
Police Practice and Research
An International Journal

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/gppr20

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**To cite this article:** Paul McFarlane & Amaria Amin (2021): Investigating fatal police shootings using the human factors analysis and classification framework (HFACS), Police Practice and Research, DOI: 10.1080/15614263.2021.1878893

**To link to this article:** https://doi.org/10.1080/15614263.2021.1878893



Published online: 01 Feb 2021.

POLICE PRACTICE AND RESEARCH
https://doi.org/10.1080/15614263.2021.1878893

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# Investigating fatal police shootings using the human factors analysis and classification framework (HFACS)

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**ABSTRACT**

Fatal police shootings are highly contentious and troublesome for normative standards of police legitimacy. Fatal police shooting investigations are often criticised because they lack impartiality, transparency and rigour. To assist policing practitioners and policymakers in the UK and beyond with managing these issues, we present a new analytical framework for investigating fatal policing shootings. We re-contextualise Shappell and Wiegmann's 'Human Factors Analysis and Classification System' (HFACS) to test whether HFACS can be used during fatal police shootings investigations to identify contributory human factors. This study used HFACS to qualitatively analyse three high-profile fatal police shooting case-studies in the UK: (i) Jean Charles de Menezes in 2005; (ii) Azelle Rodney in 2005; and (iii) Mark Duggan in 2011. The results show that HFACS is a useful analytical framework. HFACS can be used to identify human factors and failures not discoverable by current methods for investigating fatal police shootings. We also offer the first empirical insights and contribute a more nuanced understanding of using HFACS to investigate fatal police shootings. We conclude by suggesting there are high-level and operational benefits in using HFACS and recommend avenues for further research to test HFACS in other policing contexts beyond the UK.

**ARTICLE HISTORY**
Received 4 February 2020
Accepted 9 January 2021

**KEYWORDS**
Fatal police shootings; Human Factors Analysis and Classification system; Human error

## 1. Introduction

Although in the United Kingdom (UK) police officers do not routinely carry firearms, there have been seventy-four fatal police shootings between 1990 and 2020 (Inquest, 2019).[1] Because police officers are not armed, the circumstances of fatal police shootings in the UK are often amplified by high-levels of mainstream and social media reporting; causing significant public concern. Indeed, in some cases, like the widely reported fatal police shooting of Mark Duggan in 2011; fatal police shootings can, for the wider public, become highly contentious and troublesome events, because of concerns about the justification of lethal force and the perceived lack of rigour and transparency in the post-event investigations (Grimwood, 2016; Ritchie, 2014). The fatal police shooting of Mark Duggan escalated community tensions and led to large scale rioting across London and other cities in the UK; causing significant economic damage and harm to critical relationships between the police and minority ethnic communities.

As demonstrated by recent events in the United States, public dissatisfaction about fatal police shootings is not unique to the UK. To mitigate public anxieties about fatal police shootings, we recommend that policing practitioners, policymakers and researchers seek out

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new empirically-based methods to improve the rigour and transparency of post-event investigations. This improvement is essential because the circumstances and findings of post-shooting investigations must be perceived to be legitimate to have the support of the wider-public (Bradford et al., 2017; Gerber & Jackson, 2017). Like many other countries that police by consent, citizens confer legitimacy to appropriate police authority and actions (Jackson et al., 2013; Tylor, 2011a, 2011b). In this setting, legitimacy demonstrates to citizens why using lethal force is rightful (Jackson et al., 2013; Tylor, 2006). Importantly, legitimacy is also essential to how closely police and citizens work together to regulate social order (cf. Bradford et al., 2017; Grimwood, 2016; Jackson et al., 2013; Ritchie, 2014; Squires & Kennison, 2010).[2] Therefore, our study is relevant also to police leaders, police practitioners and policymakers who work in jurisdictions beyond the UK where legitimacy is essential to relations with citizens and communities, and where there is a requirement to report the circumstances of fatal police shootings publicly.

To be legitimate, most countries in the global North refer fatal police shootings to various independent investigative bodies or oversight committees. In the UK, fatal police shootings are mandatorily referred to the Independent Office for Police Conduct (IOPC) for investigation (Owers, 2014).[3] Fatal shootings fall within the broader scope of deaths during or following police contact; however, our study was only concerned with fatal shootings defined by the Independent Office of Police Conduct as 'fatalities where police officers fired the fatal shot using a conventional firearm' (IOPC, 2019). When the police refer fatal shooting cases, the IOPC is mandated to investigate and report publicly whether the circumstances of the shooting were lawful, proportionate and justifiable.[4] Nonetheless, IOPC investigations into fatal police shootings are somewhat limited, and the IOPC has been publicly criticised for their approach towards police shootings investigations (Grimwood, 2016; Ritchie, 2014). Further, IOPC investigations give little consideration to contributory human factors; particularly, factors involved in the decision-making processes that lead to the police using lethal force (McElvain & Kposowa, 2008). Our study, therefore, seeks to fill this gap by testing whether Shappell and Wiegmann (2000) HFACS framework can be used to improve fatal police shootings investigations.

