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RESEARCH ARTICLE



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'Keep your claws off the trigger'; a focus group study on involuntary firearm discharges

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ABSTRACT

Special interventions operators often operate in high-risk situations where the use of force, including firearms, is required. Firearm use carries inherent risks, including the risk of an involuntary firearm discharge (IFD), which occurs when an operator unintentionally pulls the trigger without conscious intent. To better understand these incidents, this study explored the experiences and perspectives of experts who deal with these risks. Three focus groups were conducted to identify factors that operators perceive as contributing to IFDs and to examine operational procedures that influence risk and prevention. An inductive thematic analysis resulted in five themes: Operational Complexity, Operational Resources, Operational Behaviour, IFD Risk Awareness and Mitigation, and The Inevitable?, with varying numbers of sub-themes. Participants identified personal, behavioural, situational and procedural risk factors as well as relevant operational procedures and mitigation strategies affecting IFD risk. These findings enhance understanding of the operational context and provide practice-grounded insights to inform feasible and effective prevention strategies.

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Unintentional discharge; police use of force; human factors; tactical operations; operational experts

1. Introduction

Police officers have the authority to use force when necessary to enforce the law, preserve public order, and protect human rights (United Nations, 1979). The use of force is permitted when it is necessary to perform their duties, but it must be proportionate to the specific circumstances. According to the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, the use of firearms is considered an extreme measure within the use-of-force spectrum and is only justified in cases of self-defence or

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defence of others against an imminent threat of death or serious injury (United Nations, 1990).

Operators from specialised police units, such as Special Weapon and Tactics (SWAT), or Critical Incident Teams deal with life-threatening encounters with armed suspects. In these high-risk situations, operators often have to exert force, including the use of firearms (Andersen & Gustafsberg, 2016; Williams & Westall, 2003). To optimally prepare them for high-risk situations, operators are subjected to a strict selection process, followed by an intensive training programme (Rodriguez et al., 2024; Schram et al., 2020; Sjöberg et al., 2025). Even after they finished their training programme, they dedicate a substantial portion of their time to training, estimated around 25% (Jenkins, Semple, Suss, et al., 2024). Despite their intensive training, the frequent handling of their firearms in these challenging environments exposes them to certain risks, including those related to involuntary firearm discharges (IFDs).

IFDs are defined as ‘incidents in which an operator activates the trigger mechanism involuntarily, and without a conscious decision to fire, resulting in a discharge of the firearm’ (Kooijman et al., 2025). IFDs are distinguished from other firearm incidents by the absence of intent to fire. In contrast, misdiagnosis errors occur when an officer intentionally discharges their firearm based on an erroneous interpretation of the situation, which is subsequently determined to be incorrect (Taylor, 2019). Similarly, contagious fire (also known as reflexive fire, synchronous fire, and sympathetic fire) describes incidents in which officers intentionally discharge their weapons in reaction to gunfire from colleagues, rather than by the officer’s independent appraisal of the threat (DeCarlo et al., 2024; Rostker et al., 2008). IFDs may have serious physical, psychological, and societal consequences. A bullet discharged unintentionally may hit a suspect, a fellow operator or an innocent bystander, potentially resulting in a severe injury or even death (O’Neill, 2018; O’Neill et al., 2017, 2018; Stansfield & Rushforth, 2009). Besides the immediate physical harm, IFDs can also undermine public trust in law enforcement and affect the sense of safety within the community (Stroshine et al., 2024).

Fortunately, incidents of IFD are relatively uncommon, but given the potential consequences, even a single incident is one too many. Between 1978 and 2002, IFDs by Dutch police officers resulted in 11 deaths and 33 injuries (Timmer, 2005). Reports of 9 other countries in Europe who register these incidents annually (Belgium, Denmark, Germany, Greece, Latvia, Lithuania, Luxembourg, Poland, Hungary), show that the number of IFDs varies between 1 and 59 per 100,000 police officers a year (*mean* = 32.6, *SD* = 21.5, *median* = 39.1) between 2014 and 2021 (Lorei, 2023). In Germany, the number of IFDs has increased over the last few years. When the German law enforcement agencies started reporting these incidents in 2015, the average number of IFDs was around 4 to 11 incidents a year. In 2019 this number increased to 56 incidents a year. This trend continued, reaching 96 and 98 incidents in 2020 and 2021. The cause of this trend is unclear. The increase could be related to improved reporting procedures, reduced emphasis in training following periods of low incidence, unintended safety trade-offs from training focused on high-risk encounters, or other reasons. Standardised statistical categories of these incidents are lacking, making it difficult to determine the cause. Unfortunately, many law enforcement agencies worldwide do not systematically record IFDs, making it difficult to assess the global scope of the problem.

A good understanding of how and why IFDs occur is essential for developing preventive measures or (training) interventions to mitigate the IFD risk. A recent scoping review presented an elaborate framework of the risk factors and mechanisms that may contribute to the occurrence of an IFD (Kooijman et al., 2025). This Gradient Framework for IFD Risk divides IFD risk factors and mechanisms into five categories: predisposing factors (e.g., lack of training or a lack of loaded gun indication), situational factors (e.g., threat potential or executing unfamiliar tasks), responses to the situation (e.g., narrowed attention or muscle- and cognitive fatigue), interactions in the situation (e.g., forceful behaviours while holding a firearm or a loss of grip) and motor control processes (e.g., involuntary muscle contraction or a startle reaction). The framework postulates that the factors and mechanisms affect the IFD risk at different moments leading up to the trigger pull, and that these elements differ in level of specificity. Overall, there is a broad range of risk factors that may contribute to the occurrence of an IFD. The fact that these factors are potentially interrelated further underscores the complexity of IFDs.

