



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Who and what is trusted in fire incidents?

Citation for published version:

Templeton, A, Nash, C, Spearpoint, M, Gwynne, S, Xie, H & Arnott, M 2023, 'Who and what is trusted in fire incidents? The role of trust in guidance and guidance creators in resident response to fire incidents in high-rise residential buildings', *Safety Science*, vol. 164, 106172. <https://doi.org/10.1016/j.ssci.2023.106172>

Digital Object Identifier (DOI):

[10.1016/j.ssci.2023.106172](https://doi.org/10.1016/j.ssci.2023.106172)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Publisher's PDF, also known as Version of record

Published In:

Safety Science

General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.





Who and what is trusted in fire incidents? The role of trust in guidance and guidance creators in resident response to fire incidents in high-rise residential buildings

Anne Templeton^{a,*}, Claire Nash^a, Michael Spearpoint^b, Steve Gwynne^c, Xie Hui^c, Matthew Arnott^b

^a Department of Psychology, University of Edinburgh, Edinburgh EH8 9JZ, UK

^b OFR Consultants, Lever Street, Manchester M1 1JA, UK

^c Movement Strategies, London, UK

ARTICLE INFO

Keywords:

High-rise residential buildings
Fire safety
Fire safety guidance
Trust
Group processes
Evacuation

ABSTRACT

Ensuring that residents of high-rise residential buildings follow fire safety guidance in emergencies is important to facilitate safe response. However, little prior research has explored how willingness to follow fire safety guidance is impacted by trust in the guidance itself and trust in the creators of the guidance. The research presented herein hypothesised that the relationship between perceived clarity of the guidance and self-reported willingness to follow the guidance in an emergency would be mediated by both trust in the guidance and trust in the creators of the guidance. An online survey ($N = 769$) with residents of UK high-rise residential buildings was conducted to examine the relationship between participants' perceived clarity of their building's fire safety guidance (both to stay put and evacuate) and their self-reported willingness to follow it. Specifically, we explored how this relationship was impacted by trust in the guidance itself and the providers of the guidance. Parallel mediation analyses showed that the relationship between the perceived clarity of the guidance to and willingness to follow it operated through trust in the guidance and trust in the creators of the guidance. The results replicate previous research on group processes in emergencies but highlight the importance of addressing how views of guidance, its creators, building safety as well as physical constraints may influence emergency response.

1. Introduction

High-rise buildings are being built in the UK for luxury apartments, studios, and penthouses. In 2019, 88% of high-rises in London contained residential spaces compared to only 14% in 2010 (Craggs, 2018). In April 2020, the estimated number of high-rise residential buildings was 12,500, and in February 2022, an estimated 1.31 million people in England resided in buildings of 7 or more storeys (Department for Levelling Up, Housing & Communities (DLUHC), 2022). The increasing number of high-rise residential buildings make understanding evacuee behaviour during fire incidents in these buildings a priority for public safety.

The Grenfell Tower fire disaster has cast a sharp light on the need for better fire safety strategies and to understand how residents of high-rise buildings respond to guidance in fire incidents. Grenfell Tower had a stay put policy in place due to the belief that the tower had sufficient measures in place to compartmentalise the fire. The stay put

policy advises residents to stay in their flats or escape if, for example, fire or smoke are present or they are instructed to by the fire services to leave (see Approved Document B Volume 1: Dwellings (DLUHC, 2019) for an example of guidance). In response to the outcome of the Grenfell Tower disaster, the Fire Brigades Union (2019) called for a re-evaluation of the feasibility of the stay put policy, and some brigades (e.g., London Fire Brigade, 2022) have emphasised the need for residents to know how to leave their building in the event of a fire.

Recently, the Department of Levelling Up, Housing and Communities (DLUHC, 2022) commenced a technical review of the statutory guidance for fire safety given in Approved Document B (ADB). ADB, which addresses building fire safety matters in England, predominantly focuses on physical factors of infrastructure. The main factors include occupant loads, use of floor space, fire separation and fire resistance, the provision of manual or automatic detection and alarm systems to notify occupants, and fire protection measures available in the building (e.g., sprinklers,

* Corresponding author.

E-mail address: a.templeton@ed.ac.uk (A. Templeton).

<https://doi.org/10.1016/j.ssci.2023.106172>

Received 2 October 2022; Received in revised form 27 March 2023; Accepted 11 April 2023

Available online 1 May 2023

0925-7535/© 2023 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

smoke control). Understanding the physical factors of high-rise residential buildings is vital to fire safety. For example, evacuee response can be affected by factors such as illumination conditions (e.g., Zeng et al., 2017), the type of signage provided (e.g., Ronchi et al., 2012), stair widths and stair rise height (Kuligowski et al., 2014). The focus of physical factors in ADB, though, means that there is a lack of understanding of psychological factors regarding how and why occupants might respond in the event of a fire. Notably, following the Grenfell Tower disaster, Dame Judith Hackitt's independent review of Building Regulations and fire safety in England specifically asked for research into human behaviour (Hackitt, 2018).

Prior research provides insights into the psychological factors that can impact human behaviour in emergencies, particularly in fires. Occupants' perceived risk has been found to impact evacuation decisions across a range of emergencies (Kinatader et al., 2015). For example, research into the 2019 Kincadee fire shows that perceiving a home to be safe prior to a fire reduced the perceived risk of occupants and therefore their decision to evacuate (Kuligowski et al., 2022). On the other hand, concern about fires post-Grenfell Tower increased Irish occupants' engagement in preparedness behaviours such as testing fire alarms and having a fire extinguisher (Brown et al., 2022), and occupants were more likely to evacuate if they had previous experience of a hurricane or believed a hurricane posed high risk to their property or safety (Goodie et al., 2019). Other factors, such as occupants' level of familiarity with the environment also impacts evacuation behaviour (Gwynne et al., 2001), such as which exit route is selected and how quickly occupants evacuate (Kobes et al., 2010, Lovreglio et al., 2022). Interactions between occupants can also influence evacuation behaviour (e.g., Purser & Bensilum, 2001), since social influence can cause evacuees to follow the routes others take (e.g., Kinatader et al., 2014; Lovreglio et al., 2022).

Importantly, the ways that occupants are alerted to fires and that instructions are communicated to them can impact evacuation response. Receiving information about a fire from a trusted source and receiving a warning in-person both reduce perceived risk during an emergency (Kuligowski et al., 2020). In a review of multiple evacuations, van der Wal et al. (2021) found that having staff guide people to exits in person was the most effective method encourage effective evacuation compared to other strategies (e.g., evacuation alarm, pre-recorded messages and live announcements). In terms of the guidance itself, occupants' perceived efficacy of the recommended response to a fire affects the extent to which the recommendation is followed, wherein they are more likely to follow the recommendation if they believe it led to a successful outcome (McCaffrey et al., 2017; Strahan et al., 2018).