The HFACS framework has been used successfully in many other high-risk industries. HFACS prevents human actions, human factors and human errors being considered in isolation. This approach is useful because critical human decision-making processes used by police officers are influenced by information, procedures and interactions at all levels of the policing system (Burrows, 2007). When attempting to understand the underlying contributory human factors and errors, it is essential to search across all system levels. This systematic approach is essential because (like aviation or medicine) policing is a complex system, where the underlying contextual factors must be considered in conjunction with surface-level decisions and errors to obtain a clear picture of how a failure occurred (Shane, 2013).[5]

Human error has a prominent role in any system (Reason, 1997). It has been defined as the failure to achieve an intended or desirable outcome and includes accidents, deliberate action and incorrect decision-making (Reason, 1997). Human error (or human factors) theory is widely used in similar high-risk industries such as aviation and medicine to understand causality (Elbardissi et al., 2007; Madigan et al., 2016; Wiegmann & Shappell, 2001). The similar nature of these industries suggests their methods of investigating failure should be transferable to examining high-risk areas of policing. However, while there is some emerging research, such logic is yet to be correctly applied to the analysis of fatal police shootings (Jenkins et al., 2010; Martin, 2016; Shane, 2013).

### *1.1 Aims*

The purpose of our study was to test whether Shappell and Wiegmann (2000) HFACS can be used as an analytical methodology to identify and investigate human factors and errors which contribute to fatal police shootings. By doing so, we offer the first empirical insights and provide a more nuanced understanding of using HFACS to investigate fatal police shootings. Our study considered three questions:

i. Can HFACS be used to investigate fatal policing shootings and identify contributory human factors and errors?

ii. Are the existing HFACS categories sufficient to capture the contributory human factors and errors, or does the framework require modification?

iii. What insights can HFACS provide into current post-incident investigative processes?

## 2. Analytical framework

### 2.1. Reason's taxonomy of human error

Reason's (1990, 1997, 2000) taxonomy of human error is widely used to analyse human factors in organisational systems (Salmon et al., 2011; Shappell & Wiegmann, 2000). In summary, Reason conceptualises human error in two parts: active errors and latent conditions. Active errors refer to incorrect, harmful actions performed by individual front line operators. Such actions at the individual level are, typically, apparent when searching for the cause of an accident or system failure (e.g., when a firearms officer accidentally discharges their weapon). Latent conditions, however, can be attributed to 'upstream' decision-making processes and are often overlooked when investigating the cause of system failures (e.g., inadequate training procedures and processes in place to prevent the risk of accidental discharges). Unlike active errors, whose effects occur almost immediately, latent conditions can be present, lying dormant in a system for many years before they have any malign influence (Reason, 1990, 1997, 2000).

Reason (1997) uses his 'Swiss cheese' model to explain the non-linear and highly unpredictable interactions between the latent conditions and active errors in an organisational system. The model proposes that organisational systems have four layers of defence: (i) 'organisational influences'; (ii) 'unsafe supervision'; (iii) 'preconditions for unsafe acts'; and (iv) 'unsafe acts'. In a faultless system, all four layers are always intact. However, in reality, they are continually changing with holes (different types of active errors and latent conditions) in each of the layers frequently opening and closing at different times. Each hole is an opportunity for failure. When all four layers are breached simultaneously, an accident or system failure can occur. Shappell and Wiegmann (2000) HFACS extends Reason's taxonomy into a framework for analysing real-world events to identify specific types of active errors and latent conditions that can be contributory to system failure.

### 2.2. Human factors analysis and classification system

HFACS (see Figure 1) is a widely recognised human error identification and classification framework. Based on Reason's (1990) Swiss cheese model, it was initially developed by Shappell and Wiegmann (2000) to identify and analyse human factors that contributed to military aviation accidents. When compared to the Swiss cheese model, it includes a further range of active error and latent condition categories at each of the levels. These further categorisations are useful when applied to real-world case-studies to identify system vulnerabilities or modes of potential failure. Once identified, they can be targeted for corrective action (i.e., corrective action can include more intrusive management or supervision, selecting the right staff and improved training).

HFACS has been successfully applied across a range of industries including rail (Madigan et al., 2016), oil and gas (Theophilus et al., 2017) and shipping (Chauvin et al., 2013). Madigan et al. (2016) found that HFACS revealed numerous latent conditions that were not identified by conventional investigations of railway accidents. In this case, HFACS provided a new category (operational environment) of active failures relevant to railway incidents. There are some previous studies in the United States that have used human error as a framework to analyse aspects of operational