To gain a robust understanding of police issues, practitioner-based knowledge and research-based knowledge must be combined (Fyfe & Wilson, 2012). Research has shown the value of expert knowledge for a variety of goals. For instance Huhta et al. (2023) retrieved officers' and instructors' tacit knowledge to identify elements that define situational awareness, with the aim of improving evidence-based police training, tactical decision-making and use-of-force practice. Kleygrewe et al. (2022) conducted interviews with various law enforcement agencies to gain insights into the strengths and challenges of police training practices, revealing the potential benefits and added value of Virtual Reality (VR) applications. Bailey et al. (2018) conducted focus groups and interviews to explore the barriers and facilitators influencing the implementation of the Mobile Crisis Assistance Team model, which seeks to strengthen collaboration between police and mental health professionals during emergency responses. Likewise, for a thorough understanding of IFDs, the experiences and insights of experts dealing with the risk of IFDs are invaluable. Focus groups are a suitable research method to retrieve practice-based knowledge. They allow participants to reflect on complex issues that are context specific, and discuss their shared understandings that shape their professional behaviour (ONyumba et al., 2018).

In this study three focus groups with Dutch special interventions operators were held. The special intervention division, the specialised police unit in the Netherlands, respond to life-threatening situations against the police or others such as encounters with armed suspects, high-risk arrests, and terrorist threats (Timmer et al., 2025). The aim of conducting the focus groups was to retrieve knowledge, experiences and perspectives of experts in the field. This study was focused on IFDs that occur in the operational context. IFDs that result from routine firearm tasks such as cleaning, clearing and storing were not taken into account. Specifically, the study aimed to answer the following research questions: 1. What factors do operators identify as contributing to the risk of IFDs? 2. Which operational procedures are perceived to influence the risk and prevention of IFDs? The experiences and perspectives of experts offer a unique insight into how this phenomenon manifests in practice. The focus groups also provide the

opportunity to gain a deeper understanding of the daily practices and challenges of operators which is essential for developing practically feasible and meaningful mitigation strategies for IFD risk, such as training interventions, policy recommendations, and other preventive measures.

2. Method

2.1. Participants

Three focus groups were conducted for this study. The first two groups consisted of two teams of operators ($N=7$ and $N=6$) of the Special Interventions Division of the Dutch National Police, and the third group consisted of experts involved with the special intervention division such as firearm instructors, commanders and members of a knowledge centre ($N=13$). The participants were all male, with an average age of 39 (± 5) years. As there are currently no women serving as operators in the special interventions division, it was not possible to achieve greater gender diversity in the research sample. Most of the participants were experienced operators with over 5 years of experience ($N=7$) or even more than 10 years of experience ($N=11$). Only 2 participants had less than 2 years of experience as an operator. Furthermore, all participants had a background in the police or military with a minimum of 2 years of experience. The participants were approached via an intermediary from the special interventions division, with whom the authors collaborate for their research. The potential participants were sent an information letter and information clip and were invited to participate in a focus group. Ethical approval was obtained from The Scientific and Ethical Review Board (VCWE) of the Faculty of Behavioural and Movement Sciences of the Vrije Universiteit Amsterdam [reference number 2023-167].

2.2. Procedure

All focus groups were moderated by the first and last author. At the start of each session, the goals and content of the focus groups were explained. It was explained that participation was voluntary, and that participants could discontinue their participation at any moment. All participants provided written consent before taking part in the focus group. The focus groups were audio recorded with a password-protected audio recorder. The researchers explained that the audio recordings would be deleted after the focus groups had been completely transcribed. The researchers emphasised that all transcripts would be kept confidential, pseudonymised and stored securely. Moreover, participants were given a badge with a unique letter on it, so they could refer to each other by this letter, instead of their names. Another researcher used the Behavioral Observation Research Interactive Software (BORIS) to track who was speaking by entering the corresponding letter. Participants were encouraged to share their opinions, knowledge, experiences and attitudes about the subject of IFDs. To encourage openness, researchers provided alias name tags that participants could use when referring to other people not present in the focus groups such as colleagues. Each focus groups lasted approximately two hours.

2.3. Design focus groups

Each focus group session was divided into two parts. The first part explored participants' perceptions of risk factors associated with IFDs, while the second part focused on operational procedures relevant to the occurrence and prevention of IFDs. To stimulate active participation, several interactive methods were developed. The methods were a mixture of exercises to explore their own experiences and perceptions and exercises to encourage discussion and interaction. The first part began with broad questions about situations and factors that make the job more challenging, gradually narrowing to those that complicate weapon handling, and ultimately focusing on situations in which an IFD might have occurred, or the risk of such an incident might have increased. This part was completed with an exercise in which participants evaluated a predetermined list of risk factors compiled by the researchers. They discussed whether each factor represented a potential risk for IFDs and individually ranked the factors from 1 to 5 based on their perceived importance and discuss whether they considered these factors a potential risk for IFDs. In the second part the participants were divided into smaller groups and were tasked to discuss operational procedures they deemed relevant for both the occurrence and the prevention of IFDs. Then, each group presented their findings and commented on the other's findings. Finally, the most important procedures were discussed in terms of speed, operators' safety, suspects' safety and accuracy. A detailed overview of the focus group structure, including the exercises used during the sessions, is provided in Appendix A.

2.4. Analysis

The audio recordings of the focus groups were transcribed using the software Whisper and checked by reading the transcripts and listening to the recordings simultaneously. To ensure sensitive data was handled securely, the transcriptions were performed in an ISO certified Secure Analytics Lab (SAL) on a computer without internet access. Atlas.ti (version 24.2.1) was used for the analysis.

The focus groups were analysed using thematic analysis, following the six steps of Braun and Clarke (2006). The first step is to familiarise with the data. In this step the researchers immerse themselves in the data to develop a comprehensive understanding of its scope and content. This was done by conducting the focus groups (first and last author) and checking the transcripts (first author). The second step is to generate initial codes. The transcript of the first focus group was independently analysed by the first and last author through an inductive approach using open coding. Through a consensus meeting, the initial codes were compared and merged to create an initial code list. The first author proceeded with this code list (selective coding) for the next two transcripts, which was complemented with newly identified codes. Then, the coded transcripts were reviewed by the last author. The analysis proceeded after consensus was reached. The third step is to search for themes. The first and last author independently derived initial themes from the codes. Again, in a consensus meeting the provisional themes were compared and discussed, resulting in provisional themes and sub-themes. The fourth step is to review the themes. This step consists of two levels. In the first level the first author reviewed whether the coded data extracts of the provisional theme formed

a coherent pattern. Then, the first author proceeded to the second level by going through all transcripts again to determine whether the themes are an accurate representation of the dataset. Analysis proceeded after successfully completing both levels. The fifth step is to define and name themes. Provisional themes that accurately represented the dataset and contributed to answering the research questions were refined in an iterative process and were eventually adopted as final themes (first and last author). These themes and their subthemes were then clearly labelled and defined. Next, the themes and sub-themes were presented to a third researcher (second author) who did not take part in the focus groups and did not read or code the transcripts to finalise the themes, and served as a critical friend to review the themes and sub-themes presented. The sixth and final step is to write the report. Quotations were used for illustrative purposes.

