

# The role of organizational supports in mitigating mental ill health in firefighters: A cohort study in Alberta, Canada

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## Abstract

**Introduction:** Little is known about the effectiveness of ongoing mental health support in reducing the mental health impacts of a traumatic deployment.

**Methods:** A cohort of firefighters was established among those deployed to a devastating wildfire in Alberta, Canada in May 2016. Firefighters completed three questionnaires: at recruitment giving details of exposures, a first follow-up reporting mental health supports before, during, and after the fire and a second follow-up, at least 30 months after the fire, with screening questionnaires for anxiety, depression, and post-traumatic stress disorder (PTSD). Fire chiefs were interviewed about mental health provisions. The impact of supports on mental ill health was estimated, adjusting for clustering within fire service and potential confounders.

**Results:** Of 1234 firefighters in the cohort, 840 completed the questionnaire on mental health supports. In total, 78 of 82 fire chiefs were interviewed. Analysis of the impact of supports on mental ill health included 745 firefighters from 67 fire services. Only 45.8% of reports of peer support were concordant between firefighters and fire chiefs. After adjusting for confounding, the odds ratios (OR) for peer support reported by both fire chief and firefighter were depressive disorder: OR = 0.22, 95% confidence interval (CI), 0.08–0.61; anxiety disorder: OR = 0.45, 95% CI, 0.24–0.82; PTSD: OR = 0.62, 95% CI, 0.37–1.02. Symptoms of anxiety and depression but not PTSD were reduced by resiliency training before the fire and by support offered within 48 h of return from deployment.

**Conclusion:** The results suggest peer support in firefighters is protective but its availability is poorly recognized. PTSD was somewhat less responsive, perhaps reflecting the cumulative effects of previous exposures.

## KEYWORDS

firefighters, Fort McMurray fire, intervention, mental ill health, peer support, PTSD

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## 1 | INTRODUCTION

Although firefighters are at risk of posttraumatic stress disorder<sup>1</sup> and other mental health disorders, particularly after responding to major disasters<sup>2</sup> the literature on the success of strategies to mitigate such effects is sparse. The need for evaluative studies of post-disaster mental health interventions has been well documented,<sup>3</sup> and the difficulties in their design thoughtfully described.<sup>4,5</sup> Two systematic reviews,<sup>6,7</sup> including evidence from small randomized trials,<sup>8–10</sup> concluded that primary prevention strategies had some impact but that the effect of post-event interventions was uncertain. Early attempts focused on post-incident debriefing and early psychological interventions, which were found not to be useful in the secondary prevention of posttraumatic stress disorder (PTSD).<sup>11,12</sup>

None of these reviews included an evaluation on the part played by peer support. Peer support had been described<sup>13</sup> as a way to operationalize social support within a high-risk organization, with trained peer supporters offering low-level psychological intervention, identifying at-risk colleagues, and facilitating pathways to professional help. Various peer support programs have been developed with Critical Incident Stress Management (CISM)<sup>14</sup> being adopted by some of the larger Canadian fire services. There have been studies of the impact of such programs on mental health<sup>14,15</sup> with dispute about the benefit or harm that might be associated with interventions following stressful incidents.<sup>16,17</sup> The methodological weakness of the research overall has led to the conclusion that there was no adequate evidence base to support the adoption of peer support.<sup>13</sup>

The devastating fire in Fort McMurray, Alberta in May 2016 involved firefighters from many fire services across the province. Although no firefighter was killed during the fire, there was a significant threat to life for both first responders and those living in the area engulfed by the fire: more than 80,000 inhabitants were evacuated.<sup>18,19</sup> The mental health support provided by the fire services differed markedly, with some providing integrated training and support and others little or no mental health preparation before the fire or intervention during or after deployment. This range of provisions made possible an assessment of

the impact of organizational support on the mental ill health of firefighters all deployed to the same fire in northern Alberta.

The study reported here was a “found experiment,” with analysis to compare mental health outcomes in those who had been exposed to different approaches to mitigating the mental health outcomes of participation in the fire. It was not an attempt to formally evaluate the merits of different protocols for supporting mental health or mitigating harm but rather an observational study, dependent for an account of events from firefighters who played a role in fighting the fire or, as fire chiefs, in providing support to those who did.