Despite the considerable research into human behaviour in fires, little research has directly explored precisely what influences occupant perceptions of the guidance on how to respond to fire incidents, why this influence occurs, and how this impacts evacuee behaviour in high-rise residential buildings. This research aims to address these gaps in the context of how residents of high-rise residential buildings respond to guidance to stay put or evacuate in fire incidents. Specifically, we examine whether willingness to follow the guidance is related to the perceived clarity of the guidance, trust in the guidance, and trust in the creators of the guidance.

1.1. Providing clear and practical guidance

Evidence from social psychology points to how perception of safety guidance and the source of the guidance can influence people's response in emergencies (for a review, see Drury et al., 2019). For example, in a mass decontamination field experiment, Carter et al. (2014) showed that the type of guidance provided by first responders to the public impacted the extent to which the public followed the guidance. Specifically, they showed that the most effective communication strategy was to provide health-focused and practical information about why the decontamination was needed and what actions to take to properly decontaminate. The provision of practical guidance which explained why a certain

behaviour was needed was associated with higher correct adherence to their instructions and faster time to undertake the decontamination.

Although the research has primarily focused on decontamination contexts, the principles of understanding how views of the guidance and guidance providers impact the speed and accuracy of emergency response can be applied to other emergencies such as fires. The findings suggest that effective communication involves explaining what actions are needed and how to perform them, because this approach enables people to know how to follow the instructions appropriately in emergency situations. Although Carter et al. (2014) focussed on decontaminations, the focus on information provided in the guidance and subsequent success of following the guidance can also be applied to resident response to fire safety guidance. Thus, we hypothesise that residents' perceptions of the fire safety guidance as being clear and practical will be positively associated with willingness to adhere to it (**hypothesis 1**).

1.2. Trust in the guidance and creators

Although providing clear and practical guidance can be associated with increased likelihood of it being followed, the guidance to stay put has been under strong public scrutiny during the Government inquiry into Grenfell Tower (e.g., Torero, 2022). Even if the guidance to stay put is clear, external factors such as high-profile building disasters and public debate mean it may not be trusted, therefore decreasing the likelihood of it being followed. We predict that trust in the guidance will mediate the relationship between perceived clarity of the guidance and the likelihood of following it (**hypothesis 2**).

Previous research on policing and public order has demonstrated how the perception that guidance gave sufficient practical information was associated with more positive views of the information provider (Reicher et al., 2007), and therefore higher public adherence to the instructions (Stott et al., 2011). Similarly, Carter et al. (2015) outline how emergencies are fundamentally intergroup encounters where interactions between first responders and the public influence the extent to which the public follow their guidance. Together, this research demonstrates that response is not only governed by the perceived clarity and practicality of the guidance, but also the perception of the organisations conveying the guidance.

Importantly, however, the information giver must be seen as trustworthy and acting in the best interests of the group. Lack of trust in authorities can increase non-adherence to their recommendations and increase the likelihood that the public will self-organise and decide appropriate behaviour themselves (Stott and Drury, 2000). Residents often have pre-existing relationships with the people or organisations conveying the guidance which could impact their trust in them. Where the provider of the guidance is trusted, this may lead to increased adherence to their instructions. Where pre-existing relations are less positive - such as when relations between housing managers and residents' associations are negative - this could inhibit the extent to which their guidance is followed.

Notably, the fire safety guidance in high-rise residential buildings is often provided by fire and rescue services, landlords, and housing managers, often via signage or safety notices. Thus, the present research focuses on residents' views of the creators of the guidance for the building rather than who is conveying the guidance. We expect that the relationship between perceived clarity of the guidance and willingness to follow the guidance will be mediated by residents' trust in the creators of the guidance (**hypothesis 3**).

1.3. Perceived threat and ability to adhere

Residents' views of both the stay put and evacuate guidance, the guidance creators, and willingness to adhere to it may be impacted by both trust that the building is safe enough to follow of the guidance, and their own ability to adhere to the guidance. For example, residents may

be impeded from evacuating due to health conditions or impairments (Hashemi & Tomasiello, 2018). Initiatives such as the Local Government Association's Building Safety Programme (DLUHC, 2020) demonstrates the level of concern residents may have about the ability of their buildings to contain fire incidents, which may lead to increased likelihood to evacuate instead of staying put. As such, we expect that residents' ability to follow the guidance, and trust that their building has provisions in place to allow the guidance to result in desired outcomes, are important variables to include when evaluating the relationship between perceived clarity of the guidance, views of the guidance and its creators, and willingness to adhere.

1.4. Present study

This study seeks to understand the willingness of residents of UK high-rise residential buildings to follow either stay put or evacuation guidance during fire incidents in their building. Specially, online surveys were used to address the relationship between the perceived clarity of the guidance and willingness to follow the guidance, via trust in the guidance itself and trust in the creators of the guidance. We explore how these processes are related to the ability of residents to adhere to the guidance and trust in the building to allow residents to safely follow each type of guidance.

2. Methods

2.1. Ethics and open science

This study was approved by the University of Edinburgh PPLS Research Ethics Committee (reference 157–2021/14). A full list of scale items used in this study can be found in the supplementary materials and on the Open Science Framework (<https://osf.io/m4thu/>).

2.2. Participants

We recruited residents ($N = 1136$) of high-rise residential buildings in the UK. Our inclusion criteria were that participants had to be over the age of 18 and must have lived in a building with 6 or more storeys at the time of participation. We excluded participants who did not complete the survey ($n = 306$) or identify the correct response to a comprehension question about an example excerpt of guidance to evacuate or stay put ($n = 61$). The final number of included participants was $N = 769$.

Participants were aged 18–75 years, $M_{age} = 33.56$ years (see Fig. 1 for percentages per age category). 54% identified as female, 45.2% as male, 0.4% as non-binary, 0.2% as a trans female, and 0.2% preferred not to say. The participant sample comprised of 32 ethnicities, with 72% being white or British. Of the participants who reported their first language, the first language was predominantly English (99.2%) but other first languages spoken were Cantonese ($N = 1$), Greek ($N = 1$), Hindi ($N = 1$), Gujarati ($N = 1$), Portuguese ($N = 1$), Nepalese ($N = 1$), German ($N = 1$), Yoruba ($N = 1$) and Tagalog ($N = 1$). 8.5% of participants stated they had some form of health condition (see Fig. 2).

