: Detailed methodology

This section outlines the overall methodology, including stakeholder interviews, development of the assessment protocol, and each of the specific stages in the identification, screening, extraction of evidence and reporting.

The overall design was organised into three key screening stages and a set of supporting activities, as summarised in Figure 1.

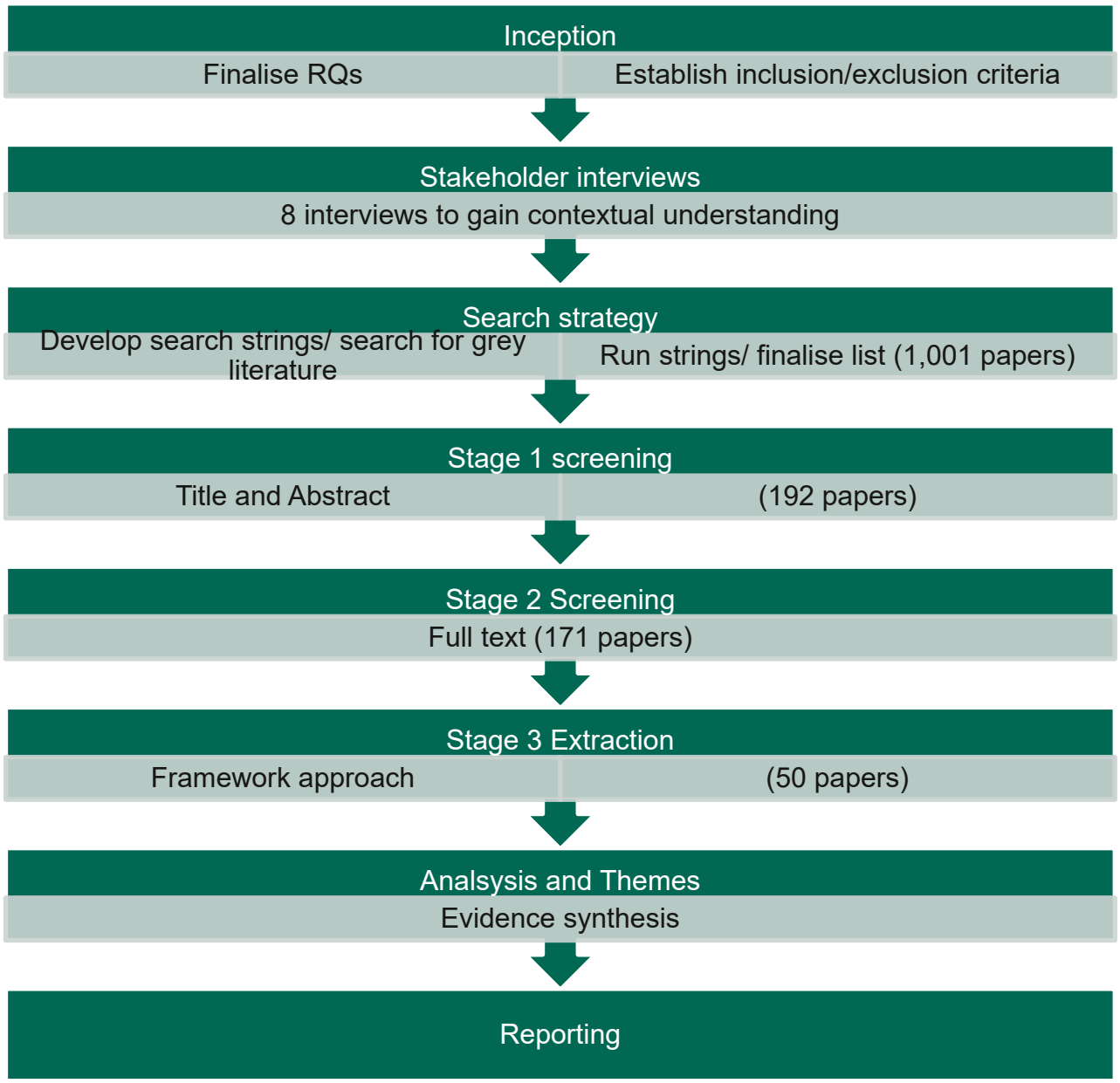

Figure 1 Evidence assessment stages. These stages included inception, stakeholder interviewers, search strategy, stage 1 screening, stage 2 screening, stage 3 extraction, analysis and themes, and reporting.

Stakeholder interviews

NatCen conducted eight online stakeholder interviews, each lasting approximately one hour. DfT identified and made initial contact with the most appropriate stakeholders. These represented a diverse range of sectors, including central government, the rail industry, charities, and other public sector bodies. NatCen conducted paired interviews when multiple stakeholders from the same organisation were available and willing to participate.

These interviews served multiple purposes:

- Ensure the research team was well-informed about the current policy and research landscape;
- Familiarise the team with relevant terminology; and
- Facilitate access to otherwise hard-to-reach grey literature.

Working closely with DfT, NatCen developed a high-level topic guide exploring the themes summarised below. The topic guide was used flexibly and ensured participants could guide the conversation.

- **Background:** to gain brief contextual information about the participant, the team they work in and interest in the subject.
- **Policy and operational landscape:** to further understand the policy and operational landscape around rail suicides prevention and impacts.
- **Research and evidence**: to build an understanding of the research and evidence base, which informed the search strategy, data extraction and analysis.

NatCen followed up with stakeholders after the interviews to ask for any literature recommendations, including unpublished industry documents that the research team would otherwise be unable to access. NatCen also asked stakeholders for permission to send further questions by email. This proved useful in the later stages of the REA process as gaps in the literature were identified.

