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Investigating Training as a Source of Injury with Specialist Tactical Law Enforcement Personnel

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Abstract: Specialist police are required to perform high risk and dangerous tasks that are physically demanding. While these groups are required to maintain an exceptional level of physical capability, this demand is thought to contribute to injury risk. The aim of this study was to investigate the extent to which maintaining operational fitness through occupational tasks and physical fitness regimes exposes specialist police officers to injury risk. An online survey was used to elicit responses from members of operational units of the Australian and New Zealand Police Tactical Groups (PTG). A total of nine (100%) PTG units participated, with 132 operational members (31% of the total population) completing the survey. All officers reported that they undertook regular physical training in the workplace. Among the 132 officers, 105 recalled experiencing at least one injury during their PTG career, giving a PTG-career-long cumulative injury incidence of 80%, with those injured experiencing an average of 1.6 injuries each. Of those reporting an injury, 70% ($n = 74$) reported sustaining an injury due to physical training in the workplace, 50% ($n = 53$) whilst on an operational activity, and 40% ($n = 42$) while completing skills training. During operations and skills training, occupational load was reported to have been worn at the time of injury by 87% ($n = 46/53$) and 79% ($n = 33/42$) of respondents injured in those activities, respectively. Physical training is a leading source of injuries in specialist police while occupational load carriage was frequently associated with injuries sustained during operational and skills training.

Keywords: law enforcement, injuries, profile, tactical load carriage, SWAT, occupational task performance.

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INTRODUCTION

Special operations law enforcement officers (or 'operators' (Sarao, 2014)) often work in units such as Special Weapons and Tactics (SWAT) teams in the USA (Sarao, 2014), or in Police Tactical Groups (PTG) in Australia (Orr, Lockie, et al., 2025). These operators perform a variety of physically demanding tasks as part of their daily duties to protect life and property (Irving et al., 2019; Maupin, Robinson, et al., 2018). These occupational tasks often require dynamic and intense physical exertion, performed under stressful and unpredictable conditions (Bowen, 2024), and whilst carrying personal protective equipment ranging from a general load of 20–25 kg (Carlton et al., 2014; Irving et al., 2019) up to 40 kg (Thomas et al., 2018). These tasks can include high risk (or no-knock) warrant executions, hostage rescues, or rural operations (i.e., searching for offenders) (Irving et al., 2019) and require operators to run / sprint, negotiate obstacles, and subdue non-compliant suspects (Irving et al., 2019; Marins et al., 2020). Thus, the physicality of their tasks imparts both metabolic and musculoskeletal system stressors that increase their risk of injury beyond that of general duties police (Lyons et al., 2025; Lyons et al., 2017).

The physical needs of these operators are noted by Maupin et al. (2018) who found that specialist police personnel serving in elite tactical units require a high level of fitness, akin to that of elite athletes, in order to complete their various and physically demanding tasks. While the need for high levels of physical fitness to optimise mission success is intuitive, the physical training modality and methods undertaken daily within the PTG workplace may be somewhat random, and may be supervised or unsupervised, or a combination of both (Irving et al., 2019; Marins et al., 2020). Orr et al. (2025) in their review of the fitness needs of specialist police identified that these officers required strength, power, and aerobic and anaerobic fitness to perform occupational tasks successfully and to mitigate injury (Orr, Lockie, et al., 2025). To achieve this physicality requirement, the authors recommended the use of block periodization physical conditioning approaches conducted in the workplace and supported by an experienced strength and conditioning professional who is able to supervise application and minimise injury risk (Orr, Lockie, et al., 2025). This recommendation is supported by the work of Talaber et al. (2022) who found that this approach was able to not only maintain, but increase, the strength of PTG personnel over an operationally-intensive 18-month period.

However, while physical conditioning is vital for these populations, in a similar manner to what is found in military populations (Macdonald et al., 2015; Schram et al., 2019), physical training itself is a source of injury. In their study of Australian PTG personnel, Larsen et al. (2016) found that, while half of reported injuries occurred during operational policing tasks, over 31% were attributed to training activities, with 17.5% due to operational training and 13% due to physical training. As such, while physical training is critical to ensuring the development of physical capabilities, such as strength (Orr, Lockie, et al., 2025; Orr et al., 2022) and aerobic fitness (Maupin, Robinson, et al., 2018), it also serves as a source of injury risk (Larsen et al., 2016).