2.5. Positionality statement

The positionality of a researcher influences all stages of the research process (Holmes, 2020). Researcher positionality can be used as a tool to make their standpoint and assumptions explicit. Acknowledging and reflecting on this influence is important for transparency and credibility in qualitative research.

All three authors originate from a positivistic research tradition but have progressed towards more applied research. Grounded in pragmatic epistemology, their work addresses complex, context-specific problems and aims to understand what works in real-world settings. Their research orientation recognises quantitative and qualitative methods as complementary ways of generating knowledge. Qualitative research allows for a deeper understanding of the lived experiences and contextual factors that shape practical problems, such as IFDs.

The first and last author, who moderated the focus groups, are both Caucasian women. The first author has approximately three years of experience in the policing context, while the second and last author have extensive experience in both policing and sports domains. The last author also has a background in psychology and substantial experience in teaching and conducting focus groups. This combination of skills facilitated the building of rapport with participants. During the focus groups, this often resulted in one participant initiating open reflections, which others then followed, a process that was supported and reinforced by the moderating researchers. The authors' professional backgrounds provided familiarity with the operational cultures, safety practices, jargon, and relevant literature. This position facilitated in-depth and engaged discussions, and supported a nuanced understanding of participants' experiences. Their positivist background provides an analytical perspective and focus on factual detail, which aligns well with the culture and professional orientation of the Special Interventions Division. This alignment appeared to support the researchers' credibility and professionalism which contributed to the researchers being taken seriously by participants. In combination with their experience in qualitative research, this positioning allowed participants' experiences to remain central throughout the research process.

At the same time, such familiarity may shape interpretations. All authors have previously conducted research on IFDs, meaning that prior knowledge could influence interpretations. To minimise bias and remain open to emergent themes, the team adopted an inductive coding approach and held reflexive discussions.

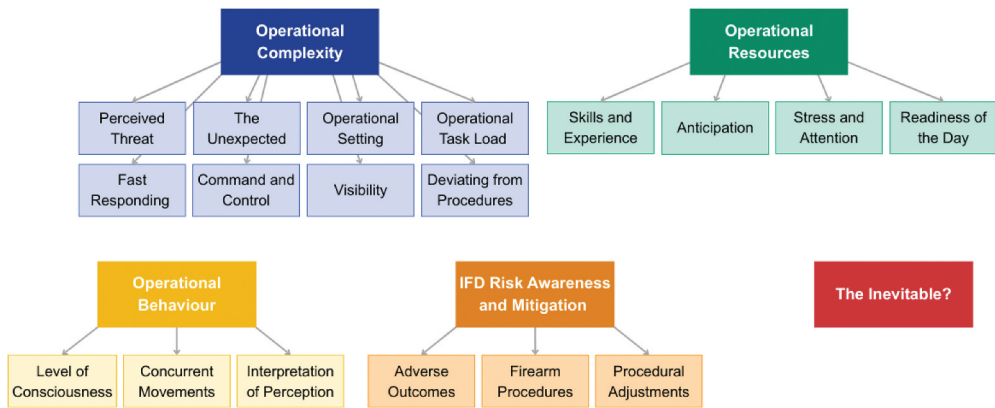


Figure 1. Overview of the five themes and accompanying sub-themes following the thematic analysis of the focusgroups transcripts; note that there was no sub-theme for the theme the inevitable?

3. Results

The aim of this study was to explore the perceived risk factors of IFDs and relevant operational procedures that affect both the IFD risk and mitigation of the risk. The themes and sub-themes that are the result of the thematic analysis are presented in Figure 1, depicting the perspectives and experiences of operators and other experts on risk factors, relevant operational procedures, and mitigation of risk. The following sections elaborate on each theme and its corresponding sub-themes in detail.

3.1. Operational complexity

The theme Operational Complexity refers to the multifaceted and challenging nature of the operation that is part and parcel of the operators' work and performance. The subthemes of the theme Operational Complexity outline factors that make the job of an operators particularly complex. These subthemes are Perceived Threat, The Unexpected, Operational Setting, Operational Task Load, Fast Responding, Command and Control, Visibility, and Deviating from Procedures.

3.1.1. Perceived threat

Perceived Threat refers to the extent to which operators appraise the situation as risky or threatening, based on their evaluation of the probability and severity of adverse outcomes to themselves, the team, or the environment. The perceived level of threat is influenced by factors such as the type of suspects and the potential presence of weapons. Operators are primarily deployed in high-risk situations and must frequently deal with such threats. The perceived threat affects how they operate, as illustrated by the following quote:

I have two examples that come to mind from my own experience. In those moments, I'm more alert than usual, so to speak. One situation was when we came under fire while

approaching a building. And then you still have to go in and you notice you're much sharper than during a normal entry. I was completely ready for it. I was carrying a long gun, and I had already taken it off safe. I really thought, 'We're going to run into him any second. He's armed. He has already fired at us.' That's the kind of situation where, although I can't recall it exactly, I can imagine that your finger is closer to the trigger than it normally would be. Because you're really operating on a knife's edge. (Focus group 2, participant E)

3.1.2. *The unexpected*

The Unexpected refers to the unforeseen and constantly changing circumstances of the operation. This sub-theme captures all factors and events that the operator did not anticipate for. The behaviour of suspects can be unpredictable or erratic. A participant phrased this unpredictable behaviour as:

That it's unpredictable, or different from what you expect, for example. That can happen, and it causes a startle reaction. You expect the suspect to stay seated, but suddenly he gets out. Or you reach the car, and they suddenly take off. Then you have to decide in a split second: okay, what do I do now? Do I already have my weapon drawn or not (Focus group 2, participant F)?