Evidence assessment protocol

An inception meeting was held to discuss and agree the thematic scope, sub-themes, research questions, as well as key concepts and terms to be included in the search strings. DfT also made suggestions for academic studies and grey literature to be included in the REA. As part of the initial scoping, the research team ran a series of test searches using generic search strings on bibliographic databases to gauge the likely size of the evidence base. This was used to further refine the thematic scope of the assessment and its sub-themes and provide initial information on the broad composition of the evidence base (e.g. likely availability of UK-based evidence, types of methods and studies, availability of systematic or meta review studies).

Following this, NatCen developed a protocol outlining the process and methods to undertake the REA, including search strategy and academic search strings.

Search strategy

The search strategy involved separate searches for academic and grey literature:

- **Peer-reviewed academic literature** was first searched for using a combination of search strings in academic databases. Citation tracking was then undertaken, which involved reviewing the list of referenced papers in selected sources to establish their relevance for inclusion in the REA.

- **Grey literature** was searched for by identifying a list of relevant organisations and searching their websites using key terms, alongside consulting key stakeholders for relevant sources.

Inclusion and exclusion criteria

The inclusion criteria were developed to narrow the search to the papers most relevant to the research questions. These are set below:

- **Language**: we included studies written in English only.
- **Publication status**: we included published academic literature in addition to published grey literature, and unpublished grey literature if any was found.
- **Date of publication**: we included studies published from 2000 onwards, but we prioritised the most recent evidence.
- **Countries**: while we initially focused on UK, Europe, North America and Australia, the scope was subsequently expanded to include studies from Japan, Hong Kong and South Korea. This is due to these countries presenting a substantial body of applied research that addressed our research questions.
- **Topic**: we searched for and prioritised evidence relating to rail suicides which discussed prevention, effectiveness of prevention measures, impacts on staff and passengers, and socio-environmental determinants of rail suicides. While maintaining a primary focus on rail suicides, we included evidence on fatalities from trespassing and at level crossings as they likely share common prevention interventions and impacts on staff and passengers.
- **Study design**: we included both primary and secondary research studies. We took a broad view on appropriate methodologies, but prioritised evaluation evidence when looking at prevention, and when looking at the effectiveness of impact mitigation strategies.

Academic database search and search strings

The search strings were developed in consultation with an information specialist. These were then used to search for suitable evidence in the following academic databases:

- Scopus
- Medline
- PsycInfo
- NatCen utilised Google Scholar with customised search strings to find additional sources. Furthermore, citation tracking was undertaken using the Citation Chaser tool.

- The search yielded a total of 883 studies potentially relevant to the evidence assessment. A further 8 academic papers were recommended by stakeholders. A total of 891 academic papers were identified. Table 1 below summarises the results of the academic search across four different databases, showing the number of sources found in each database and the total number of sources after removing duplicates. Table 2, Table 3, and Table 4 show the summary search strategies deployed and breakdowns of the number of sources returned for each search string and in each database.

Database Name	Platform	Date of search	# of results
Scopus	Elsevier	April 18, 2024	630
Medline	Ovid	April 18, 2024	372
PsycInfo	EbscoHOST	April 18, 2024	253
TRID (Transport Research International Documentation)	https://trid.trb.org/	April 18, 2024	118
Total results from all databases			1373
Total results after deduplication			883

Table 2 Search summary

1	TITLE-ABS(rail* OR train OR trains OR locomotive* OR "transit system" OR subway* OR "witches hat*" OR "platform and gates" OR "mid platform fenc*" OR "anti-trespass panel*" OR "trip wire" OR "cross hatching" OR "blue light*") OR AUTHKEY(rail* OR train OR trains OR locomotive* OR "transit system" OR subway* OR "witches hat*" OR "platform and gates" OR "mid platform fenc*" OR "anti-trespass panel*" OR "trip wire" OR "cross hatching" OR "blue light*")	558,254
2	TITLE-ABS(suicid* OR "psychological autops*" OR "lethal means") OR AUTHKEY(suicid* OR "psychological autops*" OR "lethal means")	142,852
3	#1 AND #2	807
4	TITLE-ABS-KEY(china OR india OR brazil OR indonesia OR malaysia OR japan OR africa)	4,004,195

5	#3 AND NOT #4	730
6	TITLE-ABS(((accident* OR fatal*) AND (crossing OR trespass*)) OR "critical incident*" OR "person under train") OR AUTHKEY(((accident* OR fatal*) AND (crossing OR trespass*)) OR "critical incident*" OR "person under train")	10,578
7	TITLE-ABS((((psychological OR emotional OR mental) W/3 (trauma* OR stress* OR respons* OR episode* OR outcome* OR morbidity OR consequence* OR sequela* OR symptom* OR implication* OR maladjust* OR indication*)) OR posttrauma* OR "post-traum*" OR PTSD OR coping OR impact* OR effect* OR reaction*) W/5 (driver* OR engineer OR engineers OR employee* OR staff OR worker* OR personnel OR passenger* OR commuter*)) OR AUTHKEY((((psychological OR emotional OR mental) W/3 (trauma* OR stress* OR respons* OR episode* OR outcome* OR morbidity OR consequence* OR sequela* OR symptom* OR implication* OR maladjust* OR indication*)) OR posttrauma* OR "post-traum*" OR PTSD OR coping OR impact* OR effect* OR reaction*) W/5 (driver* OR engineer OR engineers OR employee* OR staff OR worker* OR personnel OR passenger* OR commuter*))	122,660
8	TITLE-ABS-KEY("systematic review" OR "umbrella review" OR "realist review" OR "rapid review" OR "critical review" OR "scoping review" OR "systematic literature review" OR "rapid evidence assessment" OR "integrative review" OR metanalysis OR "meta-analysis")	832,468
9	#7 OR #8	952,156
10	#1 AND #6 AND #9	57
11	#5 OR #10	777
12	Limit to English	706
13	Limit 2000-present	630