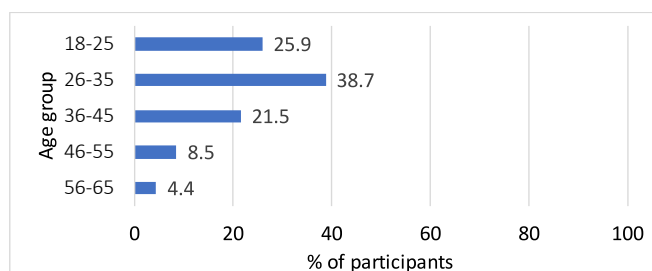


Fig. 1. Percentages of participants per age category.

23.9% of participants owned their home and 76.1% rented their home. In terms of length of residency, 25.7% had resided in their home for less than 1 year, 33.5% for 1–2 year, 22.5% for 3–4 years, 11.6% for 5–10 years, and 5.5% for over 10 years (1.2% did not know or could not remember). We asked about the approximate location of the building residents resided in, and 23.6% of residents resided at the top of their high-rise building, 58.6% resided in the middle, and 16.3% resided at the bottom.

2.3. Procedure

First, participants ($N = 4,504$) were recruited through Prolific Academic (a UK-based participant recruitment platform) to participate in an initial eligibility screening survey. Participants were asked to take part in a 1–2-minute online survey exploring residents' perceptions of the stay put and evacuation guidance in their high-rise residential buildings. Participants were paid £0.25 and asked if they currently lived in a high-rise building of 6 stories or more. The 1136 eligible participants were then invited to take part in a second 20–30-minute cross-sectional survey about the same topic and were paid £2.50 for their participation. The second survey provided example extracts of stay put and evacuation guidance based on the London Fire Brigade guidance. The survey then asked participants about their views of the stay put and evacuation guidance for their specific residential building, their level of trust in both types of guidance and its creators, as well as willingness to follow both types of guidance, ability to follow the guidance, trust in their building, and demographic questions.

2.4. Measures

The survey asked questions about the views of the guidance to stay put and evacuate, its creators, ability to follow the guidance, trust in the building, and finally demographic questions. All survey questions were measured using a 5-point Likert scale where 1 = strongly disagree/very unlikely, 5 = strongly agree/very likely. All questions were adapted from Carter et al. (2013) unless otherwise stated. The items from Carter et al. (2013) were selected since they were robust survey measures which achieved high reliability across a series of studies related to assessing views of the guidance providers, the guidance itself, and adherence (e.g., Carter et al., 2014, Carter et al., 2015).

Three items were used to measure the perceived clarity of the stay put guidance, e.g., 'The stay put guidance about how to react in the event of a fire provides sufficient practical information about what to do' ($\alpha = 0.863$ indicating high internal consistency). Trust in the guidance to stay put was measured using two items, e.g., 'The stay put guidance will help to keep residents safe' ($r = 0.787, p < .001$). Trust in the creators of the guidance was measured using two items, e.g., 'I trust the designers of the stay put guidance know how to keep residents safe in the event of a fire', ($r = 0.590, p < .001$). A three-item scale was used to measure willingness to follow the stay put guidance, e.g., 'I am willing to follow the stay put guidance' ($\alpha = 0.906$).

Next, participants were asked questions about guidance to evacuate. Perceived clarity of the evacuation guidance was measured using three items, e.g., 'The evacuation guidance for my building provides sufficient practical information' ($\alpha = 0.918$). Two items were used to measure trust in the evacuation guidance, e.g., 'The evacuation guidance will help to keep residents safe' ($r = 0.835, p < .001$). Trust in the creators of the evacuation guidance was measured using two items, e.g., 'I trust the designers of the evacuation guidance know how to keep residents safe in the event of a fire' ($r = 0.676, p < .001$). Two items addressed willingness to follow the evacuation guidance, e.g., 'I am willing to follow the evacuation guidance' ($r = 0.811, p < .001$).

Additionally, we asked questions newly created for the survey regarding ability to follow the guidance and trust in building. Ability to adhere to stay put was measured using a single item, 'I feel able to follow the actions proposed in the stay put guidance'. Trust in building to safely

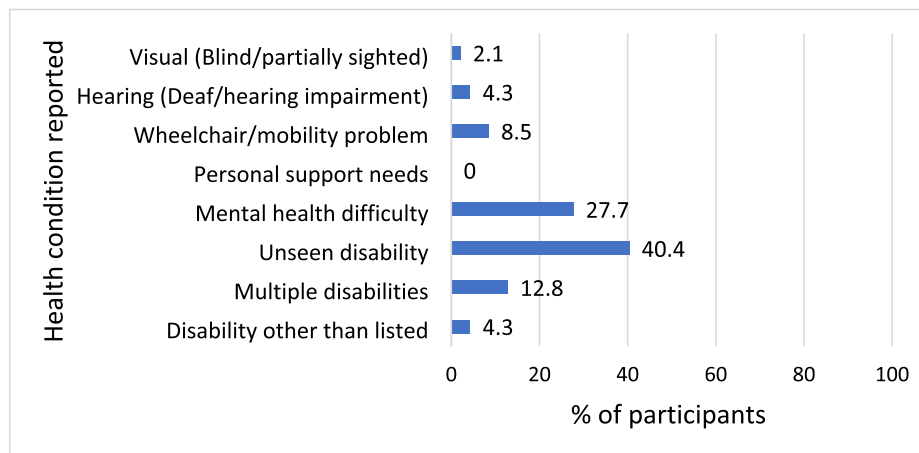


Fig. 2. Percentages of health conditions reported from the 8.5% of participants who stated they had some form of health condition.

have a stay put policy was measured using a single item designed for the survey, ‘The building is equipped to enable residents to safely follow the stay put guidance’. Trust in building to safely have an evacuation policy was measured using two items designed for the survey, e.g., ‘My building is equipped to enable residents to evacuate safely’ ($r = 0.786, p < .001$).

Finally, we presented demographic questions including age, gender identity, whether they lived in the top, middle or bottom third of their building, whether they were a homeowner or renting, duration of residency, nationality, whether English was their first language, and whether participants had a health condition, impairment or learning difficulty.