Furthermore, operational training sees operators wearing their operational loads (Robinson et al., 2023), which impart a metabolic cost (Dames & Smith, 2015; Looney et al., 2018) and can negatively impact on task performance (Carlton et al., 2014; Joseph et al., 2018; Orr et al., 2019; Orr et al., 2020; Thomas et al., 2018). Load carriage, and particularly the nature and weight of policing loads, is a well-documented contributor to a variety of injuries (Berner et al., 2024; Knapik et al., 1992; Orr, Knapik, et al., 2025; Orr, Pope, et al., 2021; Schram et al., 2018; Schram et al., 2020). As such, and in a similar manner to physical training, while operational training is critical for real-world job performance (Bowen, 2024; Di Nota & Huhta, 2019), it is likewise a source of injuries in these personnel.

If these highly specialised police are to remain job ready, understanding injury risks as a result of preparatory training, be it physical or operational training, is of utmost importance. Therefore, the aims of this study were to: a) profile the injuries suffered within PTG groups during training (both physical and operational) and operational tasks; and b) investigate load carriage requirements as a contributor to physical injuries during operational training and tasks. It was hypothesised that: a) training would lead to more injuries than operational tasks, and b) operational loads would be worn during operational training and tasks at the time of injury.

METHODS

Experimental Approach to the Problem, Participants

Each policing agency forming part of the Australia and New Zealand Counter Terrorism Committee (ANZCTC) with a specialist PTG capability (n = 9 in total) was invited to be involved in this study. Participants in the study were serving officers recruited from these PTGs. These officers were invited to participate due to their greater occupational exposure to the specialist police environment than any other Australian or New Zealand law enforcement personnel. Volunteering officers had to meet three inclusion criteria and not meet either of two exclusion criteria. The three inclusion criteria were: a) the officer was a fully qualified and operational member of a PTG unit; b) the officer was currently attached to the operational teams of the unit; and c) the officer was serving in a full-time capacity. The two exclusion criteria were that: a) the officer was on a return-to-work plan following injury; or b) the officer was seconded from a service outside of the ANZCTC.

Measurements and Procedures

The survey approach employed is described in previous work (Irving et al., 2019) and is briefly outlined below. An online, anonymous survey was utilized for this study in accordance with evidence-based recommendations from Parsons (2007). The primary advantage of using a survey method is that it allows for the collection of information directly from a sample of participants recruited from the target population (i.e., the operational PTG members of the ANZCTC), who serve in units stationed throughout Australia and New Zealand, and potentially internationally during deployments. However, while anonymous, self-report surveys may be susceptible to recall bias, studies of military personnel have suggested that alternative research designs using healthcare reporting systems are less likely to identify injuries that have occurred due to fears of negative career consequences from formal, identified reporting of injuries to healthcare services (Stannard et al., 2022).

The survey instrument was developed by the researchers to address the operational environment of the specialist tactical police officers, by providing context to their working domain by using familiar terminology. Questions were designed to capture detailed information on daily occupational tasks, physical and skills training practices and, of relevance to this research, injuries sustained in the workplace. To enhance research rigour, a practice survey was conducted prior to full survey administration ensuring the method was robust when distributed to the nine separate police agencies and that the survey links could safely navigate the agencies' information technology security framework. The final online survey comprised 78 items, organised into five sections (A–E).

Section A of the survey reported on Demographics, Section B occupational tasks/demands and Section C occupational skills undertaken in the workplace. Section D of the survey inquired about the types of physical activities undertaken, with options including resistance training, aerobic activity, group exercise, extreme conditioning, occupation-specific training, sport-specific training, and defensive tactics training, while Section E related to the officers' injury history, where respondents were asked if they had sustained one or more injuries during their PTG career and, if so, whether they sustained each injury during operational activities, physical training, or tactical skills training. Sections D and E were the most relevant to the research herein.

Prior to survey administration and data collection the research received overarching approval by the ANZCTC as well as kind support from the executive commands of all nine participating policing jurisdictions. The Bond University Human Research Ethics Committee (BUHREC) granted ethics approval (BUHREC No: 15455) for this study.

An online survey was the mechanism of data collection, utilising an independent provider, SurveyMonkey. This method ensured respondent anonymity. Additionally, SurveyMonkey is a common platform used by this cohort, ensuring familiarity and enhancing compliance. The survey design enabled respondents to be able to pause and resume the questionnaire at a later time, however, submission was restricted to a single entry (Ball, 2019; Schonlau et al., 2002). To prevent unauthorised access or duplication, the officers were required to log into their respective Restricted Network to access the survey link. Administration of the online questionnaire was for a period of six weeks, allowing flexibility in survey completion times around work duty-roster patterns and operational activity (Ball, 2019; Schonlau et al., 2002).

