



# Associations between exposure to potentially psychologically traumatic events and mental ill health among New Zealand firefighters: A cross-sectional study<sup>☆</sup>

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## ABSTRACT

**Background:** Fire and emergency services personnel face unique occupational hazards, including repeated exposure to potentially psychologically traumatic events (PPTs), which can impact their mental health. Despite growing awareness, comprehensive data on the mental health of fire and emergency services personnel in New Zealand remains sparse.

**Purpose:** This study examined the prevalence of symptoms of mental health disorders, including PTSD, Major Depressive Disorder, and Generalized Anxiety Disorder, and assessed the association between PPT exposure, coping mechanisms, and mental ill health among New Zealand firefighters and commanders.

**Methods:** A comprehensive online survey using the Qualtrics platform was administered to fire and emergency personnel, assessing exposure to PPTs and various mental health parameters. The survey utilized standard assessment tools including the PHQ-9, GAD-7, SPRINT, and AUDIT-C alongside measures of life satisfaction, emotional numbing and demographic questions.

**Main findings:** The prevalence of symptoms of Major Depressive Disorder (24 %), Generalized Anxiety Disorder (13 %), and probable PTSD (13 %) among 1264 fire and emergency personnel are higher than those observed in the general population. High exposure to PPTs was associated with higher odds of reporting moderate-to-severe symptoms of Major Depressive Disorder, Generalized Anxiety Disorder, and probable PTSD. Also of note were findings revealing a high prevalence of potentially hazardous drinking patterns (68 %).

**Conclusions:** Highlights a critical need for effective mental ill health prevention and support programs tailored to fire and emergency personnel, considering their high exposure to PPTs and elevated risk of experiencing symptoms of Major Depressive Disorder, Generalized Anxiety Disorder, and PTSD

## 1. Introduction

First responders play an essential role in safeguarding communities and responding to emergencies. As a result of their emergency response roles, they face increased exposure to potentially psychologically traumatic events (PPTs) such as accidents, disasters, and violent crimes [1,2], which can significantly affect their mental health and overall wellbeing [3–5]. Research consistently shows that first responders experience a higher prevalence of mental ill health compared to the general population, including conditions such as anxiety, depression, PTSD, and maladaptive coping mechanisms [4,6–10]. Whether through

direct, witnessed, or indirect exposure, repeated encounters with PPTs are linked to higher levels of mental ill health [2,5]. Though not all exposures result in trauma or mental ill health, evidence does suggest a dose-dependent relationship, with increased exposure correlating to a higher risk of PTSD [11–13].

In response to the need to address mental health challenges among first responders, there has been a significant increase in prevention and support programs [14]. A recent systematic review indicated that physical activity, mental health training for managers, social support, psychological debriefing, mindfulness, and chaplaincy initiatives demonstrated positive improvements in the mental health and wellbeing

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of emergency service workers in Australia and New Zealand [15]. However, the review also emphasized the need for more high-quality evaluations of the impact of these programs on mental health. Many studies in this area rely on cross-sectional designs, self-reported data, small sample sizes often lacking controls, and short time frames, which limit their ability to establish causal relationships or generalize findings to broader populations [15–19]. While some programs show small initial benefits, evidence suggests that these gains are often short-lived, with limited support for their effectiveness in producing sustained, long-term improvements [20,21]. Additionally, a comprehensive scoping review specifically focusing on mental ill health and suicide prevention programs for veterans and first responders internationally revealed a persistent lack of rigorous evaluation and a reliance on programs that have not been properly validated, raising concerns about their overall effectiveness and potential risks when poorly implemented [18]. Data is critical for guiding the development, implementation, and evaluation of effective mental health programs internationally. Despite international progress, there remains a notable gap in New Zealand's understanding of the mental health landscape among firefighters, with a lack of robust data on mental ill health [18,22,23]. This data gap hinders the development of effective, targeted support programs and limits the ability to evaluate the success of interventions. Collecting this data is essential to prioritize funding and investment in mental health initiatives, establish baseline information, and assess which groups within the firefighting community are facing more severe challenges or demonstrating greater resilience. Furthermore, it will allow for the creation of tailored programs to address the specific needs of New Zealand firefighters.

This paper presents baseline data from the evaluation of the Whanaungatanga Program, a pilot program aimed at preventing mental ill health among New Zealand firefighters by addressing organizational climate. It assesses the prevalence and correlates of mental ill health among New Zealand firefighters, with a focus on PPTE exposure, sociodemographic, and occupational role factors. It also examines indicators of wellbeing and maladaptive coping mechanisms. This research draws on one of the highest-quality data sources, as evidenced by a response rate of approximately 70 %, on first responder mental health globally.

## 2. Materials and methods

### 2.1. The pilot program

The Whanaungatanga Program is a quasi-experimental pilot program designed to prevent mental ill-health among firefighters. To achieve this objective the program utilizes co-designed interventions aimed at identifying, and then eliminating or minimizing, organizational level factors that contribute to mental ill-health. Additionally, it seeks to identify and promote organizational factors that contribute to wellbeing. The program is grounded in the Māori concept of Whanaungatanga, which refers to the sense of connection and relationship formed through shared experiences, which ultimately fosters a deep sense of belonging among individuals [24]. Led by Fire and Emergency New Zealand and supported by Movember and the Distinguished Gentlemen's Ride Veteran and First Responder (VFR) Grant Program, the program aims to cultivate a culture of trust, belonging, and value among personnel by identifying and addressing psychosocial hazards present in the workplace; in this sense the program represents a paradigm shift as it seeks to prevent mental ill-health by focusing on the 'work' rather than the worker [25]. The international VFR grant program has made significant investments in evaluating programs focused on mental ill-health and suicide prevention for veterans and first responders [25]. The results of this study will serve as a baseline, allowing for the future evaluation of the program's effectiveness. The Whanaungatanga Program will be piloted in one region, while four other regions will act as a control, with the potential for broader implementation based on the outcomes of this pilot phase.