In other situations, operators need to abandon their original plan due to unexpected or changed circumstances, such as a blocked entrance or an incorrect map of the building.

3.1.3. *Operational setting*

The Operational Setting refers to the operational backdrop, meaning the operation type, time, place and circumstances and the standard operating procedures of that operational task. According to the participants, operating in the public domain introduces additional challenges, such as the presence of bystanders that may increase safety risks. When suspects are mobile, for example in a car, the situation becomes more dynamic and requires continuous adaptation. The participants disclosed that multiple IFDs in the past have happened when arresting a suspect in a car, implying that these situations may present a risk. Entering a building requires operators to be familiar with the site plan in order to navigate properly and position themselves effectively. In each of these scenarios, the operational setting shapes the strategies and decisions of the team. The challenges associated with these different operational settings are illustrated in the following quote:

I also think in a building you have to remember much more. When you go inside, there's a lot more to keep track of. On the street, the whole lead-up is busy, but the arrest itself is actually quite simple, we almost never have to take someone over.¹ It's just walking to the door, and that's it. But inside a building, you have to think about, maybe go here, maybe go there, and you have to take over the person. So personally, I think you have to remember more in those situations. (Focus Group 1, participant B)

3.1.4. *Operational taskload*

The operational circumstances are often characterised as hectic and generally require managing simultaneous tasks that place substantial demands on information processing. This is referred to as the Operational Task Load. While not necessarily excessive or overwhelming, these situations place considerable cognitive demands on operators. A participant described this hectic nature of the work as follows: 'It's just a hectic

situation. With other teams as well, all working around you. It's simply very busy, being in that car' (Focus Group 1, participant C).

3.1.5. Fast Responding

Fast Responding refers to the necessity to make the right decision in a limited time frame given the risks associated with acting too slowly or too late. Operators' decisions to shoot or withhold fire carry serious consequences. Therefore, it is of utmost importance to make the right decision. However, there is very little time to deliberate on a decision, as delaying the action may increase personal risk. One of the participants articulated this paradoxical challenge nicely: 'I think it's not very difficult work. But sometimes it's doing the right thing very quickly. That sounds simple. But that can sometimes also be very difficult. So acting very quickly. But still doing the right thing' (Focus group 3, participant L).

3.1.6. Command and control

Command and Control refers to the level of control, grip and oversight operators have over the situation. Operators seek to maintain initiative during operations. For operators, drawing their firearm is one strategy to take this initiative and control and prevent the suspect from gaining it. A participant stated:

This is often overlooked. But one reason we also carry a weapon is to use it as a threat ourselves, to maintain the initiative, so the other person doesn't take initiative. The difference you see in for example cases in blue,² is that because their approach there is very low-profile, people do resort to violence, resistance, and even drawing a knife or a firearm. That almost never happens in our context, because a firearm is displayed immediately by us. In general, that keeps people in their place. (Focus group 1, participant E)

The lead-up to an action plays an important role in operational control and was often emphasized in discussions of IFDs. When reviewing past cases of IFDs, particular attention was given on how this phase had unfolded in those cases. Situational circumstances such as being attacked or ambushed can result in a loss of control. Other factors are more related to the behaviour of the operators. For instance, a commander can create a calm and positive atmosphere, whereas a chaotic commander can create a lack of oversight and stress. Also, communication is an important factor in this. When preparing for action there can be multiple communication channels present, potentially causing an overload in information. It is important to consider how to effectively communicate with each other and how to deal with these channels to enable command and control.

3.1.7. Visibility

Visibility refers to the extent that operators have a clear view of the situation. Their vision can be poor due to the weather circumstances or occluded because their perception is blocked because of windows or objects. A decreased vision complicates the performance of their tasks. A lack of visibility has been directly associated with an IFD incident; due to poor visibility, an operator attempted to activate the firearm's light, unintentionally causing the firearm to discharge. Fortunately, this did not cause any casualties. In the quotation below, the participant describes this incident:

But, I do know a situation where it was different. Things went wrong at the door. It didn't open properly in one go. Eventually we went inside, with the suspects coming down the stairs. There was too little light there. And then wanted to add some light. Above their heads at least. No injuries. Warning shot. (Focus group 2, participant F)

3.1.8. Deviating from procedures

Deviating from procedures refer to situations in which operators do not strictly adhere to the standard operational procedures. The aforementioned sub-themes of the Operational Complexity are mostly inherent to the operational context, or related to suspect behavior. However, participants also described how operational complexity can arise from operators' behaviors themselves, particularly when deviating from standard operational procedures. Operators are trained to follow certain protocols, yet in practice, deviations sometimes occur or mistakes are made. According to the operators, deviating from the operational procedures may impose risks as these procedures are developed to ensure consistency and safety. The following quotes illustrate the importance of adhering to the operational procedures and the potential risk when they are omitted: 'If you start making exceptions, there comes a moment when you make the wrong exception' (Focus group 2, participant A). Deviating from procedures was even directly linked to occurrences of IFDs in the past, as pointed out in the following quote: 'When you have to deviate from procedures ... With those guys where it happened, they all deviated from the procedures because things were different' (Focus group 2 participant B).

Some contradiction exists in the statements of the participants regarding deviating from procedures. On the one hand operators emphasise the importance of strict adherence to the operational procedures and the risks associated with deviating from them. On the other hand, they also state that the circumstances sometimes necessitate deviations from these procedures to stay safe. Moreover, practical experience in the field provides insights that do not always perfectly align with formal training, highlighting the complex interplay between prescribed operational procedures and the real-world decision-making.