Statistical Analysis

The Institute for Social and Economic Research and the American Association for Public Opinion Research (AAPOR) (Pitt et al., 2021) guidelines for establishing the survey response rate were adhered to. The response rate was calculated as the percentage of invited operators who completed the online survey (defined as > 80% completion across sections). The AAPOR formula recommended by Pitt et al. (2021) was implemented to adjust the response rate for potential errors in electronic distribution or any unforeseen IT disruption.

All completed responses were analysed, while partial responses were included where sufficient data were available. As a result, sample sizes (n) varied depending on the number of valid responses to each question. After collation of survey data, SPSS (SPSS reference guide, 1990) was used to derive the required descriptive statistics from the data. This primarily involved calculating and graphing frequency distributions for categorical responses. In addition, to test the two stated hypotheses, z-tests for one proportion (Altman, 1990) were conducted using MedCalc Software (MedCalc Software Ltd., 2026), to determine: (a) whether the observed proportion of injuries associated with training rather than operational tasks was significantly greater than 50%; and (b) whether the observed proportion of reported injuries during operational training or tasks associated with carrying PPE rather than not carrying PPE was significantly greater than 50%. Alongside the Z statistics from these two tests of significance, 95% confidence intervals around the corresponding observed proportions were calculated by the online calculator using the "exact" Clopper-Pearson method for calculating the confidence interval for the observed proportion (Clopper & Pearson, 1934; Fleiss et al., 2013), and these confidence intervals are also reported.

RESULTS

Survey Response Rate

A total of 136 personnel initiated the online survey, from 430 invited PTG personnel, completing the initial demographic data. The survey completion rate was 97%, with only four failing to complete the survey. This resulted in a total of 132 complete respondent data sets for analysis, a survey response rate of 31% or, when adjusted for potential errors, 34%.

Survey Response Demographics

All 132 respondents were male, with ages ranging from 20–25 years to 56–60 years, and the most common age group being 36–40 years (37%, $n = 49$). The height of respondents ranged from 161 to 210 cm, and body weight ranged from 61 to 120 kg, with the most common height being 181–190 cm (50%, $n = 66$) and the most common weight being 91–100 kg (37%, $n = 49$).

Reported Injuries

Among the 132 male members who completed the survey, 105 respondents stated they had sustained an injury during their PTG career, giving a PTG-career-long cumulative injury incidence of 80%. The 105 injured operators reported a total of 169 injuries between them, or an average of 1.6 injuries each, during their PTG career spans.

Among those who reported injuries, 74 (70%) respondents reported suffering an injury during physical training in the workplace, 53 (50%) an injury during operations, and 42 (40%) an injury during tactical skills training, with these numbers of injuries together accounting for all of the 169 reported injuries. This meant that a total of 116 of the 169 injuries (69%; 95% CI 61–76%) reportedly occurred during training rather than operational tasks, with this proportion differing significantly from 50% ($z = 4.940$, $p < 0.001$) and thus indicating a significant majority of injuries occurred during training rather than during operational tasks. In regard to the wearing of PPE load, 68 injured respondents (65%) reported they were wearing PPE when they were injured, with 46 of those (68%) reporting injuries which occurred while wearing PPE during operations and 33 (49%) reporting injuries that occurred while wearing PPE during skills training (noting that some of these respondents suffered injuries in both categories). Among those injured during operations (n = 53) or tactical skills training (n = 42), 87% (95% CI 75–95%) and 79% (95% CI 64–90%), respectively, were wearing PPE at the time, with these proportions each again differing significantly from 50% ($z = 5.387$, $p < 0.001$; $z = 3.759$, $p < 0.001$; respectively), indicating significant majorities of injuries in these operational task or tactical training contexts occurred while wearing PPE rather than in the absence of wearing PPE. These results are graphically represented in Figure 1.