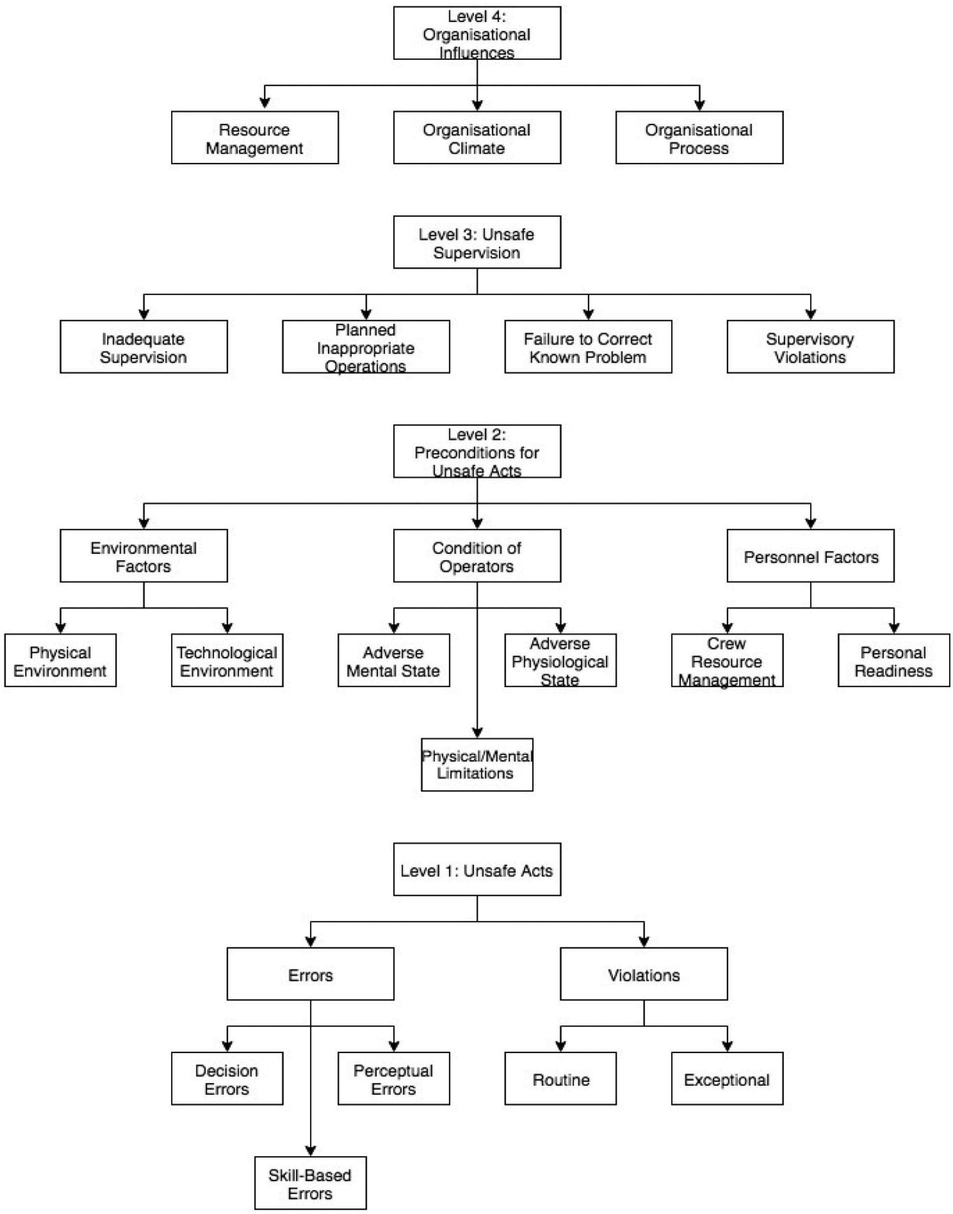


**Figure 1.** –Human Factors Analysis and Classification System (HFACS) (Wiegmann & Shappell, 2003).

policing such as police use of taser and cases of wrongful arrest. The nearest relevant study in the UK relates to work by Jenkins et al. (2010). In this case, they used AcciMaps, a framework based upon Reason's organisational accident theory, to analyse the fatal shooting of Jean Charles de Menezes.[6] The study found that conventional post-incident investigative methods missed some of the factors that would have been identified using a systematic approach (Jenkins et al., 2010). However, there appear to be no prior cases that have used the HFACS to investigate and reveal human factors which can contribute to fatal police shootings.

As shown in (Figure 1), HFACS retains the four layers of defence described by Reason (1997). In descending order, the top three levels of 'organisational influences', 'unsafe supervision' and 'preconditions for unsafe acts' are where latent conditions are created and concealed within the system. 'Organisational influences' refer to organisational-wide issues such as strategic decision-making, finance, resource management and culture. 'Unsafe supervision' relates to situations where management and front-line supervision is inappropriate, inadequate or hazardous. 'Preconditions for unsafe acts' is the final barrier before the occurrence of active failures and relates to issues with teamwork, selection and training of personnel and environmental factors. 'Unsafe acts' includes active errors by front-line operators. Faults and errors at this final level are either honest mistakes or deliberate violations of the system rules.

## 3. Methods

### 3.1. Research design

Our study used an Interpretivist qualitative research design. It included a multiple case-study method to thematically analyse three high-profile fatal police shootings in the UK. This design and method were selected because case-studies have been effectively used by many researchers to analyse systems failures and accidents within real-life contexts (cf. Aini & Fakhrul-Razi, 2010; R. K. Yin, 1981; Perrow, 1999; Toft & Reynolds, 1999; Turner, 1978; Turner & Pidgeon, 1997; R. Yin, 2009). Further, the multiple case-study method was also suitable because the findings can have external validity and be generalised to other similar cases (Herriott & Firestone, 1983).

For internal validity, the data collection and analysis was restricted to the content of officially published reports about each of the fatal shootings. Further, each of these cases, and the speculated errors made by the police, were highly publicised. Consequently, the researcher had some prior knowledge of the incidents. To overcome this influence, the researcher, as far as possible, acted with objectivity and detachment and strictly adhered to the principles of being reflexive and introspective (Guillemin & Gillam, 2004; Pillow, 2003).