### 2.2. Target population

Fire and Emergency New Zealand, a national organization established under the Fire and Emergency New Zealand Act 2017, is responsible for delivering a range of emergency prevention and response services to both urban and rural communities nationwide. Their primary role is to prevent and respond to various emergencies, including fires, hazardous substance incidents, transport accidents, and urban search and rescue operations. Additionally, they are active in responding to medical emergencies, maritime incidents, weather events, and natural disasters. In 2023, Fire and Emergency personnel responded to over 88,000 emergency incidents [26]. The organization comprises both operational and non-operational staff, totaling around 3000 individuals, alongside a significant volunteer workforce of approximately 11,800 [26]. For this study, the focus was on the paid personnel only.

### 2.3. Participants

The survey targeted all paid personnel of Fire and Emergency New Zealand, which includes both operational and non-operational staff. As of March 2023, the organization had 2945 paid personnel of which 1736 completed the survey (58.9 % response rate). For this report, our analysis will specifically focus on firefighters (which included station officers and senior station officers) and commanders (which included group, district, region and national managers also known as commanders), amounting to a total of 1264 individuals. The response rate was high among firefighters; of the 1718 firefighters employed as of March 2023, a total of 1181 participated in the survey (68.7 % response rate). This high response rate from firefighters positions the survey data as one of the most extensive self-report datasets worldwide concerning the mental health of firefighters.

### 2.4. Procedure

Data collection took place through the administration of an online self-report survey using the Qualtrics survey platform from 7 March to 30 March 2023. The study received approval from the Auckland University of Technology Ethics Committee (AUTEK 22/320) and before participating in the survey, all respondents provided verified electronic consent. Invitations to participate were distributed by Fire and Emergency New Zealand in March 2023 and included a participant information sheet. To encourage survey participation, two reminders were sent to eligible participants during the survey period, and targeted reminders were dispatched to individuals who initiated but did not complete the survey within five days. The Whanaungatanga Project Team undertook additional efforts, in collaboration with the New Zealand Professional Firefighters Union (NZPFU) and the Fire and Emergency Commanders Association (FECA), to encourage firefighters and commanders to complete the survey.

### 2.5. Survey

The survey development was a collaborative effort involving the primary researchers, a technical advisory group from Fire and Emergency New Zealand, and external subject-matter experts in organizational psychology and first responder research (see acknowledgements).

The survey utilized validated self-report measures to assess the prevalence of mental health disorders, wellbeing, and maladaptive coping mechanisms. These measures have been validated for screening, rather than being definitive diagnostic tools.

#### 2.5.1. Self-reported measures of psychological trauma

The survey assessed the frequency of exposure to potentially psychologically traumatic events (PPTEs) within the past month. Recognizing that existing measures of PPTE exposure do not fully account for the repeated and frequent exposure experienced in professional duties, a

customized measure was developed specifically for this survey. This measure was based on the DSM-5 definition of psychological trauma [27]. According to this definition, *potentially psychologically traumatic events* were defined as events involving an actual or significant threat of death, or serious injury. It was acknowledged that exposure to these events could occur directly, as the experience of a serious injury, threat of serious injury, or threat to one's own life or bodily integrity; through witnessing the death or serious injury, or the threat of either, of another; or indirectly by experiencing extreme or repeated exposure to aversive details of the traumatic event(s) (e.g., a call taker taking an emergency call where someone is seriously injured and hearing details of the injury). The measure has been reviewed for face validity by both clinical and organizational psychologists, but it has not yet undergone further psychometric testing.

Participants were asked to report whether they had been exposed to a PPTe, as defined, since becoming part of the organization. Additionally, they were requested to provide an estimated count of PPTe exposures in the past month and over the previous 12 months (see supplementary material).

## 2.6. Mental health disorders

Symptoms of Major Depressive Disorder were assessed using the Patient Health Questionnaire (PHQ-9) [28]. Participants rated the extent of symptoms experienced over the past two weeks. Scores were assigned on a scale of 0 to 3 for each of the nine questions, resulting in a total score between 0 and 27. The total score was categorized as no, minimal, or mild symptoms (values 0–9), or moderate, severe, or very severe symptoms (values 10–27). A score of  $\geq 10$  was considered a positive screen for Major Depressive Disorder. The PHQ-9 scale demonstrated high internal consistency, with an average score of 9 items and Cronbach's alpha of 0.881.

Symptoms of Generalized Anxiety Disorder were assessed using the Generalized Anxiety Disorder Scale (GAD-7) [29]. Participants rated the extent of symptoms experienced over the past two weeks. Scores ranged from 0 to 3 for each of the seven questions, providing a total score between 0 and 21. The total score was categorized as no, minimal, or mild symptoms (values 0–9), or moderate or severe symptoms (values 10–21). A score of  $\geq 10$  was considered a positive screen for Generalized Anxiety Disorder. The GAD-7 scale demonstrated high internal consistency, with an average score of 7 items and Cronbach's alpha of 0.910.

Symptoms of Post-Traumatic Stress Disorder (PTSD) were assessed using the Short Post-Traumatic Stress Disorder Rating Interview (SPRINT) [30]. Participants rated the extent to which they were affected by a range of symptoms associated with work-related traumatic experiences over the past week. Scores ranged from 0 to 4 for each of the eight questions, resulting in a total score between 0 and 32. The total score was categorized as unlikely to possible PTSD (values 0–16) or probable PTSD (values 17–32). A score of  $\geq 17$  was considered a positive screen for PTSD. The SPRINT scale demonstrated high internal consistency, with an average score of 8 items and a Cronbach's alpha of 0.905.

To determine the prevalence of overall mental ill health, a composite variable was calculated, with participants classified as having a positive screen for any mental disorder if they scored above the threshold for Major Depressive Disorder (PHQ-9  $\geq 10$ ), Generalized Anxiety Disorder (GAD-7  $\geq 10$ ), or PTSD (SPRINT  $\geq 17$ ).

### 2.6.1. Wellbeing indicator

Life satisfaction was assessed using three statements from the Satisfaction with Life Scale [31]. Participants rated their agreement with these statements on a 7-point scale. The average score of these statements provided a total score between 1 and 7, which was categorized as low-moderate (values  $< 6.0$ ) or high (values  $\geq 6.0$ ) life satisfaction, which represent 'Agree' and 'Strongly Agree' on the 7-point scale. The life satisfaction scale demonstrated high internal consistency, with an average score of 3 items and Cronbach's alpha of 0.915.