Table 3 Search strings 1

Database name: Scopus
Platform: Elsevier
Date searched: April 18, 2024
Number of results: 630

1	(rail* OR train OR trains OR locomotive* OR "transit system" OR subway* OR "witches hat*" OR "platform and gates" OR "mid platform fenc*" OR "anti-trespass panel*" OR "trip wire" OR "cross hatching" OR "blue light*").ti,ab,kf,hw.	86835
2	(suicid* OR "psychological autops*" OR "lethal means").ti,ab,kf,hw.	119354
3	1 or 2	484
4	(china OR india OR brazil OR indonesia OR malaysia OR japan OR Africa).ti,ab,kf,hw.	1211068
5	3 not 4	448
6	(((accident* OR fatal*) AND (crossing OR trespass*)) OR "critical incident*" OR "person under train").ti,ab,kf,hw.	3899
7	((((psychological OR emotional OR mental) adj3 (trauma* OR stress* OR respons* OR episode* OR outcome* OR morbidity OR consequence* OR sequela* OR symptom* OR implication* OR maladjust* OR indication*)) OR posttrauma* OR "post-traum*" OR PTSD OR coping OR impact* OR effect* OR reaction*) adj5 (driver* OR engineer OR engineers OR employee* OR staff OR worker* OR personnel OR passenger* OR commuter*)).ti,ab,kf,hw.	30711
8	("systematic review" OR "umbrella review" OR "realist review" OR "rapid review" OR "critical review" OR "scoping review" OR "systematic literature review" OR "rapid evidence assessment" OR "integrative review" OR metanalysis OR "meta-analysis").ti,ab,kf,hw,pt.	531483
9	#7 OR #8	560777
10	#1 AND #6 AND #9	26
11	5 or 10	467
13	Limit 2000-present	372

Table 4 Search strings 2

Database name: Medline
Platform: Ovid
Date searched: April 18, 2024
Number of results: 372

1	TI(rail* OR train OR trains OR locomotive* OR "transit system" OR subway* OR "witches hat*" OR "platform and gates" OR "mid platform fenc*" OR "anti-trespass panel*" OR "trip wire" OR "cross hatching" OR "blue light*") OR AB(rail* OR train OR trains OR locomotive* OR "transit system" OR subway* OR "witches hat*" OR "platform and gates" OR "mid platform fenc*" OR "anti-trespass panel*" OR "trip wire" OR "cross hatching" OR "blue light*") OR KW(rail* OR train OR trains OR locomotive* OR "transit system" OR subway* OR "witches hat*" OR "platform and gates" OR "mid platform fenc*" OR "anti-trespass panel*" OR "trip wire" OR "cross hatching" OR "blue light*")	19,237
2	TI(suicid* OR "psychological autops*" OR "lethal means") OR AB(suicid* OR "psychological autops*" OR "lethal means") OR KW(suicid* OR "psychological autops*" OR "lethal means") OR SU(suicid* OR "psychological autops*" OR "lethal means")	68,526
3	#1 AND #2	291
4	TI(china OR india OR brazil OR indonesia OR malaysia OR japan OR Africa) OR AB(china OR india OR brazil OR indonesia OR malaysia OR japan OR Africa) OR KW(china OR india OR brazil OR indonesia OR malaysia OR japan OR Africa) OR SU(china OR india OR brazil OR indonesia OR malaysia OR japan OR Africa)	130,991
5	S3 NOT S4	275
6	TI(((accident* OR fatal*) AND (crossing OR trespass*)) OR "critical incident*" OR "person under train") OR AB(((accident* OR fatal*) AND (crossing OR trespass*)) OR "critical incident*" OR "person under train") OR KW(((accident* OR fatal*) AND (crossing OR trespass*)) OR "critical incident*" OR "person under train")	3482
7	TI((((psychological OR emotional OR mental) N3 (trauma* OR stress* OR respons* OR episode* OR outcome* OR morbidity OR consequence* OR sequela* OR symptom* OR implication* OR maladjust* OR indication*)) OR posttrauma* OR "post-traum*" OR PTSD OR coping OR impact* OR effect* OR reaction*) N5 (driver* OR engineer OR engineers OR employee* OR staff OR worker* OR personnel OR passenger* OR commuter*)) OR AB((((psychological OR emotional OR mental) N3 (trauma* OR stress* OR respons* OR episode* OR outcome* OR morbidity OR consequence* OR sequela* OR symptom* OR implication* OR maladjust* OR indication*)) OR posttrauma* OR "post-	26973

	traum*" OR PTSD OR coping OR impact* OR effect* OR reaction*) N5 (driver* OR engineer OR engineers OR employee* OR staff OR worker* OR personnel OR passenger* OR commuter*)) OR KW((((psychological OR emotional OR mental) N3 (trauma* OR stress* OR respons* OR episode* OR outcome* OR morbidity OR consequence* OR sequela* OR symptom* OR implication* OR maladjust* OR indication*)) OR posttrauma* OR "post-traum*" OR PTSD OR coping OR impact* OR effect* OR reaction*) N5 (driver* OR engineer OR engineers OR employee* OR staff OR worker* OR personnel OR passenger* OR commuter*))	
8	TI("systematic review" OR "umbrella review" OR "realist review" OR "rapid review" OR "critical review" OR "scoping review" OR "systematic literature review" OR "rapid evidence assessment" OR "integrative review" OR metanalysis OR "meta-analysis") OR AB("systematic review" OR "umbrella review" OR "realist review" OR "rapid review" OR "critical review" OR "scoping review" OR "systematic literature review" OR "rapid evidence assessment" OR "integrative review" OR metanalysis OR "meta-analysis") OR KW("systematic review" OR "umbrella review" OR "realist review" OR "rapid review" OR "critical review" OR "scoping review" OR "systematic literature review" OR "rapid evidence assessment" OR "integrative review" OR metanalysis OR "meta-analysis") OR SU("systematic review" OR "umbrella review" OR "realist review" OR "rapid review" OR "critical review" OR "scoping review" OR "systematic literature review" OR "rapid evidence assessment" OR "integrative review" OR metanalysis OR "meta-analysis")	89955
9	S7 OR S8	116206
10	S1 AND S6 AND S9	16
11	S5 OR S10	285
12	Limit to English	267
13	Limit 2000-present	253