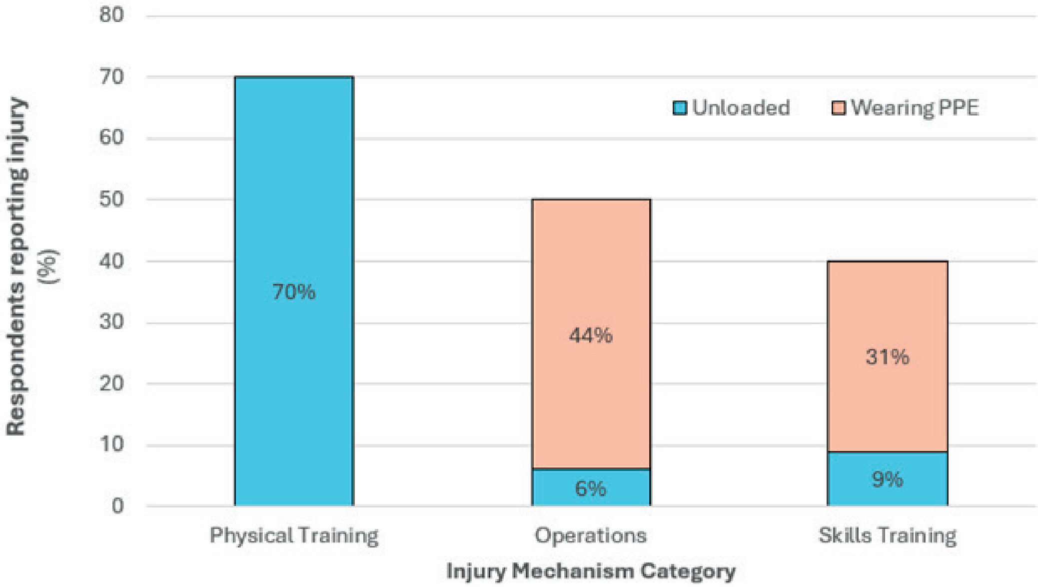

Figure 1. *Distributions of Injuries in the PTG Workplace*

Physical Training Injuries

For the respondents who indicated they sustained an injury during physical training in the workplace (n = 74, 70%), results were further dissected into the physical training modality-type category. While not attributing a specific training modality to their injuries, 96% (n = 71) reported that they engaged in aerobic activity and 91% (n = 67) in resistance training. Of note, 73% (n = 54) reported their physical training at time of injury as occupation-specific (i.e., conditioning activities replicating the physical demands they may encounter during operations). Table 1 below displays the distribution of injuries by physical training type category.

Table 1. *Distribution of Physical Training Types Conducted by Respondents Who Reported Suffering an Injury During PT*

Physical Training Type	Number	Percentage (%)
Aerobic training	71	96%
Resistance training	67	91%
Occupation-specific conditioning training	54	73%

Group physical training	38	51%
Extreme Conditioning, e.g., CrossFit	33	45%
Defensive tactics, martial arts, boxing, etc.	35	47%

Load Carriage

Among the members who reported injuries in the workplace, whether during operational tasks, physical training, or skills training, 65% (n = 68) indicated they were wearing additional external loads when injured. Of these, 63 (93%) respondents noted the weights of the loads they were carrying at the time of the reported injury, with five respondents leaving the question blank. The load weight most frequently reported to have been carried at the time of injury was 10–15 kg (n = 25: 37%), followed by loads of 5–10 kg (n = 14: 21%) and 20–25 kg (n = 10: 15%). PPE loads of 0–5 kg (n = 9: 13%), and of 15–20 kg (n = 5: 7%) were the least commonly reported.

Body Sites of Reported Injuries

Among the 105 respondents reporting injuries, body sites for the most recent injury were reported by 101 (96%) respondents, with the remaining four not reporting the body site. The shoulders were the leading body site, accounting for 22% (n = 22) of all reported injuries, followed by the knees at 16% (n = 17) and the lower back at 13% (n = 13). Figure 2 shows the distribution of all reported body sites of injury.