### 2.6.2. Maladaptive coping mechanism indicators

Emotional numbing was assessed using the Emotional Reactivity and Numbing Scale [32]. Participants rated their agreement with five statements on a 7-point scale. The average of these scores resulted in a total score between 1 and 7, which was categorized as low-moderate (values  $< 6.0$ ) or high (values  $\geq 6.0$ ) emotional numbing, which represent 'Agree' and 'Strongly Agree' on the 7-point scale. The emotional numbing scale demonstrated high internal consistency, with an average score of 5 items and Cronbach's alpha of 0.926.

Potentially hazardous drinking patterns were evaluated using the AUDIT-C scale [33]. Participants responded to three questions regarding the frequency and amount of alcohol consumption. Each question was scored from 0 to 4, with a total sum score between 0 and 12. A score of 3 or more for females and 4 or more for males was considered indicative of potentially hazardous alcohol use.

### 2.6.3. Sociodemographic characteristics

To ensure the comparability of data to general population prevalence estimates, socio-demographic questions were aligned with Statistics New Zealand standards. These questions included factors such as gender, age, and ethnicity. In line with Statistics New Zealand standards, gender was treated as a flat classification with three categories. 1 Male / Tāne 2 Female / Wahine 3 Another gender / He ira kē anō [34].

In addition to socio-demographic information, we also gathered occupational details from participants. In this analysis, we include their length of service (years) and the type of role they held (active-duty firefighters, commanders).

## 3. Statistical analysis

A total of 1736 employees completed the survey. For the purposes of this paper, the analysis was limited to firefighters (including station officers and senior station officers) and commanders (including group, district, regional, and national managers). This resulted in a final sample of 1264 participants.

The aim was to examine the distribution of symptoms of mental disorders (i.e., Major depressive disorder, Generalized Anxiety Disorder, and PTSD) wellbeing (i.e., life satisfaction), maladaptive coping mechanisms (i.e., emotional numbing and alcohol use), and exposure to PPTes within the sample.

Prevalence estimates were calculated with 95 % confidence intervals for the sample and across different demographic characteristics (including gender, age, ethnicity, role type, and length of service).

To explore the relationship between PPTe exposure and symptoms of mental disorders, wellbeing, and maladaptive coping mechanism indicators, separate sequential logistic regression models were constructed for each indicator. These models examined the odds of each indicator based on self-reported exposure to PPTes within the past month. To account for potential confounding factors, the models were adjusted for gender, length of service, and type of operational role. Missing data were excluded listwise and all analyses were conducted in SPSS (Version 29). Due to the small sample size for females ( $n = 86$ ), logistic regression modelling was not stratified by gender.

## 4. Results

The prevalence and means of self-reported symptoms of mental disorders, wellbeing, and maladaptive coping mechanism indicators among operational personnel by demographic characteristics are presented in Table 1 and Table 2, respectively.

Among the sample, approximately one-third (30 %) screened positive for one or more mental disorders. Specifically, 24 % (95 % CI: 22–27) of personnel screened positive for symptoms of Major Depressive Disorder (mean PHQ-9 score =  $6.46 \pm 5.27$ ), while the prevalence for Generalized Anxiety Disorder (mean GAD-7 score =  $4.65 \pm 4.43$ ), and PTSD (mean SPRINT score =  $8.51 \pm 6.68$ ) were lower at 13 % (95 % CI:

**Table 1**  
Total sample and socio-demographic estimates for mental disorders among firefighters and commanders.

Characteristic	Total		Any positive screen <sup>a</sup>		Depression <sup>b</sup>		Anxiety <sup>c</sup>		PTSD <sup>d</sup>		Emotional numbing <sup>e</sup>		Hazardous alcohol use <sup>f</sup>		Life satisfaction <sup>g</sup>	
	<i>n</i>	%	%	95 % CI	%	95 % CI	%	95 % CI	%	95 % CI	%	95 % CI	%	95 % CI	%	95 % CI
Total	1264	100	30	[27, 32]	24	[22, 27]	13	[12, 15]	13	[11, 15]	9	[8, 11]	68	[65, 70]	33	[30, 35]
Gender																
Male	1165	92	29	[27, 32]	24	[22, 26]	13	[11, 15]	13	[11, 15]	10	[8, 12]	67	[64, 70]	32	[29, 35]
Female	86	7	38	[28, 49]	27	[18, 37]	20	[12, 29]	10	[5, 17]	1	[0, 5]	74	[64, 83]	41	[31, 51]
Age																
20–29 years	117	9	29	[22, 38]	21	[15, 29]	16	[10, 24]	12	[7, 19]	11	[6, 18]	72	[63, 79]	34	[26, 43]
30–39 years	372	29	29	[25, 34]	21	[17, 26]	14	[11, 18]	10	[7, 14]	9	[7, 13]	66	[62, 71]	31	[26, 36]
40–49 years	355	28	33	[28, 38]	29	[24, 33]	14	[11, 18]	14	[11, 18]	9	[6, 12]	65	[60, 70]	32	[27, 37]
50–59 years	291	23	32	[26, 37]	28	[23, 33]	13	[10, 17]	15	[11, 19]	10	[7, 13]	73	[67, 78]	33	[27, 38]
60 years or older	125	10	20	[14, 28]	17	[11, 24]	8	[4, 14]	12	[7, 19]	9	[5, 15]	62	[53, 70]	39	[31, 48]
Ethnicity																
Māori	203	16	29	[23, 36]	23	[18, 29]	10	[7, 15]	13	[9, 18]	8	[5, 13]	66	[59, 72]	28	[22, 34]
Pacific peoples	72	6	38	[27, 50]	26	[17, 37]	14	[7, 23]	21	[13, 32]	14	[7, 23]	75	[64, 84]	32	[22, 43]
European	1095	87	29	[26, 32]	24	[21, 26]	13	[11, 15]	13	[11, 15]	9	[8, 11]	68	[65, 71]	33	[30, 36]
Other Ethnicity	168	13	34	[27, 42]	26	[20, 33]	13	[9, 19]	14	[9, 20]	10	[6, 16]	62	[54, 69]	35	[28, 43]
Type of role																
Commander	83	7	28	[19, 39]	25	[17, 35]	13	[7, 22]	5	[2, 11]	6	[2, 13]	67	[57, 77]	36	[26, 47]
Firefighter	1181	93	30	[27, 33]	24	[22, 27]	13	[12, 15]	13	[12, 15]	10	[8, 11]	68	[65, 70]	32	[30, 35]
Length of service																
Less than 12 Months	58	5	9	[3, 21]	3	[1, 11]	5	[1, 13]	0	[0, 0]	3	[1, 11]	68	[56, 79]	43	[31, 56]
1–2 Years	72	6	24	[15, 35]	19	[12, 30]	8	[4, 16]	6	[2, 13]	6	[2, 13]	68	[56, 78]	35	[24, 46]
3–5 Years	186	15	28	[22, 35]	22	[17, 28]	17	[12, 23]	10	[6, 15]	11	[7, 16]	65	[58, 72]	32	[26, 39]
6–10 Years	227	18	30	[24, 36]	24	[19, 30]	14	[10, 19]	13	[9, 18]	8	[5, 12]	67	[60, 73]	31	[25, 37]
More than 10 Years	677	54	32	[29, 36]	27	[24, 31]	13	[11, 16]	15	[13, 18]	10	[8, 13]	68	[64, 72]	32	[29, 36]
Volunteer service																
Current volunteer firefighter	81	6	27	[18, 37]	20	[12, 30]	13	[7, 21]	12	[6, 20]	8	[3, 15]	69	[59, 78]	32	[23, 43]
Previous volunteer firefighter	416	33	32	[28, 37]	27	[23, 32]	12	[9, 15]	11	[8, 14]	9	[6, 12]	69	[65, 74]	33	[29, 38]
No volunteer firefighter service	766	61	29	[26, 32]	23	[20, 26]	14	[12, 17]	14	[12, 17]	10	[8, 12]	67	[63, 70]	32	[29, 36]