Table 5 Search strings 3

Database name: PsycInfo
Platform: EbscoHOST
Date searched: April 18, 2024
Number of results: 253

Grey literature search

The search for grey literature was carried out in four main ways:

- **Web searching:** we compiled a list of relevant organisations, which was then signed off by DfT, and searched their websites for relevant publications. The websites for searching included:
    - Rail Suicide Prevention
    - RESTRAIL (REduction of Suicides and Trespasses on RAILway property)
    - Rail Safety and Standards Board
    - The Office for Health Improvement and Disparities (OHID)
    - UK Health Security Agency
    - Public Health England
    - Mind
    - Samaritans
    - Network Rail
    - Office of Rail and Road
    - Gov.uk
    - Parliament.uk
    - Railway Suicide Prevention
    - British Transport Police
    - Train Operating Companies (ToCs) in the UK
    - Transport Research Lab (TRL)
    - Centre for Transport and Society
    - Transport Focus
    - Railroads.dot.gov
    - Allonboard.org.uk
- **Google scholar: we searched** Google Scholar for relevant publications using custom search strings. Google automatically makes use of synonyms and related terms, so a restricted list of core search terms was used.

- **Citation tracking:** we searched for additional publications using citation tracking from the academic literature.

- **Stakeholder recommendations:** stakeholders were encouraged to recommend and share relevant grey literature.

The results were then manually screened by the research team to identify relevant evidence for inclusion in the full text screening stage. This resulted in **110** additional grey literature sources identified for inclusion on the basis that they were relevant to the evidence assessment.

Screening

Studies were screened for inclusion at two stages – title and abstract and at full text. At the title and abstract stage, 1001 sources were screened in total, and 810 were excluded. At the full text screening stage, 192 sources were screened and 171 were moved forward to the prioritisation stage.

Evidence sources were screened against the inclusion and exclusion criteria. At both stages a screening tool was developed and piloted by a senior member to ensure reliability of the screening process.

At title and abstract screening, the research team reviewed titles and abstracts to reject sources which seemed immediately out of scope based on the inclusion and exclusion criteria. At full text screening, the research team reviewed sources shortlisted in the title and subtract stage to ensure they met the inclusion and exclusion criteria and scored their relevancy. This involved identifying whether and which research questions the paper included evidence on. For each question or sub-question, a paper provided evidence on it was given a score of one. The research team also conducted a robust and systematic quality appraisal of the papers. This is discussed in further detail in the next section.

Quality appraisal

The quality appraisal undertaken for this REA was based on a bespoke approach building on the Weight of Evidence framework, and combined various guidelines, checklists, and frameworks, outlined below. This allowed the research team to compare different types of research effectively.

- 'Total Survey Error' framework

- CASP qualitative methods checklist

- Maryland Scientific Methods Scale

- Specialist Unit for Review Evidence (SURE) Systematic Review Critical Appraisal Checklist and the CASP systematic review checklist

Each study was assigned an overall quality score (C = low, B = medium, A = high). A final assessment was made which considered these criteria and the source in its entirety; with

scores for both relevance and robustness noted in a prioritisation framework created in Excel. This meant that some studies of lower quality were included. However, limitations were noted when reporting these findings throughout the report.

Prioritisation

After title and abstract and full-text screening, NatCen followed a systematic prioritisation process, based on assessing the relevance and quality of each paper, to determine which 50 would be included for final data extraction. Fifty papers were selected as this struck a balance between comprehensive coverage of the topic and the practical constraints of a REA. Prioritisation criteria included:

1. Studies that draw on multiple evidence sources such as systematic or evidence reviews;

2. Studies that obtained a higher quality score for the research methods used;

3. Studies that answered more than one REA research question;

4. Studies that were more recent (post 2018);

5. UK evidence over international evidence.

Further manual sense checks were carried out for each source to ensure they were fit for purpose and to maintain an optimal balance of sources for each research question. This process meant that not all the initially top-ranked 50 papers were selected. For example, we found limited evidence addressing research question 2.25 To address this gap, we included some papers that, while scoring lower in our prioritisation assessment, provided evidence on this specific topic.

Data extraction and reporting

Based on an initial review of a subset of the prioritised papers, NatCen developed a thematic framework. The framework was structured by the key themes included in the research questions and additional themes emerging from the selected prioritised papers. Members of the research team read the 50 prioritised papers in full and extracted relevant evidence for each theme. Evidence on each thematic area was summarised and used to populate the framework. A comprehensive quality assessment was also conducted for each paper, as described in more detail above. Detailed justifications were documented for each score assigned.

The report is structured in line with the thematic framework, including a narrative summary of evidence addressing each research question.

[25] Research Question 2: What are the impacts of rail suicides, fatalities due to trespassing, and at level crossings?