## 2 | METHODS

A cohort of 1234 firefighters was recruited from Alberta-based firefighters who had been deployed to the Fort McMurray fire. Firefighters, drawn from structural, wildland, and industrial services, completed a baseline questionnaire, either face-to-face or online, giving detailed information about their experiences at the fire.<sup>20</sup> At recruitment, they were asked for consent to link their responses to data from the Alberta administrative health record for 5 years, 3 years before the fire and two after. The firefighters were subsequently approached to complete two follow-up questionnaires online (Table 1). The first, in the winter of 2017–2018, included questions on the types of mental health supports available through their employer before, during, and since the fire (Supporting Information Appendix A). The second, in the winter of 2018–2019, included screening questionnaires for anxiety and depression (the Hospital Anxiety and Depression Scale [HADS])<sup>21,22</sup> and for PTSD (the PCL-5).<sup>23</sup> In addition, the firefighters were asked about stressful life events, including major property damage during or since the fire. The final contact with the firefighters was in 2019 and early 2020 when a stratified random sample was approached to complete a Structured Clinical Interview (SCID) to determine whether their mental health condition met the diagnostic criteria for the DSM-5.<sup>24</sup> The results of these SCID interviews were used to determine cut points for “caseness” within this cohort of firefighters.<sup>25</sup>

From May 2017 to January 2018 semistructured interviews were held with each fire chief (or wildland regional manager) of a service from which cohort firefighters had been deployed, to get a

**TABLE 1** Timeline, target respondents, and key information of surveys following the Fort McMurray fire of May 2016

Dates	Target respondents	Key information
May 2016–December 2017	All Alberta firefighters deployed to the fire	Details of deployments and exposures during the fire
May 2017–January 2018	Fire chiefs of all services with participants	Perceptions of mental health supports offered
December 2017–May 2018	Firefighters completing initial survey	Perceptions of mental health supports offered
October 2018–January 2019	Firefighters completing initial survey	Screening questionnaires for anxiety, depression and PTSD Stressful life events, during and since the fire
July 2019–February 2020	Stratified random sample of firefighters	Structured clinical interview for DSM-5 diagnosis

Abbreviation: PTSD, posttraumatic stress disorder.

fuller understanding of the mental health resources offered. The questions used in this analysis for the firefighters and fire chiefs were intended to cover the same ground but were not identical. They are given in Supporting Information Appendix A.

This report considers mental health supports at four periods: resiliency/mental health training before the fire, mental health supports during the fire, support offered in the first 48 h after return from the fire and ongoing peer or other mental health supports in the months after the fire. For each time period, variables were constructed to reflect responses by (i) the fire chief, (ii) the firefighter, and (iii) concordantly reported as present by both the fire chief and the firefighter.

The mental health outcomes assessed were anxiety disorders, depressive disorders, and PTSDs. We examined these in two ways, first as screening scores and then by whether or not the scores met the case definition from the SCID analysis.<sup>25</sup>

The screening scores for anxiety and depression were those computed from answers to the HADS questionnaire or, for PTSD, on the PCL-5. These were analyzed as continuous variables. Cases of anxiety disorder, depressive disorder, and PTSD were determined from these screening scores. An anxiety disorder was indicated by a HADS anxiety score of 12 or greater, a depressive disorder by a HADS depression score of 11 or greater and PTSD by a PCL-5 score of 16 or greater. These were analyzed as binary outcomes (meeting the case cut-off score or not).

Fire services differed importantly in characteristics that might be related to psychological responses to the fire (such as the type of firefighter, years of experience, gender) and also in the nature of their experiences during the fire (when, where, and how long they were deployed). Those based in the Fort McMurray area were particularly at risk as they were deployed in the early chaotic phase of the fire, were deployed for many rotations, and had their homes and families threatened. To understand the impact of mental health supports it was necessary to adjust for such differences. In choosing factors to consider as potential confounders, we chose measures that were least likely to be biased by the participant's current mental health. For exposures during the fire, for example, we used an estimate of total particulate exposure, an independent measure reflecting the ferocity of the fire, rather than the participant's report of how fearful the exposure had been. The variables considered as potential confounders or effect modifiers are listed in Supporting Information Appendix A.