**Table 2**  
Total sample and socio-demographic means for mental disorders among firefighters and commanders.

Characteristic	<i>n</i>	Depression		Anxiety		PTSD		Emotional numbing		Hazardous alcohol use		Life satisfaction	
		<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )
Total	1264	6.46	(5.27)	4.65	(4.43)	8.51	(6.68)	3.62	(1.63)	4.65	(2.65)	4.80	(1.48)
Gender													
Male	1165	6.37	(5.15)	4.58	(4.34)	8.51	(6.66)	3.66	(1.62)	4.73	(2.67)	4.79	(1.47)
Female	86	7.24	(6.06)	5.55	(5.18)	8.06	(6.80)	2.83	(1.49)	3.67	(2.25)	5.03	(1.44)
Type of role													
Commander	83	6.08	(5.06)	4.31	(4.27)	6.03	(5.54)	2.93	(1.61)	4.57	(2.45)	5.03	(1.43)
Firefighter	1181	6.49	(5.28)	4.68	(4.44)	8.68	(6.72)	3.66	(1.62)	4.65	(2.67)	4.79	(1.48)
Length of service													
Less than 12 Months	58	3.05	(3.71)	2.55	(3.50)	3.07	(3.12)	2.99	(1.44)	4.55	(2.39)	5.25	(1.17)
1–2 Years	72	5.89	(4.61)	4.10	(3.71)	7.06	(5.30)	3.46	(1.54)	4.01	(2.52)	4.99	(1.34)
3–5 Years	186	6.68	(5.35)	5.26	(4.84)	8.24	(6.42)	3.51	(1.63)	4.34	(2.53)	4.86	(1.36)
6–10 Years	227	6.42	(5.01)	4.75	(4.40)	8.38	(6.84)	3.58	(1.59)	4.70	(2.66)	4.82	(1.43)
More than 10 Years	677	6.75	(5.40)	4.67	(4.38)	9.07	(6.81)	3.71	(1.65)	4.77	(2.71)	4.73	(1.54)

12–15) and 13 % (95 % CI: 11–15), respectively. On the other hand, one-third (33 %) of personnel reported high levels of life satisfaction. Regarding maladaptive coping mechanisms, 9 % (95 % CI: 8–11) of personnel reported high levels of emotional numbing, while a substantial proportion (68 %, 95 % CI: 65–70) reported potentially hazardous drinking patterns.

In terms of gender differences, there was an indication that female personnel may have higher prevalence of symptoms of Generalized Anxiety Disorder (20 %, 95 % CI: 12–29) compared to their male colleagues (13 %, 95 % CI: 11–15). However, the wide confidence interval for females suggests that the estimate is less precise, and a larger sample size would be needed to obtain a more accurate estimate. In contrast, female personnel reported much lower levels of emotional numbing (1 %, 95 % CI: 0–5), compared to 10 % in male personnel (95 % CI: 8–12).

The prevalence of mental disorders varied by role type, with higher levels of PTSD (13 %, 95 % CI: 12–15) observed in firefighters compared

to commanders (5 %, 95 % CI: 2–11), while there were no differences in symptoms of Major Depressive Disorder or Generalized Anxiety Disorder. Across ethnic groups, Pacific personnel reported the highest prevalence of PTSD (21 %, 95 % CI: 13–32) compared to Māori (13 %, 95 % CI: 9–18) and European personnel (13 %, 95 % CI: 11–15).

Prevalence of symptoms of Major Depressive Disorder, PTSD, and any positive screen increased with increasing years of service. The steepest increase in prevalence was observed in personnel after serving 1–2 years, where levels of Major Depressive Disorder (19 %, 95 % CI: 12–30) and any positive screen (24 %, 95 % CI: 15–35) were more than double those seen in personnel serving less than 12 months (3 %, 95 % CI: 1–11 and 9 %, 95 % CI: 3–21 respectively), though wide confidence intervals indicate a degree of uncertainty around these estimates, suggesting that data from larger sample sizes would be necessary to confirm these trends with greater precision. Those with 10 or more years of service had the highest prevalence of positive screens for PTSD and

symptoms of Major Depressive Disorder. Previous volunteer status did not appear related to any of the indicators.

4.1. Exposure to potentially psychologically traumatic events

A total of 1241 participants reported being exposed to a PPTE since joining the organization, and 1159 participants provided their level of exposure in the last month. Table 3 displays the distribution of exposure to PPTEs over the last month by demographic characteristics.

Among firefighters, 19 % reported six or more exposures in the last month, while the majority (59 %) reported three or fewer exposures. Commanders indicated much lower exposure, with 61 % reporting one or fewer PPTEs in the last month.