Appendix B: Glossary

Acronym/Term	Definition
Blue lights intervention	Blue lights refer to blue light-emitting-diode lamps installed at stations or crossings.
British Transport Police (BTP)	The British Transport Police (BTP) is the national police force that patrols the UK's railway network, including more than 10,000 miles of track and over 3,000 stations and depots in England, Wales, and Scotland.
Bystanders	A person who is present at an event or incident but does not take part.
Clusters	A cluster is a geographical area where there is relatively high number of suicides among the population or among individuals attracted to the site. Railway clusters can be defined from a small number of suicides, as low as one occurred within 2km of the tracks. Some consider clusters when two or more rail suicides.
Copycat suicides	A copycat suicide refers to a suicide attempt or completed suicide that is inspired by or modeled after another suicide or suicide attempt, often one that has been publicised or widely known. This phenomenon occurs when an individual imitates the suicidal behaviour of another person, typically after exposure to details about the original suicide through media reports, social networks, or local community knowledge.
Direct evidence	Direct evidence is information that directly supports a fact or claim without requiring any inference or assumption. Examples of direct evidence include findings from impact evaluations.

EMDR (Eye Movement Desensitisation and Reprocessing)	Comprehensive psychotherapy that helps you process and recover from past experiences that are affecting your mental health and wellbeing. It involves using side to side eye movements combined with talk therapy in a specific and structured format.
Emotional Support Outside of Branch (ESOB) post-incident service	An initiative delivered by Samaritans and involves volunteers visiting the station on the days following an incident, talking to staff and public, and handing out Samaritans contact cards.
General Health Questionnaire (GHQ-28)	The General Health Questionnaire – 28 (GHQ-28) is a self-report screening measure used to detect possible psychological disorder. The GHQ-28 identifies two main concerns: (1) the inability to carry out normal functions; and (2) the appearance of new and distressing phenomena. The GHQ-28 consists of 28 questions designed to identify whether an individual's current mental state differs from his/her typical state.
Global Assessment of Functioning scores	The Global Assessment of Functioning, or GAF, scale is used to rate how serious a mental illness may be. It measures how much a person's symptoms affect their day-to-day life on a scale of 0 to 100.
Hamilton Rating Scale for Depression Scores	The Hamilton Depression Rating Scale (HAM-D) is a questionnaire that measures the severity of depression and the effectiveness of antidepressants in clinical trials. The scale is scored on a scale of 0–4 points, and the total score is calculated by adding the scores from each question.
Person Under Train (PUT) accident	An incident caused by a person who has accidently or intentionally fallen in front of a moving train
Principal component analysis (PCA)	Principal component analysis (PCA) reduces the number of dimensions in large datasets to principal components that retain most of the original information. It does this by transforming potentially correlated variables into a smaller set of variables, called principal components.
Priority locations	Areas with high suicide prevalence
PSDs	Platform screen doors
Lethal / lethality	Causing or capable of causing death

Appendix C: Evidence Overview

Source	Rail suicides/accidental fatalities?	Country	Grey or academic	Sample size	Overview of methods	Analytical approach	Quality Rating
Agarwal, K., 2021. Automated system for preventing suicides by train. IEEE 8th Uttar Pradesh Section International Conference on Electrical, Electronics and Computer	Railway suicides	Does not specify	Academic	52 CCTV recordings	Secondary analysis	Image analysis and Computer Vision techniques to detect behaviours on CCTV footage	B

Engineering (UPCON), pp. 1-19.							
Balt, E. et al., 2024. Sociodemographic and psychosocial risk factors of railway suicide: a mixed-methods study combining data of all suicide decedents in the Netherlands with data from a psychosocial autopsy study. BMC Public Health, 24(1), p. 60	Rail suicides	The Netherlands	Academic	• Nationwide data from Statistics Netherlands (2017-2021) • 39 psychosocial autopsies of railway suicide decedents	Mixed-methods: • Secondary analysis of quantitative data • Qualitative semi-structured interviews	• Logistic regression analysis • Thematic analysis and Constant Comparative Method	A
Bardon, C. & Mishara, B. L., 2015. Systematic Review of the Impact of Suicides and Other Critical Incidents on Railway Personnel. The American Association of Suicidology, 45(6), pp. 720-731.	Rail suicides and accidental fatalities	UK, Australia, Sweden, France, Norway, Sweden, Korea, U.S.	Academic	20 studies	Systematic review	Not applicable	B

Barker, E., Kolves, K. & Leo, D. D. L., 2017. Rail-suicide prevention: Systematic literature review of evidence-based activities. Asia-Pacific Psychiatry, 9(3), p. e12246.	Rail suicides	Japan, Hong Kong, UK, Austria	Academic	9 studies	Systematic literature review	Not applicable	A
Berman, A. L., Sundararaman, R., Price, A. & Au, J. S., 2014. Suicide on Railroad Rights-of-Way: A Psychological Autopsy Study. The American Association of Suicidology, 44(6), pp. 710-722.	Rail suicides	North America	Academic	• 55 psychological autopsies of decedents • A total of 165 interviews with families related to individuals who died by rail suicide	Qualitative semi-structured interviews	• Descriptive analysis • Data coding	A
Bhui, K., Chalangary, J. & Jones, E., 2013. Railway Suicides in the UK: risk factors and prevention strategies, s.l.: Careif.	Rail suicides	UK	Grey	20 studies	Systematic literature review	Not applicable	A