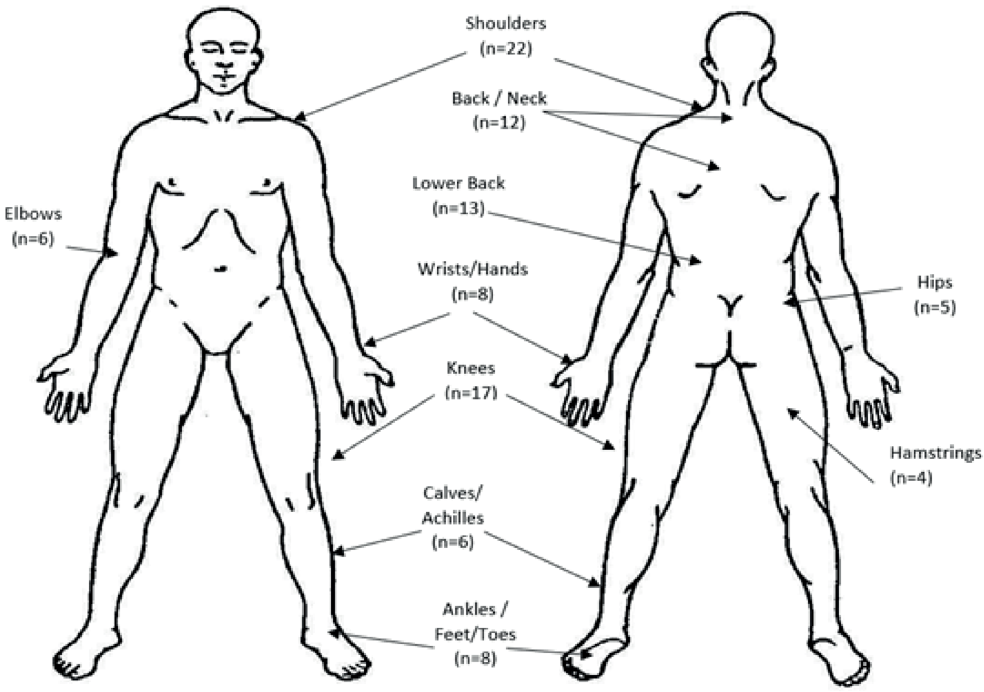

Figure 2. *Figure Illustrating the Distribution of Injuries Sustained by PTG Operators Across Body Sites*

DISCUSSION

The aims of this study were to: a) profile the injuries suffered within PTG groups during training (both physical and operational) and operational tasks; and b) to investigate load carriage requirements as a contributor to physical injuries during operational training and tasks. It was hypothesised that: a) training would lead to more injuries than operational tasks, and b) operational loads would be worn during operational training and tasks at the time of injury. The first hypothesis was supported. The results from this study indicate that a significant majority of injuries were suffered during physical or tactical skills training rather than during operations. The second hypothesis was also supported, with significant majorities of injuries occurring when respondents were wearing loads, when those injuries occurred on operations or during tactical skills training.

There is limited research investigating injuries in specialist policing from which to draw comparisons. A recent scoping review by Lyons et al. (2025) identified only two research papers focussing on injuries in specialist police. The summation of their findings thus was limited, particularly as there were differences in findings between the two studies (e.g., body sites of injuries, as will be discussed). The findings of that review did, however, suggest that specialist police can suffer injuries at a rate higher than general duties officers (Lyons et al., 2025).

In this study, physical training was the leading activity associated with injuries. This finding is not unexpected given the physical demands and fitness requirements for this population, with previous research suggesting specialist police officers require levels of physical fitness akin to those of elite athletes (Maupin, Wills, et al., 2018). In order to reach and maintain such levels, these specialist officers are required to perform extensive physical training (Orr, Lockie, et al., 2025) whereby this exposure to chronic and intense physical training would likely increase the risk of injury. This supposition is supported in research among military Special Forces personnel where, in a systematic review of musculoskeletal injuries in military Special Forces, Dresti et al. (2025) found a large volume of evidence (5/7 studies) supporting physical training as a leading source of injuries in these personnel.

Respondents who reported physical training-related injuries engaged in a range of activities, including aerobic and resistance training. Orr et al. (2025), in their review of the fitness needs of specialist police, identified that these officers require strength, power, and aerobic and anaerobic fitness to perform occupational tasks successfully and to mitigate injury (Orr, Lockie, et al., 2025). Thus, this diversity in training is desirable and supported by research in other specialist law enforcement research. In their study of Brazilian specialist police, Marins et al. (2020) found officers from both Grupo de Resposta Rápida and Comando de Operações Táticas rated aerobic endurance and muscle strength as the highest priorities in physical training. Furthermore, occupation-specific conditioning training featured strongly as a source of injuries (73% of injuries) in the current study, which is of importance given that occupational tasks and occupational skills training were also sources of injury risk.