Sequential logistic regression analyses were conducted separately for each indicator. The first model examined the prediction of the outcome based on the level of exposure to PPTEs in the last month. The second model involved the addition of gender, length of service, and type of role as covariates. Age, ethnicity, and previous volunteer firefighter service did not show a significant bivariate relationship with the indicators and were therefore not included in the models. Tables 4 and 5 present the unadjusted (Model 1) and adjusted (Model 2) logistic regression models.

Reporting six or more exposures in the last month increased the odds of a positive screen for symptoms of Major Depressive Disorder, Generalized Anxiety Disorder, PTSD, and emotional numbing, even after adjusting for covariates. After adjustment, those with high exposure to PPTEs were nearly twice as likely to meet the criteria for at least one mental health disorder (AOR = 1.82, 95 % CI: 1.23–2.70) compared to those with low exposure (0–1 exposures in last month). Specifically, personnel with high exposure were more than twice as likely to screen positive for symptoms of PTSD (AOR = 2.37, 95 % CI: 1.40–4.01) and Generalized Anxiety Disorder (AOR = 2.15, 95 % CI: 1.30–3.56), three times more likely to report emotional numbing (AOR = 3.29, 95 % CI: 1.79–6.07), and more likely to screen positive for symptoms of Major Depressive Disorder (AOR = 1.67, 95 % CI: 1.10–2.52). However, there was no association between PPTE exposure and potentially hazardous alcohol use in the unadjusted or adjusted models.

After accounting for PPTE exposure, role type, and length of service, females had higher odds of having any positive screen (AOR = 1.81, 95 % CI: 1.09–2.98) and lower odds of emotional numbing (AOR = 0.11,

95 % CI: 0.02–0.83). Compared with personnel with more than 10 years of service, those new to the role, with less than 12 months of service, had lower odds of any positive screen (AOR = 0.15, 95 % CI: 0.05–0.50] and depression (AOR = 0.13, 95 % CI: 0.03–0.57). No personnel with less than 12 months of service screened positive for PTSD (0 %), however those with 1–2 years of service had lower odds of screening positive for PTSD compared with personnel with more than 10 years of service (AOR = 0.33, 95 % CI: 0.12–0.94). Additionally, the odds of screening positive for PTSD varied by role type; firefighters having a higher odds of screening positive than commanders (AOR = 2.88, 96 % CI: 1.00–8.16).

5. Discussion

In this study, we present the first comprehensive documentation of mental health among operational firefighters and commanders in New Zealand. Our findings reveal a high prevalence of positive screens for mental health disorders, including symptoms of Major Depressive Disorder, Generalized Anxiety Disorder, and PTSD, among this population. The analysis demonstrates a direct association between high PPTE exposure and increased prevalence of symptoms of mental disorders. Specifically, the highest levels of exposure are linked to higher odds of screening positive for symptoms of Major Depressive Disorder, Generalized Anxiety Disorder, and PTSD. These results highlight the urgent need for targeted evidence-based mental ill health prevention and support programs, inclusive of primary, secondary, and tertiary approaches, to safeguard the well-being of first responders.

Compared to the general New Zealand population, firefighters showed a significantly higher prevalence of mental ill-health, in line with research on other international first responder groups [4,9]. For instance, 24 % of firefighters in our sample reported symptoms of Major Depressive Disorder within the past two weeks, substantially exceeding the 9 % prevalence observed in the general population using the same measure [35]. Similarly, the prevalence of symptoms of Generalized Anxiety Disorder (13 %) in our sample was higher than the general population prevalence of 7 % using the same measure [35]. For PTSD, the 13 % prevalence observed in our sample also exceeded the closest comparable data: a 12-month PTSD prevalence of 4 % in Australia [36] and 5 % in the United States [37]. Additionally, a New Zealand study on hospitalized and non-hospitalized injury patients found that 17 % and

Table 3  
Last month exposure to potentially psychologically traumatic events among firefighters and commanders.

Characteristic	Total	0–1 exposures		2–3 exposures		4–5 exposures		6+ exposures	
	n	n	%	n	%	n	%	n	%
Total	1159	300	26	392	34	254	22	213	18
Gender									
Male	1070	271	25	365	34	241	23	193	18
Female	77	27	35	22	29	11	14	17	22
Age									
20–29 years	109	30	28	34	31	29	27	16	15
30–39 years	347	87	25	121	35	70	20	69	20
40–49 years	325	74	23	110	34	80	25	61	19
50–59 years	267	69	26	94	35	56	21	48	18
60 years or older	108	39	36	32	30	19	18	18	17
Ethnicity									
Māori	184	44	24	57	31	43	23	40	22
Pacific peoples	67	15	22	24	36	14	21	14	21
European	1008	264	26	342	34	222	22	180	18
Other Ethnicity	158	44	28	55	35	30	19	29	18
Type of role									
Commander	74	45	61	13	18	10	14	6	8
Firefighter	1085	255	24	379	35	244	22	207	19
Length of service									
Less than 12 Months	41	12	29	18	44	6	15	5	12
1–2 Years	70	23	33	26	37	13	19	8	11
3–5 Years	178	50	28	58	33	39	22	31	17
6–10 Years	215	53	25	70	33	54	25	38	18
More than 10 Years	621	151	24	214	34	132	21	124	20

**Table 4**  
Unadjusted and adjusted binary logistic regression analysis of mental disorders predicted by last month exposure to potentially psychologically traumatic events.