Carey, M. G. et al., 2021. The prevalence of PTSD, major depression and anxiety symptoms among high-risk public transportation workers. International Archives of Occupational and Environmental Health, Volume 94, pp. 867-875.	Rail suicides	Global	Academic	10 studies	Systematic review	Not applicable	A
Clapperton, A. et al., 2022. Preventing railway suicides through level crossing removal: a multiple-arm pre-post study design in Victoria, Australia. Social Psychiatry and Psychiatric Epidemiology, 57(11), p. 2261–2266.	Rail suicides	Victoria, Australia	Academic	• Data from the Victorian Level Crossing Removal Project official website • Data from the Victorian Suicide Register (2008-2021)	Impact evaluation (prospective pre-post design with control group)	Poisson regression analysis	B

Clapperton, A., Dwyer, J., Spittal, M. & Pirkis, J., 2023. The effectiveness of installing trackside fencing in preventing railway suicides: a pre-post study design in Victoria, Australia. Injury Prevention, 29(6), pp. 525-527.	Rail suicides	Australia	Academic	Data from Metro Trains Melbourne for 36 fencing locations (2017 and 2020)	Impact evaluation (prospective pre-post design without a control group)	Rate ratios	B
Clarner, A. et al., 2015. Work-related posttraumatic stress disorder (PTSD) and other emotional diseases as consequence of traumatic events in public transportation: a systematic review. International Archives of Occupational and Environmental Health, Volume 88, pp. 549-564.	Rail suicides and accidental fatalities	Germany, France, UK , Sweden and South Korea.	Academic	7 studies	Systematic review	Not Applicable	A

Cothereau, C. et al., 2004. Professional and medical outcomes for French train drivers after ‘‘person under train’’ accidents: three year follow up study. Occupational and Environmental Medicine, 61(6), pp. 488-494.	Person under train (PUT)	France	Academic	• 202 train drivers who had experienced a PUT accident • 186 train drivers who had not experienced a PUT accident	Impact evaluation (pre-post design with control group)	• X2 test • Fisher’s extra probability test • Student’s t test • Mann-Whitney non-parametric test	A
Cox, G. R. et al., 2013. Interventions to reduce suicides at suicide hotspots: a systematic review. BMC Public Health, 13(214), pp. 1-12.	Rail suicides	Hong Kong and Vienna	Academic	19 studies	Systematic review	Not applicable	B
Duddin, K. S. E. & Raynes, B., 2022. Why Choose the Railway? An Exploratory Analysis of Suicide Notes From a Sample of Those	Rail suicides	UK	Academic	75 suicide notes and inquest reports	Secondary analysis	• Descriptive analysis • Thematic analysis	B

Who Died by Suicide on the Railway. Crisis, 43(5), pp. 419-425.							
Giupponi, G. et al., 2019. Posttraumatic stress reactions of underground drivers after suicides by jumping to arriving trains; feasibility of an early stepped care outpatient intervention. Journal of Trauma & Dissociation, 20(5), pp. 495-510.	Rail suicides	Munich, Germany	Academic	50 underground drivers	Impact evaluation (prospective pre-post design without a control group)	Spearman's rank correlations	C
Gregor, S. et al., 2019. Patterns of pre-crash behaviour in railway suicides and the effect of corridor fencing: a natural experiment in New South Wales.	Rail suicides	New South Wales, Australia	Academic	171 cases of rail suicide (2011-2018)	Impact evaluation (prospective pre-post design with a control group)	Non-parametric tests (Chi-square tests)	B

International Journal of Injury Control and Safety Promotion, 26(4), pp. 423-430.							
Havârneanu, G. M., Burkhardt, J.-M. & Paran, F., 2015. A systematic review of the literature on safety measures to prevent railway suicides and trespassing accidents. Accident Analysis and Prevention, Volume 81, pp. 30-50.	Rail suicides and accidental fatalities	Germany, the Netherlands, Finland, UK, New York and Austria	Academic	139 studies	Systematic review	Not Applicable	B
Havârneanu, G. & Topel, K., 2019. Rail Trespassing and Suicide: What Can Be Done to Improve Safety?. TR News, pp. 23-29.	Rail suicides and accidental fatalities	Europe, Australia and USA	Grey	Not Applicable	Literature review	Not Applicable	C

Hegerl, U. et al., 2013. One followed by many?—Long-term effects of a celebrity suicide on the number of suicidal acts on the German railway net. Journal of Affective Disorders, 146(1), pp. 39-44.	Rail suicides	Munich, Germany	Academic	Data from the Deutsche Bahn Event Database Safety (EDS) (two years before and after Robert Enke's suicide in 2009)	Secondary analysis	• Mann-Whitney U-tests • Negative binomial regression	B
Högberg, G. et al., 2007. On treatment with eye movement desensitization and reprocessing of chronic post-traumatic stress disorder in public transportation workers – A randomized controlled trial. Nordic Journal of Psychiatry, 61(1), pp. 54-61.	Rail suicides and accidental fatalities	Stockholm, Sweden	Academic	21 train drivers	Impact evaluation (RCT)	• Fisher's exact test • Mann-Whitney U-test	A

Katsampa, D., Mackenzie, J.-M., Crivatu, I. & Marzano, L., 2022. Intervening to prevent suicide at railway locations: findings from a qualitative study with front-line staff and rail commuters. BJPsych Open, 8(e62), pp. 1-7.	Rail suicides	UK	Academic	11 members of the public and 10 railway staff	Qualitative interviews	Thematic analysis	B
Krysinska, K. & De Leo, D., 2008. Suicide on railway networks: epidemiology, risk factors and prevention. Australian and New Zealand Journal of Psychiatry, 42(9), pp. 763-771.	Rail suicides	Global	Academic	30 studies	Systematic review	Not Applicable	C
Lasota, D. et al., 2020. Alcohol and the Risk of Railway Suicide. International Journal of Environmental	Rail suicides	Poland	Academic	60 death registers from individuals who died by rail suicide	Secondary analysis	• Chi square tests • Correlation analysis	B