3. Results

3.1. Factor analysis

We used exploratory factor analysis since our survey items were either adaptations of established questions or new questions created for the purposes of the survey. Specifically, we ran the questions relating to the guidance to stay put and its creators across all scales with a direct oblimin eigen rotation (due to theoretical grounds that the factors might correlate), using a Keiser-Meye-Olkin value of 0.5 as our cut off criteria (Field, 2005). The same procedure was used for the guidance to evacuate. The item clustering supported four core scales for each type of guidance: perceived clarity of the guidance, trust in the guidance, trust in the creators of the guidance, and willingness to follow the guidance. The descriptive statistics and correlations between each factor are shown in Table 1 together with the correlations between the variables. The percentage of answers for each variable are shown in Table 2.

3.2. Mediation analysis

We used R packages Lavaan, semPlot, psycho and lm.beta to run separate parallel mediation path models for each type of guidance. First, the stay put guidance was measured in a path model from perceived clarity of the guidance to stay put (independent variable) to willingness to follow the guidance to stay put (dependent variable) via trust in the guidance to stay put (mediator) and separately trust in the creators of the guidance to stay put (mediator). The same model layout was used for the guidance to evacuate. In these models, we included the following variables as covariates: perceived ability to follow the actions proposed in the stay put guidance; whether they had a health condition, impairment or learning difficulty; trust in the building; belief that the building was equipped to enable safe evacuation; demographic questions of age, gender identity, location of property within the building (bottom,

Table 1
Means, Standard Deviations, and Correlations.

Scale	Mean (SD)	1	2	3.	4.
Guidance to stay put					
1. Clarity of stay put guidance	3.98 (0.77)	1	0.685***	0.556***	0.487***
2. Trust in the stay put guidance	3.63 (0.94)			0.645***	0.627***
3. Trust in the creators of the guidance	3.62 (0.88)		–	–	0.608***
4. Willingness to follow the stay put guidance	3.31 (1.03)		–	–	–
Guidance to evacuate					
5. Clarity of stay put guidance	3.63 (0.97)	5.	6.	7.	8.
6. Trust in the evacuation guidance	3.80 (0.91)	1	0.760***	0.609***	0.547***
7. Trust in the creators of the guidance	3.3.78 (0.85)		–	–	0.627***
8. Willingness to follow the evacuation guidance	4.04 (0.81)		–	–	–

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2
Percentage of responses on the Likert scales for each variable.

	Strongly disagree				Strongly agree
Stay put guidance	%	%	%	%	%
Clarity of the guidance	1	9.6	17.1	57.1	15.2
Trust in guidance	3.7	13.7	27	42.4	13.2
Trust in creators	3	12.5	31.5	43.1	9.9
Willingness	9.9	19.3	34.5	32.2	4.1
Trust in the building	1.9	11.4	35.9	43.9	6.9
Ability	3.8	11.8	15.4	46.2	22.8
Evacuation guidance	%	%	%	%	%
Clarity of the guidance	5.1	13.8	25.7	44	11.4
Trust in guidance	3.5	6.4	23.8	49.9	16.4
Trust in creators	2.4	8.2	30.2	44.1	15.1
Willingness	1.3	3.9	21	47.8	26
Trust in the building	2.8	11.7	26.6	47.4	11.5

middle, top); whether they were a homeowner or renting, and duration of time living in the property. The non-significant covariates were then removed for the final parallel mediation models to improve the model fit. Table 3 gives the regressions between each variable in the separate models for the stay put and evacuation guidance, with only the significant demographic factors included. For the stay put model, AIC =

Table 3
Regressions.

	<i>b</i>	LCI	UCI	SE	<i>z</i>	<i>p</i>
Guidance to stay put						
Clarity – Trust in guidance	0.542	0.460	0.622	0.041	13.229	<0.001
Ability – Trust in guidance	0.291	0.233	0.352	0.030	9.657	<0.001
Trust in building – Trust in guidance	0.157	0.079	0.231	0.038	4.078	<0.001
Clarity – Trust in creators	0.307	0.231	0.381	0.038	8.085	<0.001
Ability – Trust in creators	0.247	0.194	0.304	0.028	8.853	<0.001
Trust in building – Trust in creators	0.392	0.320	0.461	0.036	11.031	<0.001
Clarity - Willingness	-0.036	-0.120	0.050	0.044	-0.806	0.420
Trust in guidance – Willingness	0.219	0.141	0.299	0.037	5.841	<0.001
Trust in creators - Willingness	0.188	0.121	0.292	0.037	5.063	<0.001
Ability – Willingness	0.577	0.520	0.640	0.031	18.553	<0.001
HIL – Willingness	-0.189	-0.343	-0.038	0.077	-2.453	0.014
Guidance to evacuate						
Clarity – Trust in guidance	0.550	0.495	0.605	0.028	19.634	<0.001
Trust in building – Trust in guidance	0.274	0.215	0.335	0.030	9.002	<0.001
Clarity – Trust in creators	0.258	0.199	0.317	0.030	8.620	<0.001
Trust in building – Trust in creators	0.456	0.392	0.520	0.033	14.010	<0.001
Clarity - Willingness	0.093	0.016	0.159	0.037	2.534	0.011
Trust in guidance – Willingness	0.253	0.170	0.331	0.036	6.965	<0.001
Trust in creators – Willingness	0.343	0.262	0.413	0.032	10.753	<0.001

Note. *b* = standardised beta coefficients; LCI = lower confidence interval; UCI = upper confidence interval; SE = standard error; Clarity = clarity of stay put guidance; Willingness = willingness to follow the stay put guidance. HIL = Health condition, impairment or learning difficulty. All variables were tested for significant associations with using standard error bootstrapped regressions with 10,000 samples. Only the statistically significant covariates are included in the table.

3131.421, RMSEA = 0.160, SRMR = 0.028, CFI = 0.964, $\chi^2(4) = 62.491, p < .001$. For the evacuation mode, AIC = 4129.356, RMSEA = 0.274, SRMR = 0.048, CFI = 0.938, $\chi^2(2) = 118.295, p < .001$. This makes the RMSEA a poor fit for both models using Hu and Bentler’s (1999) criteria, but all other fit indices and good or acceptable.

3.2.1. Guidance to stay put

Contrary to H1, there was a non-significant direct relationship between perceived clarity of the guidance to stay put and willingness to stay put (see Fig. 3). However, there was a significant direct relationship between perceived clarity of the guidance and trust in it as well as trust in its creators. Willingness to follow the guidance to stay put was also positively associated with trust in the guidance and trust in the creators of the guidance. Thus, there was a significant indirect effect of trust in the guidance to stay put ($b = 0.118, p < .001, z = 5.343$) supporting H2, and trust in the creators of the guidance to stay put ($b = 0.058, p < .001, z = 4.291$) supporting H3.