Aside from physical training, operations and skills training were noted as being sources of injury. Of note, in the majority of instances, injuries experienced during operations and skills training were sustained while personnel wore their occupational loads. The wearing of these operational loads is known to cause injuries in both law enforcement (Berner et al., 2024; Larsen et al., 2016) and military personnel (Orr, Knapik, et al., 2025; Orr, Pope, et al., 2021). Interestingly loads of 5–10 kg and 10–15 kg were the most reported loads worn when an injury was sustained, in the current study (21% and 37% respectively). This load weight is below that more typically worn by the population in this (21–25 kg (Irving et al., 2019)) and other (18–24kg) (Carlton et al., 2014; Marins et al., 2020; Orr et al., 2020) studies of specialist police. A potential reason for this lower load weight may be wearing of lighter than typical operation loads when training (i.e. no additional water, ammunition or loaded weaponry), as has been identified in military load carriage research (Orr & Pope, 2015).

The leading sites of the self-reported injuries in this study were to the shoulders (*n* = 22), the knees (*n* = 17), lower back (*n* = 13) and back/neck (*n* = 12). These results bear some similarities and differences to those of wider research. For example, Larsen et al. (2016) reported the hand / wrist (21%) to be the leading site of injury in specialist police followed by the back (17%). Conversely, Fredella et al. (2024) reported the lower back (25%) and shoulder (13%) to be the leading sites of injury. A reason for these differences may lie in how these injuries were reported. For example, in the study by Larsen et al. (2016) injuries considered were those formally reported to the organisation, while in the current study and that of Fredella et al. (2024) injuries considered were those self-reported in surveys.

Upper limb injuries are common in law enforcement as are lower back injuries and they are generally associated with altercations with offenders (upper limb) and load carriage (lower back / back); as such, most research suggest that these two sites are the leading sites of injury in law enforcement (Lyons et al., 2017).

To better contextualise these findings within current operational readiness frameworks, it is important to consider how injury risks may intersect with emerging fitness assessments. One such proposed occupational fitness assessment for specialist police is the Urban Rush (RUSH) test (Strader et al., 2020) which simulates real word tasks undertaken by specialist police, such as short distance sprints, aligning weapons with targets, crawls, and mannequin drags, all performed while wearing occupational loads. Given that the present study identified both physical training and load carriage as leading contributors to injury, the implementation of the RUSH warrants careful consideration. Orr et al. (2021) note that tactical personnel typically train to meet test demands, meaning that the RUSH could shape training practices in ways that amplify the existing injury risks. While aerobic and resistance training, which were the most common modalities linked to injury in the current study, are essential for RUSH performance (Orr et al., 2022; Robinson et al., 2018), their prevalence in injury reports suggest a need for structured, supervised programming to mitigate injury risks. Additionally, the prominence of occupation-specific training further reinforces the alignment between current practices and RUSH requirements but also highlights the potential for injury should load carriage not be carefully managed.

The injury burden associated with current training practices and operational demands is evident and highlights the need for structured mitigation strategies. Research by Talaber et al. (2022) has shown that embedding supervised, periodised strength and conditioning programs within the workplace may offer a practical solution, with maintenance of increases in strength evident in such situations. Such programs, led by qualified professionals and employing a block or conjugate training approach (Orr, Lockie, et al., 2025; Talaber et al., 2022), could reduce injury risk while optimising physical capabilities required for operational tasks and assessments like the RUSH. This approach would support readiness without compromising health, ensuring that specialist police maintain capability and resilience in their roles.

Limitations

A limitation of this study was potential for recall bias. As some questions in the survey covered the entire service life of the PTGs, recall bias may have been present and responses to questions about occupational tasks may not have been accurately recalled. To mitigate this risk, questions were, where possible, designed to focus on the most recent experiences of respondents. In many other contexts, the all-male sample would be of a concern, however, in the PTG context it was to be expected, as all personnel in the PTGs at the time of testing were male. While this study represents an initial step in understanding more about physical training in these specialist police groups and the injuries they suffer, future research should profile the injuries in greater detail to better inform injury reduction programs.

CONCLUSIONS

Based on the findings of this study, physical training was the leading contributor to injuries among specialist police, followed by operational tasks and tactical skills training. The majority of injuries during operations and tactical skills training occurred while personnel were wearing occupational loads, highlighting load carriage as a potential key contributing factor in these contexts. Shoulder, knee and lower back injuries were most frequently reported, consistent with injury patterns observed in both law enforcement and military populations. While current physical training practices seem well aligned with the operational requirements of these specialist police, they also carry significant injury risk. Implementing structured and supervised strength and conditioning programs may reduce this risk while maintaining operational capability.

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