Predictor variable	Any positive screen <sup>a</sup>					Depression <sup>b</sup>					Anxiety <sup>c</sup>					PTSD <sup>d</sup>					
	%	Wald $\chi^2$ -test	p	Odds Ratio	95 % CI	%	Wald $\chi^2$ -test	p	Odds Ratio	95 % CI	%	Wald $\chi^2$ -test	p	Odds Ratio	95 % CI	%	Wald $\chi^2$ -test	p	Odds Ratio	95 % CI	
<b>Model 1</b>																					
Last month PPTE exposure																					
0–1 exposures	25	Reference				21	Reference				11	Reference				9	Reference				
2–3 exposures	27	0.04		1.04	[0.73, 1.47]	22	0.01		0.98	[0.68, 1.42]	10	0.46		0.85	[0.52, 1.38]	12	1.16		1.32	[0.80, 2.18]	
4–5 exposures	32	1.42		1.26	[0.86, 1.83]	27	0.91		1.21	[0.81, 1.81]	14	0.20		1.12	[0.67, 1.88]	11	0.23		1.15	[0.65, 2.03]	
6+ exposures	41	10.51	***	1.89	[1.29, 2.77]	33	6.77	**	1.71	[1.14, 2.56]	22	9.16	**	2.12	[1.30, 3.46]	23	15.48	***	2.81	[1.68, 4.70]	
Constant		57.65	***	0.36			76.85	***	0.29			120.20	***	0.13			125.00	***	0.1		
<b>Model 2</b>																					
Last month PPTE exposure																					
0–1 exposures	25	Reference				21	Reference				11	Reference				9	Reference				
2–3 exposures	27	0.05		1.04	[0.73, 1.49]	22	0.00		0.99	[0.68, 1.45]	10	0.23		0.89	[0.54, 1.46]	12	0.29		1.15	[0.69, 1.92]	
4–5 exposures	32	1.31		1.25	[0.85, 1.84]	27	0.88		1.22	[0.81, 1.83]	14	0.30		1.16	[0.68, 1.96]	11	0.00		0.99	[0.55, 1.76]	
6+ exposures	41	8.80	***	1.82	[1.23, 2.70]	33	5.81	*	1.67	[1.1, 2.52]	22	8.96	**	2.15	[1.3, 3.56]	23	10.29	**	2.37	[1.4, 4.01]	
<b>Gender</b>																					
Male																					
Female	38	5.35	*	1.81	[1.09, 2.98]	27	1.72		1.43	[0.84, 2.44]	20	2.26		1.61	[0.87, 2.98]	10	0.18		0.84	[0.37, 1.91]	
<b>Length of service</b>																					
Less than 12 Months																					
1–2 Years	24	2.12		0.65	[0.36, 1.16]	19	1.60		0.67	[0.36, 1.25]	8	0.97		0.64	[0.27, 1.55]	6	4.34	*	0.33	[0.12, 0.94]	
3–5 Years	28	2.91		0.72	[0.49, 1.05]	22	2.75		0.71	[0.47, 1.06]	17	0.67		1.22	[0.76, 1.97]	10	5.04	*	0.52	[0.29, 0.92]	
6–10 Years	30	1.44		0.81	[0.57, 1.14]	24	1.76		0.78	[0.54, 1.13]	14	0.00		1	[0.63, 1.6]	13	1.09		0.78	[0.49, 1.24]	
More than 10 Years	32	Reference				27	Reference				13	Reference				15	Reference				
<b>Type of role</b>																					
Commander																					
Firefighter	30	0.08		1.08	[0.63, 1.87]	24	0.04		0.94	[0.54, 1.66]	13	0.29		0.82	[0.41, 1.67]	13	3.87	*	2.86	[1, 8.16]	
Constant		12.83	***	0.38			14.35	***	0.35			28.92	***	0.15			30.10	***	0.05		
Model 2 goodness-of-fit <sup>e</sup>		$\chi^2$ (7, n = 1112) = 1.167, p = .992					$\chi^2$ (8, n = 1113) = 4.164, p = .842					$\chi^2$ (8, n = 1112) = 1.97, p = .982					$\chi^2$ (8, n = 1113) = 3.859, p = .870				

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ ; a Positive screen for depression and/or anxiety, and/or PTSD, Model 2 correctly classified 69.7 % of cases (Nagelkerke R2 = 0.004); b Score  $\geq 10$  on PHQ-9, Model 2 correctly classified 75.0 % of cases (Nagelkerke R2 = 0.035); c Score  $\geq 10$  on GAD-7, Model 2 correctly classified 86.5 % of cases (Nagelkerke R2 = 0.038); d Score  $\geq 17$  on SPRINT, Model 2 correctly classified 87.0 % of cases (Nagelkerke R2 = 0.073); e Hosmer-Lemeshow goodness-of-fit statistic.

**Table 5**

Unadjusted and adjusted binary logistic regression analysis of emotional numbing and hazardous alcohol use predicted by last month exposure to psychologically potentially traumatic events.

Predictor variable	Emotional numbing <sup>a</sup>					Hazardous alcohol use <sup>b</sup>				
	%	Wald $\chi^2$ -test	p	Odds Ratio	95 % CI	%	Wald $\chi^2$ -test	p	Odds Ratio	95 % CI
<b>Model 1</b>										
Last month PPTE exposure										
0–1 exposures	6	Reference				64	Reference			
2–3 exposures	7	0.07		1.09	[0.58, 2.02]	67	0.73		1.15	[0.83, 1.59]
4–5 exposures	10	1.39		1.48	[0.77, 2.82]	67	0.64		1.16	[0.81, 1.66]
6+ exposures	19	16.46	***	3.42	[1.89, 6.18]	72	3.57		1.46	[0.99, 2.15]
Constant		122.65	***	0.07			21.18	***	1.76	
<b>Model 2</b>										
Last month PPTE exposure										
0–1 exposures	6	Reference				64	Reference			
2–3 exposures	7	0.01		1.03	[0.55, 1.94]	67	0.88		1.17	[0.84, 1.63]
4–5 exposures	10	0.92		1.38	[0.71, 2.67]	67	0.82		1.18	[0.82, 1.71]
6+ exposures	19	14.61	***	3.29	[1.79, 6.07]	72	3.61		1.47	[0.99, 2.19]
Gender										
Male	10	Reference				67	Reference			
Female	1	4.57	*	0.11	[0.02, 0.83]	74	1.87		1.45	[0.85, 2.48]
Length of service										
Less than 12 Months	3	0.49		0.59	[0.14, 2.56]	68	0.00		0.99	[0.5, 1.98]
1–2 Years	6	1.62		0.46	[0.14, 1.52]	68	0.01		0.98	[0.57, 1.67]
3–5 Years	11	0.42		1.20	[0.69, 2.11]	65	0.84		0.84	[0.59, 1.21]
6–10 Years	8	1.08		0.73	[0.41, 1.32]	67	0.00		1.01	[0.72, 1.41]
More than 10 Years	10	Reference				68	Reference			
Type of role										
Commander	6	Reference				67	Reference			
Firefighter	10	0.10		1.17	[0.44, 3.09]	68	0.12		0.91	[0.53, 1.56]
Constant		29.66	***	0.07			6.04	*	1.90	
Model 2 goodness-of-fit <sup>c</sup>		$\chi^2$ (8, n = 1112) = 8.046, p = .429					$\chi^2$ (8, n = 1114) = 1.318, p = .995			

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ ; a Score  $\geq 6$  on emotional numbing scale, Model 2 correctly classified 90.6 % of cases (Nagelkerke R2 = 0.072); b Score  $\geq 3$  female and  $\geq 4$  male on AUDIT-C, Model 2 correctly classified 67.1 % of cases (Nagelkerke R2 = 0.008); c Hosmer-Lemeshow goodness-of-fit statistic.