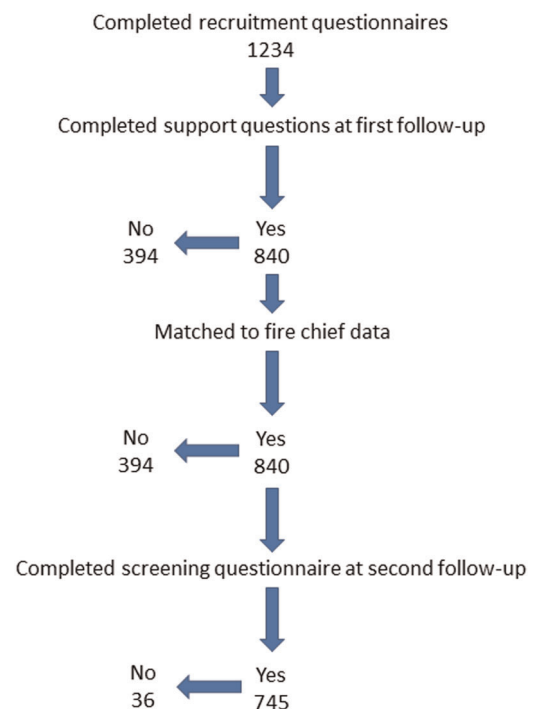
### 3 | STATISTICAL METHODS

Reports of mental health supports from the fire chief and firefighter were compared and variables constructed to reflect concordance. The relation between each outcome measure and mental health support was examined in univariate analyses. The relation between outcome measures and potential confounders was examined, allowing for clustering within fire service, using multilevel modeling within STATA 14.2, adopting a linear model for screening scores, and a

logistic model for mental health disorders. Deployment from a fire service based in Fort McMurray and the type of service was retained in each model, but other variables were dropped if they did not contribute significantly ( $p < 0.05$ ) to the model containing other potential confounders. The influence of each mental health intervention was tested, for each outcome, in a model including all variables retained for that outcome in the multivariable modeling of confounders. The effect of using a formal (Michell model) system of firefighter support was tested by adding to the final models a factor contrasting firefighters from "Mitchel model" fire services with those from services using more informal methods of peer support.

### 4 | RESULTS

Of the 1234 firefighters who completed a recruitment questionnaire, only 840 completed the first follow-up in the winter of 2017–2018. Those recruited very close to that date (or, for some wildland firefighters, after the launch of the first follow-up) were not invited to complete the 2017–2018 questionnaire. Eighty-two fire services and wildlife areas were identified as having deployed at least one firefighter in the cohort to the fire. The number available for analysis reduced to 745 (Figure 1). Of these 745 only 68 (9.1%) were female. The median age was 37 years (range, 18–72). The majority (62.7%) of firefighters completed only one rotation of 3–5 days at the fire, but those based in Fort McMurray did multiple rotations. Wildland and industrial firefighter rotations lasted up to 14 days.



**FIGURE 1** Participants included in the analysis [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

**TABLE 2** Fire chief and firefighter reports of mental health support at four time periods

Fire chief report		Firefighter report						
		No		Yes		Overall		
		N	%	N	%	N	%	
1) Before the fire								
Resiliency training	No	269	80.0	67	20.0	335	100.0	
	Yes	242	54.3	204	45.7	446	100.0	
	Overall	510	65.3	271	34.7	781	100.0	
2) During the fire								
Mental health supports	No	309	89.6	36	10.4	345	100.0	
	Yes	319	73.2	117	26.8	436	100.0	
	Overall	628	80.4	153	19.6	781	100.0	
3) First 48 h after								
Coping support	No	130	92.9	10	7.1	140	100.0	
	Yes	460	71.8	181	28.2	641	100.0	
	Overall	590	75.5	191	24.5	781	100.0	
4) In the months after								
In-house peer support								
Formal	240	59.3	141	34.8	24	5.9	405	100.0
Informal	19	37.3	23	45.1	9	17.6	51	100.0
External peer support								
Used	19	19.6	69	71.1	9	9.3	97	100.0
Not used	73	71.6	17	16.7	12	11.8	102	100.0
EAP etc. only	52	41.3	30	23.8	44	34.9	126	100.0
Overall	403	51.6	280	35.9	98	12.5	781	100.0

Abbreviations: EAP, Employee Assistance Program.