Ability to follow the guidance was a significant covariate for trust in the guidance to stay put ($b = 0.291, p < .001, z = 9.657$), its creators ($b = 0.247, p < .001, z = 8.853$), and willingness to follow it ($b = .577, p < .001, z = 18.553$). Trust in the building was a significant covariate for trust in the guidance ($b = 0.157, p < .001, z = 4.078$) and trust in the creators of the guidance ($b = 0.392, p < .001, z = 11.031$). Having a health condition, impairment or learning difficulty was also a significant covariate for willingness to adhere to the guidance to stay put ($b = -0.189, p = .014, z = -2.543$).

3.2.2. Guidance to evacuate

In support of H1, there was a significant association between perceived clarity of the guidance to evacuate and willingness to evacuate (see Fig. 4). There was also significant direct relationship between perceived clarity of the guidance to evacuate and trust in it as well as trust in its creators. Willingness to follow the guidance to evacuate was also positively associated with trust in the guidance and trust in the creators of the guidance. Thus, there was a significant indirect effect of trust in the guidance to evacuate ($b = 0.139, p < .001, z = 6.564$) supporting H2, and trust in the creators of the guidance to evacuate ($b = 0.089, p < .001, z = 6.726$) supporting H3. Notably, trust in the building was a significant covariate for both trust in the guidance ($b = 0.274, p < .001, z = 9.002$) and the creators ($b = 0.456, p < .001, z = 14.010$).

4. Discussion

The survey results demonstrate that the willingness of residents of high-rise residential buildings to follow the guidance to stay put or evacuate is related to their trust in the guidance and the creators of the guidance. The relationship between perceived clarity of the guidance and willingness to adhere to it was mixed. In support of H1, higher belief that guidance to evacuate was clear and practical was associated with higher adherence to it. However, this relationship was non-significant for the guidance to stay put, where the relationship between the perceived clarity of the guidance to stay put and willingness to follow it operated indirectly through both trust in the guidance and trust in the creators. Crucially, the relationship between the perceived clarity of the guidance of willingness to follow it operated through both trust in the guidance and trust in its creators, supporting H2 and H3 for both the guidance to stay put and to evacuate.

Together, these results indicate the importance of trust beyond simply having clear guidance. This conceptually replicates previous

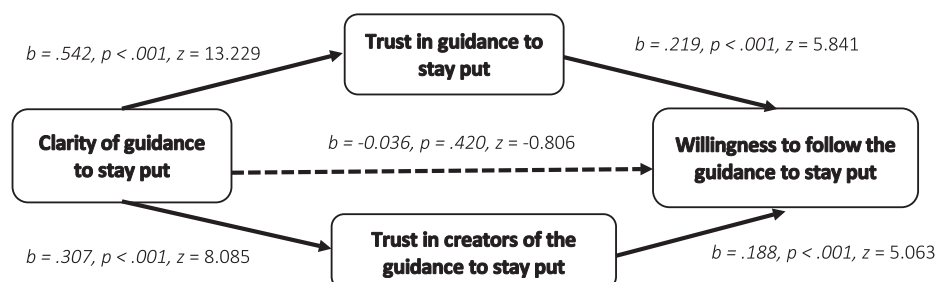


Fig. 3. Indirect effects of trust in guidance to stay put and creators of the guidance.

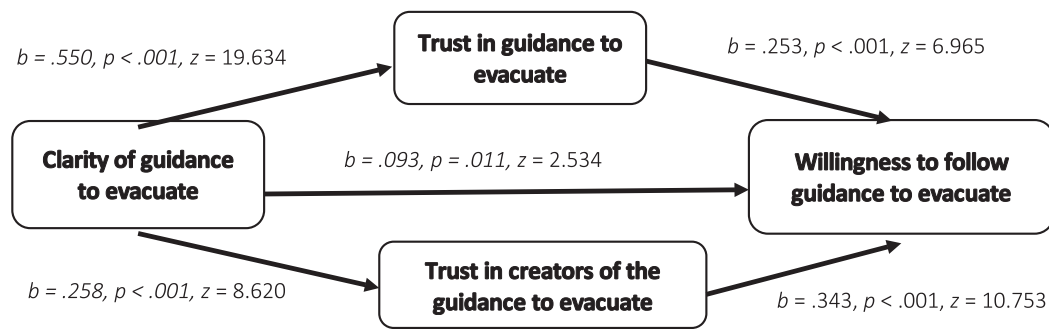


Fig. 4. Indirect effects of trust in guidance to evacuate and creators of the guidance.

research on how the clarity of information (e.g., Carter et al., 2013, 2014) and pre-existing trust in information provided (e.g., Stott and Drury, 2000) can affect public behaviour. Additionally, we build on existing research to highlight the importance of understanding how pre-existing views of the guidance itself may impact emergency response. Particularly in the case of the guidance to stay put, the level of trust in the guidance and its creators were key predictors of willingness to adhere when clarity of the guidance itself was not.

Our results indicate how residents' perceived safety of the building is related to their views of the guidance and its creators. For both the guidance to stay put and to evacuate, the level of trust residents had of their building to be safe for either policy was significantly related to their trust in the guidance and the creators. Here, resident belief that their building had the correct infrastructure to safely allow either a stay put policy or evacuation policy was positively associated with trust in the guidance and its creators. However, another interpretation of this is that when trust in the building was low so too was trust in the guidance and its creators.

Another factor related to views of the guidance to stay put (but not guidance to evacuate) was the extent to which residents believed they had the ability to follow it. Residents' belief that they were able to follow the actions proposed in the stay put guidance was associated with their trust in the guidance, the creators, and willingness to adhere to it. Willingness to follow the stay put guidance was also related to whether participants had a health condition, impairment or learning difficulty.

One interpretation of these results is that participants who are elderly or have disabilities face additional challenges egressing from buildings (e.g., Hostetter & Naser, 2022; Rahouti et al., 2021; Oswald, 2021) and may be required to stay put to some extent because their personal emergency evacuation plans require them to wait for assistance from others before evacuating. While previous research has demonstrated that trust in safety procedures can influence the perception of risk by vulnerable persons (e.g., Tancogne-Dejean & Laclemece, 2016), the current study extends this to show that the perceived ability to adhere to the stay put guidance predicts both views of the guidance and also the creators of the guidance.