### 3.2 Selection of case-studies

Our study used Hersen and Barlow (1976) literal replication logic to select three cases aligned to the aims of the research. Literal replication logic is a widely accepted method to select multiple sample cases, expected to yield similar results (R. Yin, 2009). Each fatal police shooting in the UK since 1990 was reviewed to choose the primary case. The findings of the official reports were used to decide whether the events within the cases were similar and whether the HFACS framework could conceptualise the documented failings (i.e., underlying active errors and latent conditions). The similarity of the selected cases (i.e., pre-planned police firearms operations) was necessary for triangulating and testing the applicability of HFACS to these types of events. Once the primary case was identified, the remaining two secondary cases were selected to replicate the design. The three chosen fatal police shooting cases were:

i. **John Charles de Menezes (primary case)**: Jean Charles de Menezes was shot and killed by the Metropolitan police during a pre-planned anti-terrorist firearms operation in London in 2005 after being mistaken for an Islamist terrorist believed to have been responsible for attempted bombings in London. Jean Charles de Menezes was not a terrorist and not connected to any of the attempted attacks in London. He was an innocent citizen on his way to work.

ii. **Mark Duggan**: Mark Duggan was shot and killed by the Metropolitan police in London during a pre-planned firearms operation in 2011 after armed police stopped the minicab vehicle he was travelling in. Although his killing was determined lawful, it was highly contested that Mark Duggan was shot when throwing the gun away when challenged by the police. His death triggered the riots in London and other parts of the UK.

iii. **Azelle Rodney**: Azelle Rodney was shot and killed by the Metropolitan police in London during a pre-planned firearms operation in 2005 after armed police stopped the vehicle he was travelling in. Police intelligence indicated that Azelle Rodney and the other occupants of the car were believed to have a firearm and were going to commit a robbery. The killing was determined as being unlawful, and firearms officer who killed Azelle Rodney was charged, but later acquitted of his murder.

### 3.3 Data collection and analysis

We used a two-phased approach to collect the data. In the first phase, content analysis was used to identify the most prominent contributory factors in the official IPCC investigation or inquiry reports (cf. Holland, 2013 for Azelle Rodney; IPCC, 2007 for John Charles de Menezes, 2015 for Mark Duggan). Thematic analysis of relevant human factors, within and across each case, was used to identify gaps in the existing HFACS framework and to propose additional factor categories related to fatal police shootings. In this case, the thematic analysis was concerned with the inductive identification, analysis and reporting of patterns, relationships and themes within the data (Braun & Clarke, 2006; Merton, 1968). The additional factor categories were added to create the first version of the modified HFACS framework for analysing fatal police shootings.

In the second phase, the first version of the modified HFACS framework was used to analyse the content of each case-study to identify the frequency of relevant human factors and errors in every category. The data from each case study were compared in preparation for cross-case comparison. Evidence from both phases of the data collection analysis was considered simultaneously, and the final modified HFACS framework (referred to as HFACS_FPS) specific to cases of fatal police shootings was confirmed.

HFACS_FPS was then used to analyse the case-study data deductively. However, for more nuanced findings and more in-depth understanding of the data, the analysis also included inductive content and thematic analysis to systematically record the human factors and errors in each case and allocate them to the pre-determined HFACS_FPS categories. This process reduced researcher bias (Stemler, 2001). It was also useful to (i) highlight areas with the highest and lowest frequency of errors, and (ii) compare the prevalence of errors in each of the case studies.

## 4. Results

The results can be summarised by saying that HFACS_FPS was effective in categorising latent conditions and active errors in each of the fatal police shooting cases. The majority were coded into the pre-determined HFCAS categories. (Table 1) summarises the frequency of latent conditions and active errors for each of the 19 original HFACS categories, along with four new categories. These results are presented for each case-study and combined across all instances. The number of relevant factors identified across the case-studies was 177. 80.2% (n = 142) of these factors were captured using the original HFACS model. The new categories of 'situational environment', 'missed intelligence', 'incorrect intelligence', and 'failure to adequately consider risk' added to HFACS_FPS identified 19.8% (n = 35) of these factors.

### 4.1. Organisational influences

At level 4 ' organisational influences', these data indicate that latent conditions were present in all three case studies. 'Organisational process' was most frequently coded against, with 4.5% of the total errors. There was evidence of poor cross-organisational collaboration in both the John Charles de Menezes and Mark Duggan cases. This factor is an instance of a latent condition that creates lower-level active errors. For example, in the Mark Duggan case, there was a lack of high-level collaborative policy between the Metropolitan Police Service and the Probation Services. The level 3 effect was that the planning for the operation failed to consider alternative investigative options. These