Interviews were carried out with 78 fire chiefs (95%), 76 face-to-face and two by telephone. Of the 78 fire chiefs interviewed, 29 said they provided in-house resiliency training, 15 that their firefighters received mental health support in the field (eight through in-house peer support), and 51 that their firefighters were contacted within 48 h of return to offer support. Forty-four services had a formal in-house peer support program in place before the fire. Of these, 31 used formally trained peer support firefighters, the great majority (26/31) in CISM, with 23 reporting they used the Mitchell model.<sup>15</sup> Two fire services used the R2MR

program<sup>26</sup> and three wildland area managers reported firefighters trained for a defunct peer support program.

Reports by the fire chiefs and firefighters on mental health support at four time periods are given in Table 2. There was low concordance overall. The fire chief of 57.1% (446/781) of firefighters reported resiliency training before the fire, but only 34.7% of firefighters recorded this. Similarly, mental health support during the fire was reported for 55.8% (436/781) but recorded by 19.6%, and support in the first 48 h after returning from the fire by fire chiefs for 82.1% (641/781) but by only 24.5% of the firefighters themselves. For the months after the fire, the fire chiefs of 51.7% (404/781) of firefighters said that there had been a formal in-house peer support system in place, but this was reported by only 35.9% of firefighters. For each time period, a variable was constructed contrasting those in which both the fire chief and the firefighter reported the intervention with those in which one or both did not. For resiliency training, this included 204 firefighters, for supports during the fire; 117 firefighters, for support in the first 48 h after return; 181 firefighters and for peer support in the months after the fire; 233 (141 + 23 + 69) firefighters, where the firefighter indicated peer support and the fire chief reported in-house peer support or peer support available from other fire services that had been used after the Fort McMurray fire.

Table 3 shows the univariate relationship between mental health outcomes and organizational supports in the four time periods. Only supports on which there was concordance between a firefighter and their fire chief are included in this table. In this univariate analysis, before adjustment for clustering within fire service or for confounders, interventions were generally associated with lower scores on symptom scales, although these differences did not always reach statistical significance. Reduction in mental health disorders was less apparent.

The analysis to identify important confounding covariates is reported in Supporting Information Appendix B. Tables 4 and 5 show the effects of mental health supports at four time periods, having adjusted for all covariates included in the final multivariable models (Tables SB4 and SB5). The most marked effects were when the firefighter and fire chief agreed that the support was available. Anxiety score was reduced significantly for each of the interventions for the group in concordance (Table 4). Similar results were seen for depression scores, other than for support during the fire. None of the interventions reduced PCL-5 scores significantly but all coefficients were negative, consistent with some reduction. The effects of interventions on mental health disorders were less marked, except for peer support in the months after the fire (Table 5). Where there was concordance between the firefighter and fire chief, peer support was associated with reduced risk of being found to have a disorder, with an odds ratio for a depressive disorder of 0.22, for an anxiety disorder of 0.45, and for PTSD of 0.62.

A final analysis examined whether the type of peer support was important. In the fully adjusted models used in Tables 4 and 5, the 200 firefighters from the 23 fire services that reported using the Mitchell model for CISM were no less likely to have mental health

**TABLE 3** Mental health screening scores and disorders by supports at four time periods reported by both fire chiefs and firefighters (N = 745)