Research and Public Health, 17(19), p. 7003.						• T-tests • Logistic regression	
Limosin, F. et al., 2006. A prospective study of the psychological effects of "person under train" incidents on drivers. Journal of Psychiatric Research, 40(8), pp. 755-761.	Rail suicides and accidental fatalities	France	Academic	202 drivers who were involved in a PUT accident	Impact evaluation (prospective pre-post design with a control group)	• X2 tests • Fisher's exact test • Mann-Whitney U-test • Stepwise backward conditional logistic regression	A
Lukaschek, K., Baumert, J., Erazo, N. & Ladwig, K.-H., 2014. Stable time patterns of railway suicides in Germany: comparative analysis of 7,187 cases across two observation periods (1995–1998; 2005–	Rail suicides	Germany	Academic	7187 cases of rail suicide from the National Central Registry of person accidents on the German railway network (STABAG)	Secondary analysis	Linear regression	A

2008). BMC Public Health, 14(124), pp. 1-5.							
Mackenzie, J.-M.et al., 2018. Behaviours preceding suicides at railway and underground locations: a multimethodological qualitative approach. BMJ Open, 8(4), p. e021076.	Rail suicides	UK	Academic	• 9 individuals who survived a rail suicide attempt • 16 CCTV footage clips of individuals who died by rail suicide	• Qualitative Interviews • Qualitative survey data	• Thematic analysis • CCTV footage analysis	B
Majava, E. & Nicholls McNaughton, C., 2015. Communicating delays caused by suicides on the railway, London: Truth.	Rail suicides	UK	Grey	• 7 industry stakeholders • 46 rail passengers	*Focus groups*	Thematic analysis	C

Makara-Studzinska, M. et al., 2021. Statistical Review of the Suicide Attempts Rates Committed on Polish Railway Tracks between the Years 2013-2016. Central Nervous System Agents in Medicinal Chemistry, 21(2), pp. 85-92.	Rail suicides	Poland	Academic	834 cases of RS fatalities (2013-2016)	Secondary analysis	Descriptive analysis	A
Marsh, I., Marzano, L., Mosse, D. & Mackenzie, J.-M., 2021. First-person accounts of the processes and planning involved in a suicide attempt on the railway. BJPsych Open, 7(e39), pp. 1-7.	Rail suicides	UK	Academic	34 individuals who had attempted or contemplated rail suicide	Qualitative interviews	Thematic analysis	A

Martin, S. & Rawala, M., 2017. Suicide patterns on the London Underground railway system, 2000-2010. BJPsych bulletin, 41(5), pp. 275-280.	Rail suicides	London, UK	Academic	• 644 rail suicide attempt files from BTP (2000-2010) • 433 PUT incident files from BTP (2004-2010)	Secondary analysis	Descriptive analysis	B
Marzano, L. et al., 2016. Why do people take their lives on the Railways in Great Britain? A research study, London: Middlesex University London and University of Westminster.	Rail suicides	UK	Grey	• 1804 survey responses • 34 individuals who survived a rail suicide attempt • 15 CCTV footage clips of rail suicide incidents • 21,810 news/online reports of suicidal behaviours	Mixed-methods: • Online survey· • In-depth interviews • Secondary analysis	• Descriptive analysis • Thematic analysis • Structured analysis of CCTV and news/online reports	B

Marzano, L. et al., 2020. Suicide and Life-Saving Interventions on the Railways in Great Britain: A Research Study, London: Middlesex University London and University of Westminster.	Rail suicides	UK	Academic	• 2270 survey responses • 21 individuals who had been suicidal at a railway location or intervened when someone else was at risk • 8 CCTV footage clips of bystander interventions • 5671 records of pre-suicidal behaviour on the British Railway Network	• Secondary analysis of BTP suicide and interventions data • Survey • Qualitative interviews • Observations	• Descriptive analysis • Visual mapping analysis • Thematic analysis • Structured analysis of CCTV data	B
Marzano, L. et al., 2019. Factors deterring and prompting the decision to attempt suicide on the railway networks: findings from 353 online surveys and 34 semi-structured	Rail suicides	UK	Academic	34 individuals who had attempted or considered suicide	Mixed-methods: • Qualitative interviews • Online survey	• Thematic analysis • Descriptive analysis	B

interviews. The British Journal of Psychiatry, 215(4), pp. 582-587.							
Mehnert, A., Nanninga, I., Fauth, M. & Schäfer, I., 2012. Course and predictors of posttraumatic stress among male train drivers after the experience of 'person under the train' incidents. Journal of Psychosomatic Research, 73(3), pp. 191-196.	Rail suicides and accidental fatalities	Germany	Academic	73 train drivers	Impact evaluation (prospective pre-post design without a control group)	• Analysis of variance (ANOVA) • Two-factorial repeated measures analysis of variance (RM-ANOVA) • Regression analysis	C
Mishara, B. L., 2007. Railway and Metro Suicides: Understanding the Problem and Prevention Potential. Crisis, 28(1), pp. 36-43.	Rail suicides	Does not specify	Academic	Does not specify	Literature review	Not Applicable	C

Mishara, B. L. & Bardon, C., 2016. Systematic review of research on railway and urban transit system suicides. Journal of Affective Disorders, Volume 193, pp. 215-226.	Rail suicides	Europe, Japan, Australia, Canada, USA	Academic	55 studies	Systematic review	Not Applicable	A
Mishara, B. L. & Bardon, C., 2017. Characteristics of railway suicides in Canada and comparison with accidental railway fatalities: Implications for prevention. Safety Science, Volume 91, pp. 251-259.	Rail suicides and accidental fatalities	Canada	Academic	428 rail suicides and 460 accidental deaths. Information on these were obtained from files from the Transportation Safety Board, railway companies, and provincial coroners and medical examiners (1999-2008)	Secondary analysis	Descriptive analysis	B