**Table 1.** Frequency of factors for each category.

| Error category | Sub-category | JCdm | | AR | | MD | | All cases | |
|---|---|---|---|---|---|---|---|---|---|
| | | n = | % | n = | % | n = | % | n = | % |
| **Level 4: organisational influences** | Organisational process | 3 | 3.8 | 2 | 3.6 | 3 | 7.1 | 8 | 4.5 |
| | Organisational climate | 1 | 1.3 | 1 | 1.8 | 1 | 2.4 | 3 | 1.7 |
| | Resource management | 1 | 1.3 | 2 | 3.6 | 2 | 4.8 | 5 | 2.8 |
| **Level 3: Unsafe supervision** | Supervisory violations | 2 | 2.5 | 1 | 1.8 | 2 | 4.8 | 5 | 2.8 |
| | Failure to fix know problem | 3 | 3.8 | 1 | 1.8 | 0 | 0 | 4 | 2.3 |
| | Failure to adequately consider risk | 3 | 3.8 | 5 | 9.1 | 5 | 11.9 | 13 | 7.3 |
| | Planned inappropriate operations | 9 | 11.3 | 8 | 14.5 | 6 | 14.3 | 23 | 13 |
| | Inadequate supervision | 2 | 2.5 | 1 | 1.8 | 0 | 0 | 3 | 1.7 |
| **Level 2: Pre-conditions for unsafe acts** | | | | | | | | | |
| Intelligence failures | Incorrect intelligence | 3 | 3.8 | 2 | 3.6 | 0 | 0 | 5 | 2.8 |
| | Missed intelligence | 1 | 1.3 | 2 | 3.6 | 5 | 11.9 | 8 | 4.5 |
| Personal factors | Personal readiness | 1 | 1.3 | 4 | 7.3 | 0 | 0 | 5 | 2.8 |
| | Crew resource management | 18 | 22.5 | 7 | 12.7 | 6 | 14.3 | 31 | 17.5 |
| Conditions of operation | Physiological/mental limitations | 0 | 0 | 1 | 1.8 | 1 | 2.4 | 2 | 1.1 |
| | Adverse psychological state | 0 | 0 | 1 | 1.8 | 0 | 0 | 1 | 0.6 |
| | Adverse mental state | 5 | 6.3 | 4 | 7.3 | 3 | 7.1 | 12 | 6.8 |
| Environmental factors | Technological environment | 8 | 10 | 0 | 0 | 1 | 2.4 | 9 | 5.1 |
| | Situational environment | 4 | 5 | 3 | 5.5 | 2 | 4.8 | 9 | 5.1 |
| | Physical environment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Level 1: Unsafe acts** | | | | | | | | | |
| Violations | Exceptional | 3 | 3.8 | 1 | 1.8 | 1 | 2.4 | 5 | 2.8 |
| | Routine | 3 | 3.8 | 0 | 0 | 0 | 0 | 3 | 1.7 |
| | Perceptual | 4 | 5 | 1 | 1.8 | 1 | 2.4 | 6 | 3.4 |
| | Skills-based | 3 | 3.8 | 3 | 5.5 | 2 | 4.8 | 8 | 4.5 |
| | Decision | 3 | 3.8 | 5 | 9.1 | 1 | 2.4 | 9 | 5.1 |
| | **Total** | **80** | | **55** | | **42** | | **177** | |

failures led to a range of downstream active errors that placed police officers in a sub-optimal situation.

'Organisational climate' and 'resource management' accounted for 1.7% and 2.8% of errors, respectively. Ambiguity regarding command structures for the operations and uncertainty of the most appropriate operational strategy to follow were the most prominent factors within 'organisational climate' category. Errors under 'resource management' were various. Many of these issues related to problems at the local level and, consequently, were coded at level 2 in the 'preconditions for unsafe acts' category.

### 4.2. Unsafe supervision

Level 3 'unsafe supervision' contained the second-highest number of errors at 27.1%. Except for 'failure to fix a known problem' and 'inadequate supervision' in the Mark Duggan case, all human factor categories at this level were present in each of the case studies. The level 3 sub-category, 'planned inappropriate operations' accounted for 13% of errors, making it the second most frequently coded category across all levels. A repetitive theme within this category was the failure to consider alternative strategic or tactical options that could have led to a non-fatal outcome.

Notably, there were several factors associated with risk assessments and supervision. They were distinctive from other HFACS classifications and a new category of was created to include supervisory errors related to risk management. For example, 'failure to adequately consider risk' was found in all three cases, accounting for 7.3% of all total errors. This new category was added to the modified HFACS_FPS framework. A small number of 'supervisory violations' were coded for all three cases.

### 4.3. Preconditions for unsafe acts

By far, most underlying conditions can be attributed to level 2 'preconditions for unsafe acts', with 46.3% (n = 82) errors coded to sub-categories at this level. 22.5% of the errors within the John Charles de Menezes case-study were attributed to 'crew resource mismanagement', compared to 12.7% and 14.3% respectively, in the Azelle Rodney and Mark Duggan cases. The analysis revealed 'crew resource mismanagement' was particularly susceptible to error.

One of the most significant outcomes at this level was the development of the 'missed intelligence' and 'incorrect intelligence' sub-categories. They are grouped under 'intelligence failures' and account for 7.3% (n = 13) of all errors. These two sub-categories were developed because errors relating to the collection, analysis and dissemination of intelligence did not fit into any of the existing HFACS categories.

'Adverse mental state' with 6.8% (n = 12) errors was another noteworthy category. These data suggest a heightened perception of danger by the firearms officers was related to information given in the briefings before the operations. The analysis also indicated the official post-incident reports did not evaluate the effect of adverse mental states of operators adequately considering their relevance. This conclusion appeared to be true for all three cases (this point is developed further in section 5.3).

Another significant result related to level 2 'environmental factors' was the creation of the 'situational environment' sub-category. Errors in this group pertain to situational factors such as a noisy operations room or excessive traffic on the roads. Overall, 5.1% of total errors were coded in this category, slightly above the mean of 4.3% (this point is developed in section 5.2).

### 4.4. Unsafe acts

Level 1 'unsafe acts' accounted for 17.5% of the total active errors identified as being contributory to the fatal police shootings. These active failures were the third most frequent errors to be detected. This finding differs from previous research and is explored further in section 5.1.2. Both routine and exceptional were observed in the data. Comparatively, perceptual, skills-based and decision errors were observed with a slightly higher frequency.

## 5. Discussion

This section will consider whether HFACS can be applied to identify contributory human factors in fatal police shootings. It will also discuss whether the existing HFACS categories are sufficient to capture all relevant human factors or does the model require modification for fatal police shootings. Finally, it will consider what new insights HFACS can provide post-incident investigations of fatal police shootings.