3.2. Operational Resources

The theme Operational Resources refers to the qualities, skills and conditions that shape an operator's ability to perform their duties and meet operational demands. The sub-themes of the Operational Resources capture different factors that contribute to this capacity. The sub-themes are Skills and Experience, Anticipation, Stress and Attention, and Readiness of the day. The sub-themes encompass both stable factors and situationally dependent factors.

3.2.1. Skills and experience

The Skills and Experience of the operator are the result of their background, educational programme and (tactical) training, but also relate to the years of experience as an operator, in the team, and with the specific operational procedures and circumstances. These factors are relatively constant and therefore steadily contribute to the operational resources of the operator. This sub-theme was extensively discussed in all three focus

groups. According to the participants, a lack of experience may potentially be related to the occurrence of an IFD:

When you look at the most recent IFDs, those who were involved were relatively new guys. It doesn't happen very quickly, I mean, of course, never say never, but not quickly with guys who have been around for a longer time. (Focus group 2, participant D)

Moreover, having a lot of experience and being well-trained and experienced was often described as a 'protective factor', potentially decreasing the risk of an IFD. Yet, extensive training and experience can also foster complacency and carelessness, which in turn, paradoxically, creates a risk. One of the participants shared this dual role of experience as:

I think that for the guys who have been on the team for a long time, it may be a bit of carelessness. That it happens in the rush, because they have done it so many times. They might be a bit less consciously engaged with it. And for those who are new to the team, they still really want to do everything right. Thinking about which steps they have to go through, and then carry them out. In that case, the stress level might be a bit higher, and that may be why it happens. (Focus group 1, participant H)

3.2.2. Anticipation

Anticipation refers to an operator's expectations about how a situation will unfold and the corresponding actions they deem appropriate, shaped by prior experiences, situational context, and the suspect's behaviour. Several operators noted that, repeated encounters with violence or weapons may bias operators to expect similar threats in new situations. This may lead to the misinterpretation of ambiguous cues. Within the context of shooting, operators described how anticipating the need to fire influenced their behaviour, such as gradually moving the finger towards the trigger, which may create a risk. A participant described this process as follows:

If you have the intention to fire, your finger automatically moves a little lower on the weapon because you want to get the shot off as quickly as possible. And if you intend to fire but are interrupted in the process, something unexpected happens that you couldn't have anticipated, your finger is already lower on the gun, and the shot is more likely to go off prematurely. (Focus group 1, participant A)

3.2.3. Stress and attention

Stress and Attention are also affected by situational circumstances. Operators reported that both excessive and insufficient stress can impair performance and potentially influence the risk of an IFD. Participants noted that heightened stress can impair attentional capacity, potentially resulting in tunnel vision or missed cues during rapidly evolving situations. The following quote illustrated the potential risk of increased stress:

Stress. I think that's definitely a factor as well. When your stress level is really very high and you're approaching the door, you feel like your field of vision becomes something like this [narrowing gesture]. Then sound may fade into the background, and everything goes into autopilot. And then I think you end up performing actions simultaneously. Whereas if your stress level hadn't been that high, then it wouldn't have happened. (Focusgroup 1, participant H)

On the other side of the spectrum, low stress may reduce vigilance and alertness, which also imposes a risk. In sum, there is an optimal level of arousal required for effective

performance, as both excessive and insufficient arousal can impair functioning and affect the risk of an IFD. But not only narrowed attention can impair performance, also scattered attention or a distraction can create a risk.

3.2.4. Readiness of the Day

Readiness of the Day refers to an operator's overall state of being prepared to perform operational duties on a given day. Multiple factors that influence the operator's readiness of the day were shared including hours of sleep, working hours, and home situation. The readiness of the day is a holistic construct and therefore encompasses physical, mental and emotional dimensions. The multitude of factors that may contribute to the readiness of the day is reflected in this quote:

That all comes together, right? It was rightly said, a new colleague, time pressures, responsibilities at home, or other particular circumstances, a thousand and one factors can mean that, in the moment, you're not performing at your best. And that you might do something that actually should not be done. (Focus group 3, participant H)

3.3. Operational behaviour

The theme Operational Behaviour includes the physical execution of movements and the cognitive processes and decision-making underlying those actions. The sub-themes are The Level of Consciousness, Concurrent Movement, and Interpretation of Perceptions.

3.3.1. Level of Consciousness

The Level of Consciousness refers to the degree to which the operators are aware of the execution of their actions. Operators reported different levels of awareness of their bodily movements during the operation. In some cases, actions were deliberate and reflective. In other cases, actions were performed more automatically, without conscious control, as mentioned by this participant:

Either you draw it [the firearm] or you don't draw it, and afterwards you always have a rationale for it. Very often it's an instinctive action. Only afterwards do you start reasoning about it. Then you think, yes, it's probably a good thing that I did it. That's how fast it happens. (Focus groep 2, participant E)

According to the operators, the unconsciousness of the execution of movement could play a role in the occurrence of an IFD.

3.3.2. Concurrent movements

Concurrent movements are actions in which the operator is performing another task while holding a firearm. The participants have directly linked IFDs in the past to the execution of concurrent movements: 'Well, in the past, it has always occurred when someone [an operator] pulls out their firearm or grabs something from the door and pulls it toward them' (Focus group 2 participant B). Concurrent movements may result in a discharge of the firearm because activity in the other limb can induce co-contraction of the triggerfinger muscles.

3.3.3. Interpretation of perception

The Interpretation of Perception of the operator shapes operational behaviour, as it influences how operators evaluate their environment and act accordingly, as shared by an operator: 'But in general, there is always some stimulus that makes your finger move toward the trigger. Whether that is a perception, the situation, the circumstances, or a mistake' (Focus group 1, participant A). Perception can be distorted, and participants discussed several factors contributing to such distortions, including stress and time pressure, biases and expectations or fatigue. In the context of firearms and decision-making, an incorrect perception may have serious consequences. Incidents where an operator mistakenly perceives a suspect as a threat and incorrectly decides to shoot are referred to as misdiagnosis errors. Although misdiagnosis errors differ from IFD, such errors represent an operational risk and were also discussed in the focus groups.