12 %, respectively, exhibited symptoms suggestive of PTSD within 12 months. In both groups, perceived threat to life was identified as a predictor [38]. This finding underscores the potential role of perceived threat in the elevated PTSD prevalence observed in our sample.

Prevalence estimates of mental health disorders observed in our study are comparable to other national and international studies of first responders, providing valuable insights into how New Zealand firefighters' experiences align with global trends. For example, 13 % of firefighters screened positive for probable PTSD in our study compared to 14 % among Canadian firefighters [6], and 14 % and 10 % among New Zealand police and military personnel, respectively [22,23]. Likewise, our estimated prevalence of 24 % for symptoms of Major Depressive Disorder aligns with estimates reported among Canadian firefighters (20 %) using the same measure [6]. A recent meta-analysis reported the prevalence of Major Depressive Disorder among first responders to range between 22 % and 37 %, although various measures were used in these studies [39]. It is notable that findings from the Beyond Blue report indicated that Australian firefighters have a greater prevalence of mental ill health compared to the general population, including a roughly twofold higher prevalence of PTSD [4]. The high prevalences of mental ill health among firefighters compared to the general population is particularly concerning, considering that firefighters are highly active and have stable employment, which are commonly considered protective factors for mental health [40–42].

We found that high exposure to PPTEs was prevalent among operational personnel, with 19 % of firefighters reporting 6 or more PPTE exposures in the last month. Furthermore, personnel who reported high exposure to PPTEs in the last month were almost twice as likely to meet the criteria for at least one indicator of a mental health disorder, including symptoms of Major Depressive Disorder, Generalized Anxiety Disorder, and PTSD, compared to those with low exposure. These findings provide additional evidence to support the link between PPTE exposure and mental health disorders, as observed in previous studies involving first responders and military veterans [2,5,15,16,28].

Socio-demographic and occupational analysis revealed notable variations in mental ill health outcomes, with female personnel more likely to screen positive for mental disorders. Within the general New Zealand population, prevalence of high or very high psychological distress are also higher in women (13 %) than in men (10 %) [43] and international reviews have reported that women are almost twice as likely to be affected by anxiety as men [44]. In contrast, female personnel in our sample were less likely to engage in emotional numbing than their male counterparts. This suggests differences in how male and female personnel cope with the demands and challenges of their roles, as has been suggested in studies looking at gender differences in coping with trauma [45,46]. More broadly, research has suggested a gendered nature to coping styles, with females generally more likely to use emotion-focused strategies, such as seeking support and emotional expression, while males tend to favor problem-focused approaches [47,48]. These trends are supported by studies across different populations, though the extent and consistency of these differences vary across contexts and studies [49].

It is important to note that not all PPTE exposures result in psychological injury, however, several studies have indicated that higher levels of PPTE exposure are associated with increased mental ill health [11–13]. In our study, the prevalence of mental disorders was found to increase with the length of service, demonstrating an association between cumulative exposure to PPTEs and mental ill health outcomes. Indeed, those with 10 or more years of service tended to have the highest prevalence of mental disorders. This finding aligns with studies conducted among Canadian and Australian firefighters, which found that individuals were more likely to screen positive for mental health issues as they grew older and accumulated more years of service [6,13]. However, it is important to note that the present study cannot directly attribute the increase in mental disorders with longer service length to higher exposure to PPTEs alone. Indeed, other research has shown that factors such as low perceived social support and self-blame, contributed to PTSD symptoms whereas exposure frequency did not [50], suggesting

that the factors that contribute to mental ill health are complex and can vary between individuals and contexts.

This study also raises concerns about the high prevalence of potentially hazardous drinking patterns among operational personnel. Two-thirds of the sample, including both males and females, reported elevated levels of alcohol consumption. In contrast to international studies that have established a link between PPTE exposure and alcohol use [1,13,51], as well as its associations with increased distress and higher levels of PTSD among firefighters and other first responders [52–54], our study did not find a direct association between hazardous drinking and PPTE exposure or length of service. This suggests that alcohol use may be influenced more by social and role-related norms surrounding alcohol rather than the level of PPTE exposure. Previous international studies have also brought attention to the existence of heavy [51,55,56] and problematic drinking cultures [57] within the firefighting profession. In the general New Zealand population, estimates of hazardous alcohol use vary widely, making direct comparisons challenging. However, data using comparable assessment methods indicate that 19–40 % of New Zealand adults may be classified as hazardous drinkers [58,59]. Prevalence is higher among older adults, with over 50 % of men aged 55 and above identified as hazardous drinkers [60], suggesting that norms around alcohol use in New Zealand may contribute to elevated consumption among firefighters, although this remains lower than the levels observed within this occupational group.

PPTE exposures are a significant risk factor for firefighters, however it is notable that most participants did not screen positive for a current mental disorder. This suggests the presence of protective mechanisms that buffer the effects of high PPTE exposure. Research highlights that personal factors, such as perceived social support and coping strategies, can either mitigate or amplify these effects [50,61]. Additionally, organizational factors like workplace culture, leadership support, and perceived organizational support play a crucial role in reducing the negative psychological impact and maladaptive behaviors associated with PPTEs [61–64]. However, there remains a prevailing tendency for programmes to focus on individual strategies, rather than addressing systemic workplace factors [14]. Alternatively, Drew and Williamson [14] propose that while exposure to PPTEs cannot be eliminated, focusing on modifiable organizational factors offers a meaningful opportunity to support mental well-being and mitigate adverse outcomes across an entire workforce. Further research should continue to examine the operational, personal, and organizational factors contributing to mental ill-health so interventions can be targeted. Additionally, evaluating the effectiveness of mental ill health prevention programs should be a critical focus for identifying if individual and organizational programmes and interventions are effective at preventing mental ill-health and/or supporting the recovery of fire and emergency personnel.