Norman, H. et al., 2022. Suspected Suicides on the Railways in England: A Psychological Autopsy Study, London: Middlesex University.	Rail suicides	UK	Academic	All data related to suspected rail suicides on English railways, obtained from BTP files	Secondary analysis	• Descriptive analysis • T-tests • Chi-square tests • Cluster analysis	A
Norman, H. et al., 2024. Characteristics and circumstances of rail suicides in England 2019–2021: A cluster analysis and autopsy study. Journal of Affective Disorders, Volume 354, pp. 397-407.	Rail suicides	UK	Academic	436 files of suspected rail suicide, obtained from BTP files	Secondary analysis	• Descriptive analysis • Cluster analysis • Comparative statistical analysis	B
Plaza, J. et al., 2014. Evaluation of measures, recommendations and guidelines for further implementation, s.l.: RESTRAIL.	Rail suicides	UK, Sweden	Grey	• Three pilot areas, including 51 stations (20 on the Western route, 23 on the London North West	Mixed-methods: • Literature review • Impact evaluation (prospective	• Cost effectiveness analysis • Cost benefits analysis	C

				route, 8 on the Sussex route) • Data on incidents from the industry safety management system	pre-post design without a control group)	• Descriptive analysis • Pearson's Chi-square test	
Ryan, B. et al., 2018. Collecting evidence from distributed sources to evaluate railway suicide and trespass prevention measures. Ergonomics, 61(11), pp. 1433-1453.	Rail suicides	Europe	Academic	22 stakeholders	Mixed-methods: • Survey • Literature review	Descriptive analysis	B
Silla, A. & Luoma, J., 2012. Main characteristics of train–pedestrian fatalities on Finnish railroads. Accident Analysis and Prevention, Volume 45, pp. 61-66.	Rail suicides	Finland	Academic	311 cases of railway fatalities, of which 264 where due to suicide	Secondary analysis	Chi-square tests	B

Strale, M., Krysinska, K., Van Overmeiren, G. & Andriessen, K., 2018. Suicide on the Railways in Belgium: A Typology of Locations and Potential for Prevention. International Journal of Environmental Research and Public Health, 15(10), p. 2074.	Rail suicides	Belgium	Academic	Geographic distribution of railway suicides in Belgium from 2008-2014	Secondary analysis	Principal component analysis	A
Strauss, M. J., Klimek, P., Sonneck, G. & Niederkrotenthaler, T., 2017. Suicides on the Austrian railway network: hotspot analysis and effect of proximity to psychiatric institutions. Royal Society Open	Rail suicides	Austria	Academic	• 15 rail suicide clusters in Austria • 1130 cases of rail suicide	Secondary analysis	Principal Component Analysis	A

Science, 4(3), p. 160711.							
Tavistock Institute of Human Relations, 2013. Improving suicide prevention methods on the rail network in Great Britain: Annual Report 2013, London: RSSB.	Rail suicides	UK	Grey	Data collected by Samaritans on the delivery of programme activities and RSSB on rail suicides and delays caused by suicide	• Evidence synthesis of eight different evaluation projects • Two case studies • One survey	• Qualitative analysis • Quantitative analysis	C
Too, L., Spittal, M. J., Bugeja, L., Milner, A., Stevenson, M., & McClure, R. (2015). An investigation of neighborhood-level social, economic and physical factors for railway suicide in Victoria, Australia. Journal of affective disorders, 183, 142-148.	Rail suicides	Australia	Academic	334 cases of rail suicides obtained from the National Coronial Information system (2001-2012)	Secondary analysis	• Descriptive analysis • Regression analysis	A

Too, L. S. et al., 2017a. Predictors of using trains as a suicide method: Findings from Victoria, Australia. Psychiatry Research, Volume 253, pp. 233-239.	Rail suicides	Australia	Academic	Data on all suicides in Victoria, Australia between 2009 and 2012	Secondary research	Logistic regression analysis	A
Too, L. S., Milner, A., Bugeja, L. & McClure, R., 2014. The socio-environmental determinants of railway suicide: a systematic review. BMC Public Health, 14(20), pp. 1-10.	Rail suicides	Austria, Hong Kong, Japan, Germany, UK, the Netherlands	Academic	11 studies	Systematic review	Not applicable	C
Too, L. S. et al., 2017b. Railway suicide clusters: how common are they and what predicts them?. Injury Prevention, 23(5), pp. 328-333.	Rail suicides	Victora, Australia	Academic	Data on railway suicides in Victoria, Australia between 2001 and 2012	Secondary research	• Spatial-temporal analysis • Logistic regression	A

van Houwelingen, C. A. J., Di Bucchianico, A., Beersma, D. G. M. & Kerkhof, A. J. F. M., 2022. Railway Suicide in The Netherlands Lower Than Expected: Are Preventive Measures Effective?. Crisis, 43(5), pp. 368-374.	Rail Suicides	The Netherlands	Academic	Data on railway suicides (1980-2018)	Secondary research	Generalized linear regression	C
van Houwelingen, C. et al., 2013. Train suicide mortality and availability of trains: A tale of two countries. Psychiatry Research, 209(3), pp. 466-470.	Rail suicides	The Netherland, Germany	Academic	• Data on Dutch train suicides from the Department of Corporate Communication of the NV Nederlandse Spoorwegen • Data on German train suicides from the German Event Database Safety	Secondary analysis	Poisson regression analysis	A