### 5.1. The application of HFACS to fatal police shootings

These findings indicate that HFACS is a useful aid for investigating fatal police shootings because all 19 categories of the HFACS framework were successfully conceptualised and transferable to the analysis of the fatal police shooting cases. 18 of the 19 categories were coded against and 80.2% (n = 142) of all observed factors fitted into the existing HFACS categories. This finding concurs with research in analogous industries where the HFACS framework was also applied and tested (e.g., Lenné et al., 2012; Madigan et al., 2016; Theophilus et al., 2017).

Using HFACS is also validated by the successful conceptualisation of active errors and latent conditions relating to the fatal police shootings. The framework differentiated between these typologies to highlight many underlying contributory factors. For example, in the John Charles de Menezes case, one of the most critical active errors was a misinterpretation of the word "stop" by the strategic commanders to the tactical teams. This failure of misunderstanding an important command related to a range of latent conditions such as inferior technology hampering communication, ineffective operational briefings, and a lack of consistency in terminology.

#### 5.1.2. Most prominent causal factors

The findings show patterns of errors clustering around particular contributory factors. Level 2 and level 3 latent conditions are the most common contributory factors. Interestingly, this finding diverges from research in mining and rail industries, where level 1 was the most prominent, and level 3 was the least (Lenné et al., 2012; Madigan et al., 2016).

The most frequently observed sub-category was level 2 'crew resource management', emphasising the importance of communication, coordination and planning in avoiding fatal police shootings where mistakes are made. In this category, the findings revealed that different firearms teams received various briefings from different sources affecting tactical coordination and decision making. Indeed, this discovery is substantiated by other research in medicine, where 'crew resource management' contained the most errors, and the oil and gas industry, where this factor was the third most prominent category (Elbardissi et al., 2007; Theophilus et al., 2017).

Communication errors were highlighted in the John Charles de Menezes case in particular. Although most prominent in the 'crew resource management' category, the findings identify communication errors across different levels. For instance, poor communication between the strategic and operational teams meant that the firearms team misinterpreted essential instructions, which resulted in the fatal police shooting of John Charles de Menezes. This example also illustrates the interplay between latent conditions such as the use of ambiguous operational terminology and downstream active errors where firearms teams misinterpreted instructions as authorisation for a critical shot.

Another noticeable factor was 'planned inappropriate operations', which had the second-highest number of errors (13%). While in medicine, this finding is supported (Elbardissi et al., 2007), research in other industries such as mining, rail and oil found this category to be far less significant. Similarly, in these industries, there was a relatively low frequency of level 1 active errors in 'unsafe acts' category (Lenné et al., 2012; Madigan et al., 2016; Theophilus et al., 2017). These variances can be attributed to different working environments such as the dynamic nature of police investigations and operations compared to slower-moving industries, such as oil and rail.

Most of the observed level 3 and level 2 errors were significant in contributing to the fatal police shootings. HFACS identified that level 2 latent 'preconditions for unsafe acts' and level 3 'unsafe supervision' were the most common factors in each of the cases. These findings suggest that corrective action needs to be implemented at these levels.

## 5.2. Modification of HFACS

The existing HFACS categories were able to capture the majority of the errors. However, the findings warrant the addition of four new categories when investigating fatal police shootings. The modified version of HFACS for investigating fatal police shootings is referred to as HFACS_FPS. These new categories are:

i. Failure to adequately consider risk;
ii. Missed intelligence;
iii. Incorrect intelligence; and
iv. Situational environment.

### 5.2.1. Failure to adequately consider risk

'Failure to adequately consider risk' is a new level 3 category for analysing fatal police shootings. The findings reveal that the failure to consider risk adequately was integral to each of the fatal shooting cases. This category refers to instances where front line supervisors fail to recognise the relevant risks when planning firearms operation appropriately. There were 13 instances of such errors across the three case studies that also included failing to complete the required risk assessments and signing off on incomplete threat assessments. For example, in the John Charles de Menezes case, there was no contingency plan for several of the difficulties they encountered. In this case, the risk assessment was not completed to the expected standard, and there was no consideration of the risk of misidentification of the subject. Furthermore, there was no assessment of the danger posed by the subject travelling on public transport. Had these risks been considered, there should have been strategies in place to overcome them.

### 5.2.2. Intelligence failures

'Intelligence failures' is the second new category. As shown in Figure 2, the two sub-categories of 'missed intelligence' and 'incorrect intelligence' are added to the parent 'intelligence failures'. 'Missed intelligence' refers to intelligence that was obtainable and would have been beneficial to the operation. 'Incorrect intelligence' relates to information that was used to inform decisions, but after the events were exposed as being factually incorrect. For example, of in the Mark Duggan case, only one (while also holding other duties) police intelligence researcher was available to the investigation. The researcher did not explore all lines of inquiry when information regarding another subject of interest came to light. Consequently, significant intelligence was missed that could have redirected the focus of the investigation, and an opportunity to avoid the fatal shooting was overlooked.

### 5.2.3. Situational environment

The final addition to the model is the 'situational environment' sub-category. This sub-category refers to environmental factors that negatively impact on operational capability. For example, in the John Charles de Menezes case, the operations room where the strategic team were based was described as being noisy and difficult to work in. Another instance was the difficulties caused by a large amount of traffic on the roads when the tactical firearms team was following Mark Duggan's vehicle. These features were situational factors that contributed to reducing operational capability.