3.4. IFD risk awareness and mitigation

IFD Risk Awareness and Mitigation refers to the potential consequences of IFDs and the ways in which operators anticipate, assess, and respond to the potential risk of an IFD. This theme is reflected in the following sub-themes: Adverse outcomes, Firearm Procedures and Procedural Adjustments.

3.4.1. Adverse outcomes

IFDs can potentially result in Adverse Outcomes. When a firearm is discharged involuntary there is a possibility that this causes injuries or even death to the suspect, colleagues or innocent bystanders who are positioned in the line of fire. The adverse outcomes in the past were described by one of the participants as: 'There have been a few instances where someone was hit or shot up' (Focus group 2, participant D). Fortunately, not all IFDs result in fatalities or injuries, and these incidents were also discussed in the focus groups.

3.4.2. Firearm procedures

The risk of IFDs or an adverse outcome is reduced when operators adhere to their Firearm Procedures, particularly the triggerfinger discipline, the muzzle discipline, and the Sul position. In the focusgroups it became apparent that participants consider the triggerfinger discipline the most important procedure to adhere to in the context of IFDs. The triggerfinger discipline is the safety rule that dictates that operators should position their triggerfinger high up the muzzle until they have made the conscious decision to shoot. This becomes evident in the following quote: 'Yes, triggerfinger discipline, everyone has something to say about that. It's a recurring theme. If you don't touch that thing. Conclusion of the study: keep your claws off the trigger' (Focus group 3, participant D). The participants discussed two other firearm procedures that are relevant to mitigate the IFD risk and/or reduce the likelihood of an adverse outcome. Muzzle discipline refers to the principle that operators must remain aware of the direction of their firearm and ensure it is pointed in a safe direction, unless a conscious decision has been made to aim it at a suspect. If the firearm would discharge by accident and the operators adhered to this safety protocol, the bullet will hit a safe location such as the wall or the ground instead of a person. The Sul is the positioning of the firearm against the chest, with the

muzzle pointed downwards. This position is developed to move around safely while holding the firearm. Provided that this positioning is carried out correctly, it should physically be very difficult to pull the trigger. If it would go off, the firearm is still pointed to the ground.

3.4.3. Procedural adjustments

Procedural adjustments refer to changes or alterations that are designed to reduce the likelihood of an operator pulling the trigger unintentionally. Various procedural adjustments were discussed, alongside the criticism towards those adjustments. One such adjustment, already in place, is the requirement that operators holster their firearm before engaging in any other physical actions (e.g., opening a door). This rule aims to prevent IFDs caused by concurrent movements. A different adjustment that would mitigate the risk of an IFD that was mentioned, is to reduce the number of times that operators draw their firearm. Fewer draws would reduce the number of opportunities for IFDs to occur. However, this adjustment increases the safety risk for the operator. If operators hesitate to draw their firearm when confronted with a threat, they may respond too slowly, increasing the risk of getting injured or killed. A participant reflected: ‘That you think: I’ll just let it happen. See what’s going on. That you might stretch that moment out for a long time. That you yourself might be hit’ (Focus group 1, participant A). This tension highlights an important dilemma: every procedural adjustment involves a trade-off between the safety of the suspect and the safety of the operator. The high-risk circumstances operators operate in, do not allow for much room for second-guessing their decisions or evaluating the trade-off. Careful considerations must be given to the implementation of all procedural adjustments to ensure that new or altered procedures reduce the IFD risk without undermining the operator’s safety.

3.5. The inevitable?

The theme *The Inevitable?* refers to incidents that are the result of an accident. These situations include startle reactions, tripping, falling down, and the trigger getting stuck behind a piece of clothing. All these situations can be framed as some sort of accident or as bad luck. The question mark was deliberately put here. One can question whether these accidents are actually inevitable, or if there was a mistake that could have been prevented. Fact is, however, that some operators perceive IFDs resulting from this type of accidents differently than IFD that are caused by procedural mistakes. The following quote highlights this perceived difference:

I think there is a very big difference between unintentional shots, so to speak. Whether you really had your finger on the trigger, or your weapon got caught behind a piece of equipment and then a shot goes off. That is also an unintentional shot, but that can happen to anyone. But having your finger on the trigger, in my view, that simply wouldn’t happen with me”.
(Focus group 2, participant E)

In sum, the analysis identified a range of risk factors, operational procedures and mitigation strategies, as described by the operators and other experts. These findings were organised into five overarching themes and their corresponding sub-themes. The themes and sub-themes are summarised in [Table 1](#) to outline

Table 1. An overview of the number of quotations per theme and sub-theme.

Theme	Sub-theme	Number of quotations				Number of participants
		Total	FG 1	FG2	FG3	
Operational Complexity	Perceived Threat	34	10	13	11	10
	The Unexpected	34	12	18	4	14
	Setting	59	15	25	18	23
	Operational Task Load	13	9	3	1	10
	Command and Control	16	5	6	5	11
	Fast Responding	9	5	3	1	7
	Visibility	16	3	11	2	10
Operational resources	Deviating from Procedures	24	14	9	1	13
	Skills and Experience	93	14	48	31	22
	Anticipation	21	14	3	4	11
	Stress and Attention	39	10	13	16	17
	Readiness of the Day	14	2	8	4	10
Operational behaviour	Level of Consciousness	35	8	11	16	16
	Concurrent Movements	42	12	25	5	15
	Interpretation of Perception	15	12	1	2	9
IFD Risk Awareness and Mitigation	Adverse Outcomes	42	14	14	14	16
	Firearm Procedures	51	19	20	12	20
	Procedural Adjustments	28	13	11	5	11
The inevitable?		34	9	16	9	12

the frequency and dispersion of the sub-themes over participants and focus groups. This outline illustrates that all (sub-)themes were discussed by multiple participants, and addressed in every focus group, although the extent of discussion varied. For example, topics related to Command and Control were discussed more frequently in the first and second focus groups, and only once in the third.