In addition to considering broad organizational influences, our findings highlight specific areas that warrant attention in future research and intervention strategies. While much focus has traditionally been placed on supporting new recruits on the basis they may be more at risk of mental ill health relative to senior personnel, our results suggest that this is not the case. Consequently, consideration should be given to increasing monitoring and interventions for longer-serving personnel given the association between length of service and a higher prevalence of mental ill health symptoms. Additionally, the high prevalence of potentially hazardous alcohol use indicates a need for research into organizational factors contributing to this issue, as well as targeted efforts to address these drinking behaviors. Finally, our findings reinforce the importance of considering gender differences in coping styles, as male personnel were much more likely to engage in emotional numbing than their female counterparts. Future research should explore how these differences influence mental health outcomes and the effectiveness of targeted interventions.

## 6. Strengths and Limitations

This study has both significant strengths and limitations. One of the major strengths is the high response rate from firefighters, which was approximately 70 %. This places the survey among the highest-quality datasets on first responder mental health globally, as of the time of writing. The high response rate helps to reduce potential selection bias and provides confidence that our sample is largely representative of the population. Additionally, the gender, age, and ethnicity distributions in our sample closely align with those reported by Fire and Emergency NZ [26], further supporting its representativeness.

Despite this strength, our study does have some inherent limitations. Firstly, we relied on self-report screening assessments of mental disorders and PPTE exposure, which may differ from diagnostic assessments conducted by healthcare professionals. However, comparable estimates are observed in international studies that also relied on self-report screening measures to assess symptoms of mental ill health and previous research suggests that there is little difference in prevalence estimates between clinical diagnostic and self-report measures [9]. The online mode may also have an impact on prevalence estimates as the anonymity of our survey may have helped reduce any stigma associated with answering questions about mental health.

Secondly, it is important to note that the estimates obtained in our study offer a snapshot of recent PPTE exposure and symptoms related to mental ill health. Capturing the true extent of PPTE exposure can be challenging, as levels of exposure can fluctuate over time. Similarly, symptoms of mental disorders can also vary over time. In our study, we used the length of service as a proxy measure to estimate cumulative PPTE exposure. While this provides an indication, it may not fully capture the full extent of cumulative exposure to PPTEs over the length of a career. Additionally, the customized measure for assessing PPTE exposure used in this study has not undergone formal psychometric validation, which limits our ability to ensure its reliability and validity. On the other hand, no existing tool specifically captures this construct, which is a significant limitation for research on first responders. Further, the customized tool we used did identify a relationship between cumulative PPTE exposure and mental disorders outcomes in line with research utilizing different measures. Future iterations of this research should prioritize conducting psychometric testing of this measure to enhance the robustness and interpretability of the findings. Additionally, a continuous measure was not employed due to challenges with self-report recall, and the stepped measure featured inconsistent reporting ranges. These factors should be considered when interpreting the results. We also did not account for the specific type of exposure, with previous research indicating that exposure to some PPTEs, such as attending sudden violent deaths, suicides, or infant deaths, may contribute more to the risk of mental ill-health than other types of PPTE exposure [12,65].

Thirdly, despite the high response rate, we acknowledge the possibility of sample bias. Individuals who are experiencing symptoms related to mental ill health may be more motivated to participate in the survey, potentially leading to an overestimation of prevalence. Conversely, those with the most severe symptoms may choose to avoid participating or may have already left their job due to mental health reasons, potentially leading to an underestimation of prevalence. Furthermore, firefighters tend to perceive high levels of stigma towards mental health [4], which can influence the willingness of individuals to accurately report their mental health concerns. Additionally, our study did not include retired firefighters, a group that is known to have a higher prevalence of mental ill-health [13]. This exclusion may impact the representation of mental ill health prevalence within the firefighter population.

Fourth, our use of the SPRINT scale instead of the more common PCL-5 limits comparability with other first responder studies. The SPRINT was chosen for its shorter length to reduce participant burden in an already extensive survey. It also assesses functional impairment,

providing insight into how symptoms affect daily life, which the PCL-5 does not capture. While the PCL-5 aligns more closely with DSM criteria, SPRINT's focus on real-world impact makes it a valuable tool for this cohort.

Finally, the cross-sectional design of this study, while suitable for establishing baseline data, limits the ability to draw causal inferences about the relationship between PPTE exposure and mental health outcomes. However, this study forms the baseline measure of a quasi-experimental evaluation of the Whanaungatanga Program over several years, which will provide greater certainty regarding the relationship between factors, along with insights into how mental health symptoms evolve over time in relation to cumulative PPTE exposure and organizational interventions.

It is important to consider these strengths and limitations when interpreting the results of our study and making conclusions about first responder mental health. Further research and ongoing evaluation are essential to gain a more comprehensive understanding of the factors influencing mental health in this population.

## 7. Conclusions

This study highlights the urgent need for targeted, evidence based mental ill health prevention, early intervention, and postvention support programs to safeguard the well-being of fire and emergency personnel in New Zealand, and firefighters and first responders internationally. The findings provide valuable insights into the prevalence of mental disorders, such as Major Depressive Disorder, Generalized Anxiety Disorder, and PTSD, among first responders. Effective, evidence-based, programs are necessary to address these challenges and promote the resilience and well-being of our first responders.

Future research could build on these findings by investigating the effectiveness of specific interventions designed to prevent and treat mental disorders among firefighters, while also exploring demographic factors that may influence resilience or vulnerability to mental ill health. Additionally, ongoing evaluation of prevention and support programs, such as the Whanaungatanga Program, will contribute to our understanding and the development of strategies to support the mental health of first responders globally.

## CRedit authorship contribution statement

**Lisa Mackay:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Jessica L. Campbell:** Writing – review & editing, Writing – original draft, Project administration. **Josh Darby:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Kate Pendergast:** Writing – review & editing, Formal analysis, Data curation. **Grant Schofield:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.comppsy.2025.152595>.

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