## 5.3. HFACS and post-incident analysis

Analysing the case studies using HFACS provided insight into three areas that were missed by the official post-incident investigations. Firstly, the IPCC recommendations regarding the use of risk assessments are superficial. For example, in the John Charles de Menezes report, there were recommendations to review current procedures, training, and learning for conducting risk assessments

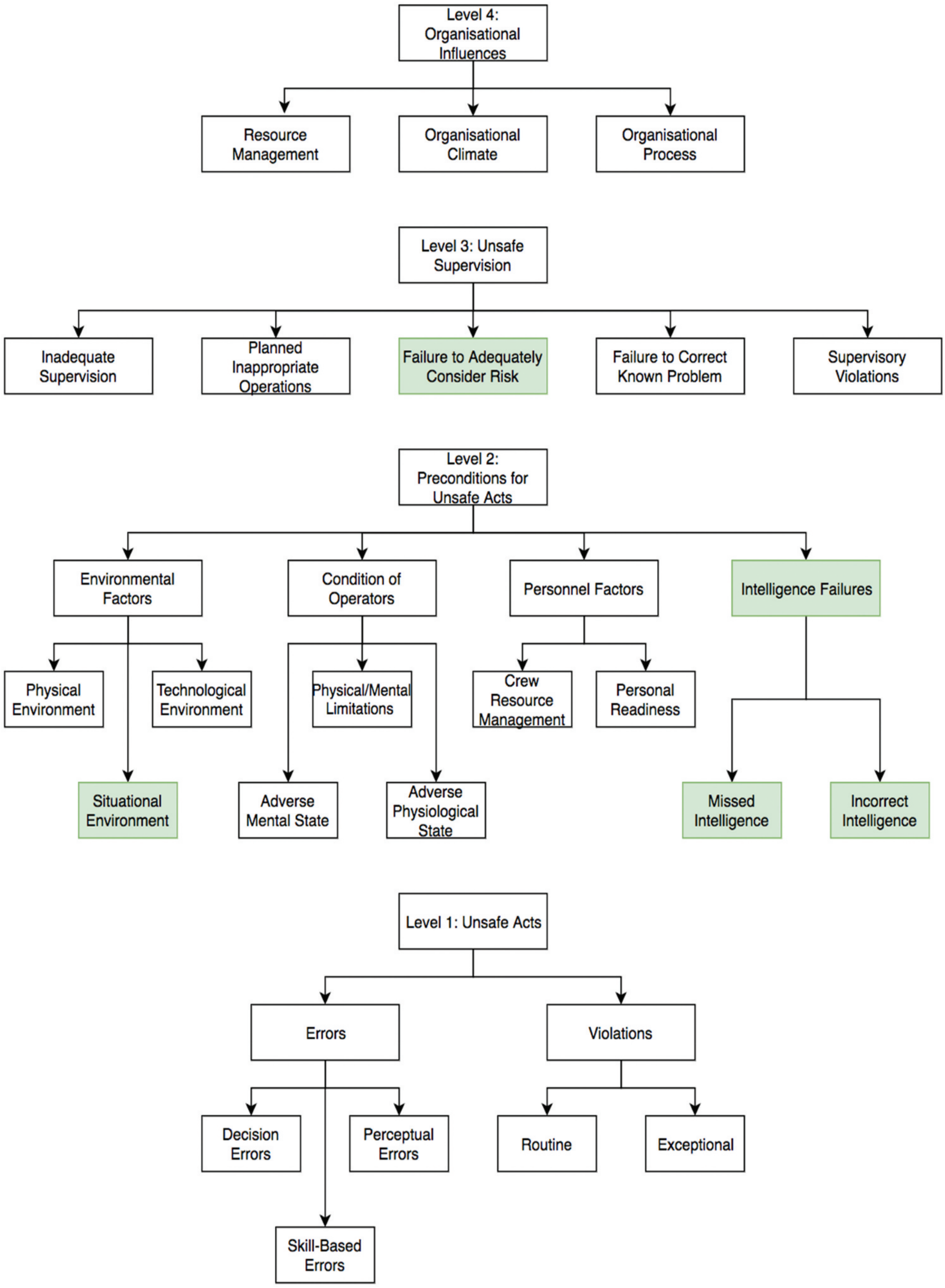


**Figure 2.** –Modified HFACS_FPS for analysing fatal police shootings.

(IPCC, 2007). This recommendation fails to adequately emphasise how inadequate risk assessments can contribute to adverse outcomes and also fails to acknowledge the complexity of the consequences of insufficient risk assessments. In each case, protocols for risk and threat assessments already existed at the organisational level. However, the HFACS framework identified issues with both supervisors and front-line operators failing to recognise the importance of carrying out these protocols.

Secondly, an important theme consistent across all three cases was the failure of the firing officer to warn and announce the presence of armed police before shooting. In most cases, firearms officers are required to announce their presence to allow the subject to comply with instructions before using lethal force. Ordinarily, without providing a warning, officers would not be conforming with existing rules and procedures to mitigate the unnecessary loss of life. In suicide-bomber type cases, like that involving John Charles de Menezes, the requirement for armed officers to provide a warning is more complex. There may be exceptional (operation Kratos) circumstances where firing a critical shot without warning may be necessary to prevent the initiation of an explosive device.[7] Albeit, the firearms officers perceived John Charles de Menezes to be a suicide-bomber the critical shot was not authorised. The respective firearms officers stated they provided the warning. However, this was not accepted by the inquest findings and may relate to the confusion about the word 'stop' being used by the Designated Senior Officer rather than authorising the critical shot.