4. Discussion

IFDs are complex incidents. To gain a thorough understanding of how IFD risk manifests in practice, three focus groups were held to retrieve knowledge, experiences and perspectives of special interventions operators. This study aimed to examine what factors operators identify as contributing to the risk of IFDs and which operational procedures are perceived to influence the risk and prevention of IFDs. The inductive thematic analysis resulted in five themes with varying number of sub-themes. Operators identified various risk factors including personal (e.g., Readiness of the Day), behavioural (e.g., Concurrent Movements), situational (e.g., Perceived Threat) and procedural factors (e.g., Deviating from Procedures). They also discussed several operational procedures and mitigation strategies that affect the IFD risk, such as the triggerfinger and the muzzle discipline. For transparency and trustworthiness, an overview of the number of quotes divided over the focus groups and participants was provided (Table 1). Although this overview showcases that the themes and sub-themes are reflected in all three focus groups, these quantitative results are not intended, nor suitable, to determine the importance of each of the themes and sub-themes. This study extends current understanding of IFDs and IFD risk factors, by capturing the operational reality and knowledge and experiences of operators.

4.1. Aligning the results with the Gradient framework for IFD risk

This study adopted an inductive approach, allowing themes to be derived directly from the data rather than guided by pre-existing assumptions. To situate these emergent themes within a wider understanding of IFDs, The Gradient Framework for IFD Risk (Kooijman et al., 2025) offers a useful structure. This framework provides an overview of the currently known risk factors and mechanisms that contribute to the risk of an IFD and organises them according to the timing and the specificity of their influence. Aligning the results of this study with the Gradient Framework is therefore valuable, as it allows for the interpretation of the findings in relation to the established knowledge. This can further strengthen the framework by either confirming earlier identified risk factors or contributing new information and extending the knowledge. The framework should not be interpreted as a rigid categorisation but rather as a structural guideline that helps to situate the different factors described by the participants of the focus groups.

4.1.1. Predisposing factors

Predisposing factors are presented at the beginning of the gradient and refer to the factors that exist before an operational event occurs. They describe pre-existing factors that operators bring into an operational setting. Several sub-themes can be categorised as predisposing factors such as Skills and Experience and Readiness of the Day. Skills and experience are acquired through extensive training and experience, and were extensively discussed during the focus groups. Skills and experience are stable attributes of operators and largely determine the predisposed state of the operator. The Readiness of the Day describes the state of being of the operator and is also characterised as a predisposing factor. Sleep was mentioned as one of the factors that affects the operator's readiness of the day. Research has demonstrated that insufficient or poor-quality sleep impairs performance and decision-making capacity (Dong et al., 2024; Mai et al., 2022). In addition, work characteristics of operators such as high levels of stress, hectic circumstances and high workloads further decrease sleep quality (Åkerstedt et al., 2002; Mai et al., 2022; Radstaak et al., 2014), thus presenting a risk to IFDs.

4.1.2. Situational factors

The specific environmental and contextual conditions of the operation are referred to as situational factors. Sub-themes that can be characterised as situational factors include Perceived Threat and The Unexpected. The participants emphasised that high-risk encounters rarely unfold as planned and require continuous adaptation. The finding that operators' work is characterised by heightened threat and unpredictability aligns with earlier research. Operators often respond to high-risk calls, an empirical study reported that nearly half of operators' responses involved an indication of weapons, and in about a quarter of the calls a firearm was reported (Jenkins, Semple, & Bennell, 2024). A qualitative study that explored the use of tactical officers in Canada (similar to the special interventions operators) discussed the high number of 'high-risk calls', defined as situations involving elevated danger to officers or the public, often involving weapons or violent suspects (Jenkins et al., 2021).

4.1.3. Responses to situation

The third category, responses to the situation, refers to the behavioural, psychological, cognitive, emotional and physiological responses of operators in a specific situation. Examples of sub-themes that align with this category are: Fast Responding, Stress and Attention, Anticipation and Level of Consciousness. The sub-theme Fast Responding reflects the need for operators to act quickly in rapidly evolving situations. Human factors such as rapid and accurate decision-making were found to contribute to the operational complexity faced by operators and therefore introduce potential risks for IFDs. Boulton and Cole (2016) discussed that specialised police officers are characterised by their adaptive flexibility, allowing them to quickly respond to the fast changing situations. Boulton and Cole argue that this is in line with naturalistic decision making (NDM), which focuses on real-world decision-making under complex conditions such as time pressure and uncertainty (Klein, 2008; Lipshitz et al., 2001). According to the NDM framework, experience enables experts to recognise patterns in complex situations and to identify, prioritise and execute tasks largely subconsciously, rather than through a conscious step-by-step analytical process. These subconscious processes reduces cognitive load and increases situational awareness.

Stress and attention-related factors have been identified as risk factors within the framework, and were discussed at length in the focus groups as well. Specifically, narrow and divided attention, cognitive automaticity, inattentiveness, and complacency are recognized as risk factors that can be influenced by either excessive or insufficient stress (Hendrick et al., 2007; Taylor, 2019). Literature shows that there is an optimal level of arousal, creating an optimal level of alertness and perceptual control (Vine et al., 2016), which holds for IFD risks as well. Anticipation (e.g., of the presence of firearms) could also influence IFD risk. Participants discussed how anticipation may lead to risk prone behaviour, such as gradually moving the finger towards the trigger. This aligns with research showing that anticipation influences police officers' behaviour. For instance, incorrect dispatch information that the suspect would be armed increases the risk of making the incorrect decision to shoot the unarmed suspect (Taylor, 2020). Additionally, research on the gun embodiment effect has shown that holding a firearm can heighten perceptual bias toward detecting weapons with others (Witt & Brockmole, 2012). In line with this, there is a growing concern that specialised police officers have adopted a military mindset, that emphasises the use-of-force and are therefore 'primed' to use force. A systematic review investigating decision-making of officers with and without tactical experience, did not confirm this hypothesis (Jenkins, Semple, Suss, et al., 2024). They did find that tactical officers make both more accurate and faster decisions in comparison with officers without tactical training but were not predisposed to use force. Taken together, past and current experiences and behaviour affect expectations of how a situation will unfold which may increase IFD risk related behaviour. The operators in this study also expressed concerns about being unaware of performing certain actions. This concern was also raised by Heim et al. (2006a), who found that 20% of the participants were unaware that they placed their finger on the trigger. In high-risk and time-pressured situations, there is insufficient time for deliberate cognitive control and operators rely on automatic, intuitive processes (DiNota & Huhta, 2019). Research has shown that marksmanship skills such as shooting are less affected by arousal and fatigue

when performance becomes more automatic and less consciously controlled (Brown et al., 2013; Oudejans, 2008; Tornero-Aguilera et al., 2021). This creates a paradox: while automaticity is necessary for effective performance in a high-risk, time-pressured environment, the lack of conscious awareness of motor actions may increase the risk of an IFD.