4.1. Limitations and future directions

In contrast to previous research, we did not find significant demographic differences of age or gender when exploring the views of the guidance or guidance creators. There was also no effect of whether the residents lived in the top, middle or bottom third of their building, contrary to prior research which found differing times in occupants of different floors to reach stairwells (e.g., Averill et al., 2012). Nor were there differing views of the guidance depending on whether they were a homeowner or renting, or the duration of their time living in the home (contrary to e.g., Kuligowski et al., 2022). One reason for this may our relatively homogenous sample, for example that most participants rented their home or resided in the middle third of their building. However, this does speak to this importance of trust in the guidance and its

creators for most residents when deciding whether to follow the guidance. Notably, we asked about intended behaviour in a fire incident instead of actual behaviour, and these results may be influenced by participants taking part at a time when high-profile disasters and the safety of stay put guidance were part of public debate and in the media. The results may not indicate actual behaviour or how effective this would be in an emergency, and the results may also be different for other residential building types (e.g., semi-detached houses), and the cross-sectional survey means that we cannot infer causal directionality between the variables but instead focus on which variables are related.

The guidance on how to respond in the event of a fire can come from multiple sources, such as fire and rescue services, housing managers, or residents' associations. Oswald (2021) shows how homeowners' relations with people and organisations involved in fire safety for their buildings can lack trust due to issues such as perceiving that the people responsible for safety have a lack of expertise to handle issues, or lack of care about the homeowners' fire safety concerns. Our questions did not ask about trust in each potential provider of the guidance, whether those providing the guidance had positively engaged with the community regarding fire preparedness, or views on the quality of fire safety leadership among their building management. Future research could examine whose guidance is most trusted and why, and how this impacts levels of trust in the creators of the guidance, such as by focusing on the quality of engagement between the guidance givers and the occupants.

Similarly, our questions about perceived ability to adhere do not specify what impacts the participants' abilities. For example, potential barriers could include factors such as physical ability or blockages in the evacuation route. Future research could delve into what barriers residents believe impact their ability to either stay put or evacuate from their building, and crucially how these barriers may be mitigated or removed to increase adherence to the guidance. Importantly, our findings showed that perceived ability to follow the stay put guidance (but not the guidance to evacuate) was related to trust in the guidance, trust in the creators, and willingness to adhere. Further research could examine the relationship between trust and perceived ability to adhere in more depth to explore the nature of these relationships and particularly its implications for people with mobility impairments.

Although we required participants to correctly answer a question about example guidance to stay put or evacuate, it is not possible to gauge whether the participants understood the guidance for their building or simply thought that they did. It would have been infeasible to obtain examples of the guidance for each participants' building and assess their understanding of it. Regardless, the results show that perceived clarity and trust in the guidance and its creators are key to understanding the willingness to follow it.

Finally, our research did not explore social influence. Prior research suggests that occupants are influenced by the response of others in emergency evacuations (e.g., Kinatader et al., 2014; Lovreglio et al., 2022), and people in emergencies are more likely to be influenced by the people they believe are in the same group as them (for a review, see Reicher et al., 2010). This is because the impact of social influence is not

within the scope of work here. However, future work could provide a deeper exploration of the role of social influence in evacuations of high-rise residential buildings, such as who occupants look to when deciding their response, and how the influence occurs in the immediate moments of the emergency.

4.2. Theoretical and practical implications

Taken together, the results demonstrate novel insights towards understanding how trust in the fire safety guidance and its creators are related to residents' decision-making in a fire incident. However, they also show that residents' decision-making about how to respond in a fire is nested within their trust in their building and perceived ability to adhere.

Previous social psychological research into disasters has focussed on the roles of clear guidance and group relations in evacuation response (e.g., Drury et al., 2019), and research into evacuation behaviour has examined physical factors impacting ability to evacuate (e.g., Sano et al., 2018). The current study is the first time these areas have been brought together to examine how the psychological factors of trust in the guidance, information providers, and building structure coincide with the physical factor of ability to adhere when guiding resident response in fire emergencies.

The importance of trust is a prominent finding in this work, but trust may be related to both factors within the occupants' building and the broader societal environment. Our results demonstrate that trust in guidance and creators of guidance is related to residents' perception of their physical environment and ability to follow the safety guidance set out for their building. However, trust in high-rise residential buildings may be impacted by knowledge of fire disasters in similar buildings, particularly those with flammable cladding. The finding by Brown et al. (2022) that occupants in Ireland were concerned about fires in their buildings following the Grenfell Tower fire in England (and subsequently changed their fire preparedness behaviours) show how far the ramifications of disasters can spread. This points to the importance of guidance creators, governing bodies, and distributors of the guidance making efforts to build trusting relationships with occupants, including by understanding what barriers occupants may face to following the guidance.

Several practical implications can be taken from this research for evacuation models and fire safety operational procedures. First, we demonstrate that evacuation models which assume residents will quickly (or even automatically) adhere to guidance to evacuate or stay put may be unrealistic. We provide distributions of residents' willingness to follow the guidance to evacuate or stay put (from strongly disagree to strongly agree) as well as how variables are related to residents' willingness (e.g., the significant positive relationship between trust in the guidance and willingness to follow it). Modellers can use these variables and their inter-relationships to inform scenarios in their models. For example, where distributions are used to simulate various reasons for occupant delays before evacuating, modellers could include delays that represent hesitancy to stay put depending on the perceived clarity of the guidance, trust in their building, or pre-existing relations with the guidance creators. In these scenarios, there would be a positive linear relationship between higher trust in the guidance, building and creators, and willingness to adhere.

Second, we show that organisations providing clear and practical guidance is not sufficient to predict residents' willingness to adhere to it. Instead, organisations interested in facilitating willingness to follow guidance should focus on residents' perceived ability to follow the guidance and trust in their building.

Related to this, the third practical implication is that our results demonstrate areas that organisations can focus on when informing residents about fire safety policies. The relationship between trust in the creators and willingness to adhere highlights the importance of fire and rescue service activities such as community engagement to build

positive pre-existing relations with residents and therefore facilitate willingness to follow the fire safety guidance. However, the results also demonstrate that residents' trust in their building and perceived ability to adhere to guidance are related to their views of the guidance and its creators. As such, fire and rescue services and building management associations should focus on engaging with residents' trust in their building (e.g., listening to and addressing concerns about the building for the fire safety policies in place), as well as ensuring the guidance is clear to residents and can be followed.

5. Conclusions

Having clear guidance to evacuate or stay put in high-rise residential buildings is important to encourage occupants' willingness to follow the guidance. However, it is not the entire picture. Trust in the fire safety guidance and trust in its creators are important factors in whether residents decide to follow their fire safety guidance. This is particularly the case for the guidance to stay put, where trust in the guidance and its creators were associated with willingness to follow the guidance beyond clarity of the guidance alone. Importantly, occupants' trust that their building was sufficiently safe enough for them to follow the guidance was related to their trust in both in the guidance and its creators.