Thirdly, within the official reports, there is little discussion about the mental state of the firearms officers who discharged their weapons. For example, the firing officer in the Azelle Rodney case had been involved in a previous fatal police shooting. While this history is mentioned, it was not critically considered. There was also little consideration given to the effect of how strategic decisions may increase the perception of danger held by the front-line firearms officers. For instance, in the Azelle Rodney case when the (tactically inappropriate) decision was made to implement a 3-car hard stop, this increased the perception of danger and contributed to the subconscious pre-emptive decision to shoot. This sequence of events resulted in Azelle Rodney being fatally shot after '0.06 seconds' of partially obstructed observation (Holland, 2013) by the firing officer. The HFACS category 'adverse mental state' was ranked 4th out of 23 causal factors in our analysis. Yet, this finding was unclear from the official post-incident investigative process. Again, the HFACS framework provided new insights into latent conditions contributory to the fatal police shootings, which were missed by the formal investigations.

### 5.4 Limitations of the study

This study has some limitations. First and most obviously, the sample was restricted to three case-studies from seventy-four. This was intentional because the aims of the study were exploratory; taking the first steps to determine whether HFACS could be a practical methodology for investigating fatal police shootings. It was decided to test HFACS in a small sample first to assess whether initial findings are consistent with the broader field and merit reporting to recommend further work to build the evidence-base for using HFACS in police settings. Further, in terms of resources, the selection of the small sample was influenced by the availability of accurate and reliable data to robustly test the HFACS methods and how much researcher time was available to collect the data. The sample size is also reflected in the weight attributed to the findings and conclusions. Second, although recognised in the research design, external validity is also somewhat reduced because the data were coded by one researcher. Third, HFACS and HFACS_FPS are limited to retrospectively identifying contributory factors from secondary data sources and should not be used to estimate the casual effects.

## 6 Conclusions

Our study set out to tackle an important issue by determining whether Shappell and Wiegmann (2000) HFACS framework can be used to identify human factors and human errors which contribute to fatal police shootings. While the sample size was small, we successfully applied both the original HFACS and modified HFACS_FPS to provide new empirical insights into contributory factors related to fatal police shootings. Albeit fatal police shootings are statistically rare in the UK, we propose that HFACS_FPS has utility and recommend there are high-level and operational benefits in using HFACS to improve conventional post-incident investigative approaches. Testing on a larger sample in different geographic locales is required to determine whether the findings can be generalised more widely.

Rather than providing a comprehensive exposition, the case-studies were used primarily to test the usefulness of the HFACS methodology in analysing fatal police shootings. In doing so, we also identified new contributory factors. Future research into using HFACS should initially focus on two areas. Firstly, determine why most errors cluster in the level 2 category of 'preconditions for unsafe acts' and level 3 category of 'unsafe supervision'. Secondly, establish why current investigative approaches may not identify key contributory human factors in areas such as risk assessment, failing to provide warnings and mental health of firearms officers. Both areas may require re-formulation to provide a suitable explanation for their contribution to fatal police shootings.

Our study supports the future use of HFACS_FPS to investigate fatal police shootings. More generally, our findings also suggest the HFACS methodology could be developed further for use in investigations in other controversial areas of policing, for example, miscarriages of justice, failed investigations, wrongful arrests, excessive force and deaths following police contact. Future developments should focus on how this approach can be used to become more anticipatory of the risks of failure and improve organisational learning in police organisations. In this way, HFACS could be used to understand better how the non-linearity of interactions between system elements creates complex modes of failure in high-risk policing events. Future developments, more broadly, might also focus on using a more systematic type approaches to post-incident investigations. These developments will go some way to far more accurate conclusions and recommendations from post-event investigations and greater reliability about contributory human factors.

Finally, we suggest, empirical methodologies have a role to play in maintaining trust and legitimacy in cases of fatal police shootings. At the time of writing this paper, we must acknowledge the significant events happening in policing across the world. The tragic death of George Floyd has increased levels of public concern about the police use of lethal force. In this context, we, therefore, consider it appropriate to use this study to challenge policing practitioners, policymakers and independent investigative bodies to consider how lethal-force investigations and relations with citizens can be improved by using empirical frameworks such as HFACS. While the road ahead in policing may indeed be very challenging, there are, we believe, opportunities to be more scientific about our understanding when a police officer using a firearm, lawful or otherwise, takes the life of another human being.

## Notes

1. These figures only include England and Wales and do not cover Scotland and Northern Ireland. Figures last updated 2 February 2020.
2. As seen in the riots in London and across the UK after the shooting of Mark Duggan.
3. Each of the cases used in this study; Jean Charles de Menezes, Azelle Rodney, and Mark Duggan were high-profile, controversial fatal police shootings investigated by the IOPC.
4. The Independent Office for Police Conduct (IOPC) was formed in January 2018. Before this, the equivalent body was referred to as the Independent Police Complaints Commission (IPCC). The reports used in this study are titled 'IPCC Reports'. However, this study relates to the new name 'IOPC'.
5. In the case of fatal police shootings, the terms human factors and human errors are used interchangeably throughout the paper.
6. AcciMap is a methodological approach for systematically analysing accidents and failures in complex socio-technical systems.
7. Operation Kratos refers to the circumstances and protocols for London's Metropolitan Police firearm officers dealing with suspected suicide bombers and firing critical shots without warning.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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