4.1.4. Interaction in the situation

Interactions in the situation relate to the actions and interactions of the operator during the operation. One of the sub-themes that can be assigned to this category is Concurrent Movements. Operators highlighted that performing forceful movement, such as opening a car door while holding a firearm, has resulted in IFDs in the past. This is consistent with the empirical findings of O'Neill and colleagues (O'Neill, 2018; O'Neill et al., 2017, 2018). This is also consistent with the experimental studies of Heim et al. (2006a, 2006b), demonstrating that concurrent movements induce motor overflow increasing the risk of an IFD.

4.1.5. Motor control processes

The final category on the gradient, motor control processes are the factors that directly influence the action of pulling the trigger. The theme The Inevitable? contains factors that can be characterised as motor control processes, such as startle reactions and a loss of balance. Situations such as a startle reaction or losing your balance are framed as accidents. Early research by Enoka (2003) already identified these situations as a potential risk for IFDs. Empirical studies by O'Neill (2018) and O'Neill et al. (2017, 2018) confirmed these findings by analysing IFD reports. They found several incidents that occurred as a result of startle reactions and a loss of balance. These situations align with the category of the motor control processes in the framework. The opinions concerning these accidents differed among the operators. Some operators stated that the IFDs that were caused by these 'accidents' were perceived as less problematic than IFDs caused by an operational mistake. Others argued that these accidents can likewise be attributed to an operator's error, and thus regarded as equally problematic. The discussion about accidents and errors raises a broader, more philosophical question whether the IFD risk is preventable or is this an inevitable byproduct of tactical work?

To sum up, the findings of this focus group study further refine and extend the risk factors and mechanisms described in the Gradient Framework for IFD Risk. As discussed by Kooijman et al. (2025), the framework should not be interpreted as a linear prediction model, but rather as a representation of the dynamic interplay between multiple interacting factors that may contribute to the occurrence of an IFD. Similarly, the factors discussed in this paper should not be interpreted as separate constructs but as interrelated factors. Future research should adopt an experimental design to determine the relative contributions of, and mutual relationships between the risk factors, strengthening the empirical foundation of the framework. VR could be a valuable tool to systematically examine the effects of diverse risk factors. Within a VR environment it is possible to recreate complex, realistic, high-pressure operational environments while allowing for precise control and measurement of relevant variables (e.g., Kleygrewe et al., 2023, 2024; Muñoz et al., 2024)). For instance, immersive VR scenarios could manipulate situational threat (Uhl et al., 2022) or task complexity (Giessing, 2021), while collecting physiological and behavioural data such as eye-tracking to measure

attention (Yang et al., 2025), heart-rate variability to measure stress (Binsch et al., 2023; Muñoz et al., 2020), and EMG or pressure sensors to measure motor activation (Orozco-Mora et al., 2024).

4.2. Sentiment coding

During the analysis of the transcripts, an underlying emotional tone was detected. Although this dimension did not directly contribute to answering the research question and was therefore not included in the results section, it is considered valuable to report here. The prevailing sentiment was mainly expressed in two opposites: dissociation and acknowledgement. Several operators distanced themselves from the issue, expressing that IFDs were very unlikely to happen to them. In contrast, other operators acknowledged the problem, recognising that IFDs have occurred in the past and could potentially happen to anyone, including themselves. Furthermore, a few quotations reflected a sentiment of appreciation for the profession and a high level of intrinsic motivation. The researchers interpreted this as indicative of the operators' deep commitment to their work and sense of professional pride.

4.3. Implications

The existing literature on IFDs is primarily based on literature studies and incident reports. This study extends current understanding by integrating knowledge of experts dealing with these risks, hereby contributing to an evidence-based understanding of IFDs. Evidence-based policing is about using the best available evidence to improve police practice (Ratcliffe, 2022). It acknowledges the need to incorporate expertise of police officers in research. A thorough understanding of IFDs and the operational context is required to develop practically feasible and meaningful mitigation strategies, such as training interventions, policy recommendations and other preventive measures. By integrating practitioners' knowledge with the Gradient Framework, this study bridges the gap between theoretical understanding and operational practice, providing a foundation for evidence-based strategies to minimise IFD risk.

Developing mitigation strategies for IFDs is challenging because these incidents are often ambiguous and are not directly linked to a single, identifiable cause. There is therefore no simple solution for this problem. Nevertheless, the interrelated nature of the identified risk factors suggests that targeted improvements to one factor may positively influence other factors. This creates the opportunity for interventions to affect potential pathways and mitigate the overall risk.

The knowledge and insights of operators offers essential, practice-grounded understanding of IFD risk factors and enhances our understanding of the operational context. By identifying risk factors, relevant operational procedures and mitigation strategies, this study aims to contribute to inform evidence-based decision-making in law enforcement that enhances operational performance and safety.

Notes

1. Overtaking means taking over responsibility for a colleague's firing line or sector, when for example, that colleague moves, escorts someone, or is temporarily unable to cover it.

2. Blue refers to patrol officers, it is the colour of their uniform.

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Author contributions

CRedit: **Karlijn Kooijman**: Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing; **Raoul R. D. Oudejans**: Conceptualization, Funding acquisition, Project administration, Supervision, Writing – review & editing; **R. I. Vana Hutter**: Conceptualization, Formal analysis, Funding acquisition, Investigation, Project administration, Supervision, Writing – review & editing.

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During the preparation of this work the authors used ChatGPT in order to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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