The current study demonstrates that research into occupant response to fire incidents in high-rise residential buildings must focus more deeply on understanding the impacts of occupants' trust in the fire safety guidance, trust in the people and/or organisations who provide guidance, and trust that their building is equipped to support the stay put guidance. In practical terms, we show that assumptions of evacuee behaviour such as quick adherence to guidance may be unrealistic. Moreover, we illustrate that guidance creators, guidance distributors, and governing bodies should make further efforts to build trusting relationships with occupants. In particular, they should attend to occupants' views of their residential building and the barriers they face when following the guidance. Fire safety guidance for new high-rise residential properties is evolving in response to recent UK fire incidents. This will likely include modifications to evacuation strategies and/or evacuee notification requirements. As such, the findings of this article might prove useful in determining communication strategies with residents before and during an incident. Finally, we advocate the importance of incorporating trust into evacuation models and provide example distributions that modellers can use to inform occupant response in fire scenarios in future research.

Ethical approval and open science

This study was approved by the [University of Edinburgh PPLS Research Ethics Committee (reference 157–2021/14)]. A full list of scale items used in this study can be found in the supplementary materials and on the Open Science Framework (<https://osf.io/m4thu/>).

Funding

This research is funded by the Department of Levelling Up, Housing and Communities for the project CPD 004/121/103 'Means of Escape in Residential Buildings'.

CRediT authorship contribution statement

Anne Templeton: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Claire Nash:** Writing – review & editing, Methodology, Formal analysis, Data curation, Conceptualization. **Michael Spearpoint:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Steve Gwynne:** Writing – review & editing, Methodology, Conceptualization. **Xie Hui:** . **Matthew Arnott:** Writing – review & editing, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Averill, J.D., Peacock, R.D., Kuligowski, E.D., 2012. Analysis of the evacuation of the world trade centre towers on september 11, 2001. *Fire Technol.* 49, 37–63.
- Brown, G.D., Largey, A., McMullan, C., Daffy, P., 2022. Fire safety protection motivation and preparedness in Irish apartments: A post-Grenfell analysis. *Saf. Sci.* 148, 1–5630. <https://doi.org/10.1016/j.ssci.2021.105630>.
- Carter, H., Drury, J., Amlot, R., Rubin, G.J., Williams, R., 2014. Effective responder communication improves efficiency and psychological outcomes in a mass decontamination field experiment: implications for public behaviour in the event of a chemical incident. *PLoS One* 9 (3), e89846.
- Carter, H., Drury, J., Amlot, R., Rubin, G.J., Williams, R., 2015. Effective responder communication, perceived responder legitimacy, and group identification predict public cooperation and compliance in a mass decontamination visualisation experiment. *J. Appl. Soc. Psychol.* 45, 173–198. <https://doi.org/10.1111/jasp.12286>.
- Carter, H., Drury, J., Rubin, G.J., Williams, R., Amlot, R., 2013. The effect of communication during mass decontamination. *Disaster Prev Manag* 22 (2), 132–147. <https://doi.org/10.1108/09653561311325280>.
- Craggs, D., 2018. Skyscraper development and the dynamics of crisis: The new London skyline and spatial recapitalisation. *Built Environ.* 43 (4), 500–519. <https://doi.org/10.2148/benv.43.4.500>.
- Department for Levelling Up, Housing & Communities. (2019). The Building Regulation 2020 Fire Safety Approved Document B Volume 1: Dwellings. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/832631/Approved_Document_B_fire_safety_volume_1_-_2019_edition.pdf.
- Department for Levelling Up, Housing & Communities. (2020, December). Guidance: Building Safety Programme. <https://www.gov.uk/guidance/building-safety-programme>.
- Department for Levelling Up, Housing & Communities. (2022, April). Buildings included in the new more stringent regulatory regime: factsheet. <https://www.gov.uk/government/publications/building-safety-bill-factsheets/buildings-included-in-the-new-more-stringent-regulatory-regime-factsheet>.
- Department for Levelling Up, Housing & Communities. (2022, June). Consultation outcome Technical review of Approved Document B: 2022 progress update. Retrieved from <https://www.gov.uk/government/consultations/technical-review-of-approved-document-b-of-the-building-regulations-a-call-for-evidence/outcome/technical-review-of-approved-document-b-2022-progress-update>.
- Drury, J., Carter, H., Cocking, C., Ntontis, E., Tekin Guven, S., Amlot, R., 2019. Facilitating collective psychosocial resilience in the public in emergencies: Twelve recommendations based on the social identity approach. *Front. Public Health* 7 (141), 1–21. <https://doi.org/10.3389/fpubh.2019.00141>.
- Field, A., 2005. *Discovering statistics using SPSS, second ed.* Sage Publications Inc.
- Fire Brigades Union (2019, October). The Grenfell Tower Inquiry phase 1 report and 'stay put' policy. Retrieved from <https://www.fbu.org.uk/circulars/2019hoc0539mw/grenfell-tower-inquiry-phase-1-report-and-stay-put-policy>.
- Goodie, A.S., Sankar, A.R., Doshi, P., 2019. Experience, risk, warnings and demographics: Predictors of evacuation decisions in Hurricanes Harvey and Irma. *Int. J. Disaster Risk Reduct.* 41, 101320 <https://doi.org/10.1016/j.ijdrr.2019.101320>.
- Gwynne, S., Galea, E.R., Lawrence, P., Filippides, L., 2001. Modelling occupant interactions with fire conditions using the buildingEXODUS evacuation model. *Fire Safety J.* 36 (4), 327–357. [https://doi.org/10.1016/S0379-7112\(00\)00060-6](https://doi.org/10.1016/S0379-7112(00)00060-6).
- Hackitt, J. (2018, May). Building a safer future. Independent review of building regulations and fire safety: Final report. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/707785/Building_a_Safer_Future_-_web.pdf.
- Hashemi, M., Tomasiello, S., 2018. Emergency evacuation of people with disabilities: A survey of drills, simulations, and accessibility. *Cogent Eng.* 5 (1), e1506304.
- Hostetter, H., Naser, M.Z., 2022. Characterising disability in fire evacuation: A progressive review. *J. Build. Eng.* 53 (1), E104573. <https://doi.org/10.1016/j.job.2022.104573>.
- Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct. Equ. Model.* 6 (1), 1–55. <https://doi.org/10.1080/10705519909540118>.
- Kinatader, M., Ronchi, E., Gromer, D., Muller, M., Jost, M., Nehfischer, M., Muhlerger, A., * Pauli, P., (2014). Social influence on route choice in a virtual reality tunnel fire. *Transport. Res. Part F*, 26, 116–125. <https://doi.org/10.1016/j.trf.2014.06.003>.
- Kinatader, M.T., Kuligowski, E.D., Reneke, P.A., Peacock, R.D., 2015. Risk perception in fire evacuation behaviour revisited: Definition, related concepts, and empirical evidence. *Fire Sci. Rev.* 4 (1) <https://doi.org/10.1186/s40038-014-0005-z>.
- Kobes, M., Helsloot, I., de Vries, B., Post, J., 2010. Exit choice, (pre-)movement time and (pre-)evacuation behaviour in hotel fire evacuation – Behavioural analysis and validation of the use of serious gaming in experimental research. In *Procedia Eng.* 3, 37–51. <https://doi.org/10.1016/j.proeng.2010.07.006>.
- Kuligowski, E.D., Peacock, R.D., Reneke, P.A., Wiess, E., Overholt, K.J., Elkin, R.P., Averill, J.D., Hagwood, C.R., Ronchi, E., Hoskins, B.L., Spearpoint, M., 2014. NIST Technical Note 839 Movement on Stairs During Building Evacuations. Retrieved from <https://doi.org/10.6028/NIST.TN.1839>.
- Kuligowski, E.D., Walpole, E.H., Lovreglio, R., McCaffrey, S., 2020. Modelling evacuation decision-making in the 2016 Chimney Tops 2 fire in Gatlinburg, TN. *Int. J. Wildland Fire* 29 (12), 1120–1132. <https://doi.org/10.1071/WF20038>.
- Kuligowski, E.D., Zhao, X., Lovreglio, R., Xu, N., Yang, K., Westbury, A., Nilsson, D., Brown, N., 2022. Modeling evacuation decisions in the 2019 Kincadee fire in California. *Saf. Sci.* 146, e105541.
- London Fire Brigade (2022, May). London Fire Brigade responds to government fire reform announcement. Retrieved from <https://www.london-fire.gov.uk/news/2022-news/may/london-fire-brigade-responds-to-government-fire-reform-announcements/>.
- Lovreglio, R., Dillies, E., Kuligowski, E., Rahoui, A., Haghani, M., 2022. Exit choice in built environment evacuation combining immersive virtual reality and discrete choice modelling. *Automat. Construct.* 141, 104452 <https://doi.org/10.1016/j.autcon.2022.104452>.
- McCaffrey, S., Wilson, R., Konar, A., 2017. Should I stay or should I go now? Or should I wait and see? Influences on wildfire evacuation decisions. *Risk Anal.* 38 (7), 1390–1404. <https://doi.org/10.1111/risa.12944>.
- Oswald, D., 2021. Homeowner vulnerability in residential buildings with flammable cladding. *Saf. Sci.* 136, e105185.
- Purser, D.A., Bensilum, M., 2001. Quantification of behaviour for engineering design standards and escape time calculations. *Saf. Sci.* 38 (2), 157–182. [https://doi.org/10.1016/S0925-7535\(00\)00066-7](https://doi.org/10.1016/S0925-7535(00)00066-7).
- Rahoui, A., Lovreglio, R., Nilsson, D., Kuligowski, E., Jackson, P., Rothas, F., 2021. Investigating evacuation behaviour in retirement facilities: Case studies from New Zealand. *Fire Technol.* 57, 1015–1039. <https://doi.org/10.1007/s10694-020-01058-x>.
- Reicher, S., Stott, C., Drury, J., Adang, O., Cronin, P., Livingstone, A., 2007. Knowledge-based public order policing: principles and practice. *Policing: A J. Policy Practice* 1 (4), 403–415. <https://doi.org/10.1093/polic/pam067>.
- Reicher, S., Spears, R., Haslam, A., 2010. The social identity approach in social psychology. In: Wetherall, M., Mohanty, C.T. (Eds.), *The SAGE Handbook of Identities*. Sage, pp. 45–62.
- Ronchi, E., Nilsson, D., Gwynne, S., 2012. Modelling the impact of emergency exit signs in tunnels. *Fire Technol.* 48, 961–988. <https://doi.org/10.1007/s10694-012-0256-y>.
- Sano, T., Ronchi, E., Minegishi, Y., Nilsson, D., 2018. Modelling pedestrian merging in stair evacuation in multi-purpose buildings. *Simulating Modelling Practice and Theory* 85, 80–94. <https://doi.org/10.1016/j.simpat.2018.04.003>.
- Stott, S., Hoggett, J., Person, G., 2011. 'Keeping the peace': Social identity, procedural justice and the policing of football crowds. *The British J. Criminol.* 52 (2), 381–399. <https://doi.org/10.1093/bjc/azr076>.
- Stott, C., Drury, J., 2000. Crowds, context and identity: Dynamic categorisation processes in the 'poll tax riot'. *Hum. Relat.* 53 (2), 247–273. <https://doi.org/10.1177/a010563>.
- Strahan, K.W., Whittaker, J., Handmer, J., 2018. Predicting self-evacuation in Australian bushfire. *Environ. Hazards* 18 (2), 146–172. <https://doi.org/10.1080/17477891.2018.1512468>.
- Tancogne-Dejean, M., Laclemece, P., 2016. Fire risk perception and building evacuation by vulnerable persons: Points of view of laypersons, fire victims and experts. *Fire Saf. J.* 80, 9–10. <https://doi.org/10.1016/j.firesaf.2015.11.009>.
- Torero, J. (2022, January). Phase 2 Grenfell Tower Inquiry: Adequacy of the current testing regime. https://assets.grenfelltowerinquiry.org.uk/JTOR00000006_Professor%20Jose%20Torero%20-%20Phase%20%20Report_%20Adequacy%20of%20the%20Current%20Testing%20Regime%20dated%204%20January%202022.pdf.
- Van der Wal, C.N., Robinson, M.A., de Bruin, W.B., Gwynne, S., 2021. Evacuation behaviours and emergency communications: An analysis of real-word incident videos. *Saf. Sci.* 136, e105121.
- Zeng, Y., Song, W., Jin, S., Ye, R., Liu, X., 2017. Experimental study on walking preference during high-rise stair evacuation under different ground illuminations. *Physica A* 479, 26–37. <https://doi.org/10.1016/j.physa.2017.02.060>.