<b>(A) Screening scores</b>											
		HADS anxiety			HADS depression			PCL-5			N
		Mean	SD	p*	Mean	SD	p*	Mean	SD	p*	
Before											
Resiliency training	Yes	5.04	4.06	0.001	2.97	3.24	0.011	5.38	10.98	0.007	195
	No	6.21	4.10		3.31	3.55		8.11	12.62		550
During											
Mental health support	Yes	5.80	3.85	0.781	3.68	3.28	0.573	9.28	12.38	0.080	111
	No	5.92	4.17		3.48	3.52		7.07	12.24		634
After											
48-h coping support	Yes	5.01	3.91	0.001	2.97	3.17	0.019	6.13	11.02	0.121	172
	No	6.17	4.14		3.68	3.56		7.78	12.59		573
Peer support	Yes	5.27	4.11	0.006	3.23	3.30	0.145	7.73	13.20	0.630	221
	No	6.17	4.10		3.63	3.55		7.26	11.83		524
<b>(B) Mental health disorders</b>											
		Anxiety disorder			Depressive disorder			PTSD			N
		n	%	p**	n	%	p**	n	%	p**	
Before											
Resiliency training	Yes	18	9.2	0.297	6	3.1	0.136	26	13.3	0.080	195
	No	68	12.4		33	6.0		104	18.9		550
During											
Mental health support	Yes	12	10.8	0.873	5	4.5	1.000	23	20.7	0.343	111
	No	74	11.7		34	5.4		107	16.9		634
After											
48-h coping support	Yes	14	8.1	0.134	6	3.5	0.329	26	15.1	0.423	172
	No	72	12.6		33	5.8		104	18.2		573
Peer support	Yes	20	9.0	0.209	6	2.7	0.048	37	16.7	0.833	221
	No	66	12.6		33	6.3		93	17.8		524

Abbreviations: HADS, Hospital Anxiety and Depression Scale; PCL-5, Posttraumatic Stress Disorder Checklist; PTSD, posttraumatic stress disorder.

\*Analysis of variance.

\*\* $\chi^2$ .

disorders post-fire than those from fire services with more informal peer support models.

## 5 | DISCUSSION

The range of organizational support for mental wellness offered by fire services in Alberta allowed assessment of the impact on the mental ill health of interventions at each of four time periods. Where both firefighter and fire chief reported that support was present before, during, or after the fire, each intervention was associated with lower scores on screening questionnaires for anxiety and, very

largely for depression but not on the screening scale for PTSD. Only peer support post-fire was related to a reduction in the prevalence of cases, with marked reductions in the odds ratios for depressive and anxiety disorders and a more marginal but still noteworthy reduction in PTSD.

An important feature of this study was the ability to take account of differences between the firefighters and their experiences during the fire, using variables that were largely independent of self-report. This analysis was reported in Supporting Information Appendix B so as not to distract from the central analysis but is a key strength of the study. Being based in the Fort McMurray area was related to increased screening scores on all three measures, and was

**TABLE 4** Relation of screening scores for anxiety, depression, and PTSD to mental health support at four time periods in 67 fire services, by source of reporting support available: linear regression analysis allowing for confounders

HADS anxiety <sup>a</sup> (N = 745)	Reported by fire chief			Reported by firefighter			Reported by both		
	Coeff.	95% CI	p	Coeff.	95% CI	p	Coeff.	95% CI	p
Before									
Resiliency training	-0.15	-1.12 to 0.83	0.770	-0.60	-1.23 to 0.04	0.065	-0.99	-1.72 to -0.25	0.008
During									
Mental health support	-0.95	-1.59 to -0.31	0.003	-0.61	-1.38 to 0.17	0.125	-0.98	-1.87 to -0.09	0.031
After									
48 h coping support	-0.67	-1.78 to 0.35	0.198	-0.98	-1.67 to -0.29	0.005	-1.11	-1.81 to -0.41	0.002
Peer support	0.03	-0.76 to 0.82	0.931	-1.14	-1.78 to -0.49	0.001	-1.36	-2.06 to -0.66	<0.001
HADS depression <sup>a</sup> (N = 745)	Coeff.	95% CI	p	Coeff.	95% CI	p	Coeff.	95% CI	p
Before									
Resiliency training	-0.23	-1.02 to 0.56	0.566	-0.42	-0.96 to 0.12	0.125	-0.68	-1.30 to -0.07	0.030
During									
Mental health support	-0.60	-1.11 to -0.03	0.038	-0.69	-0.34 to -0.03	0.039	-0.60	-1.36 to 0.16	0.121
After									
48 h coping support	-0.66	-1.51 to 0.18	0.121	-0.60	-1.19 to -0.01	0.043	-0.79	-1.38 to -0.19	0.009
Peer support	0.30	-0.32 to 0.93	0.342	-0.86	-1.41 to -0.32	0.002	-0.87	-1.46 to -0.28	0.004
PCL-5 score <sup>a</sup> (N = 744)	Coeff.	95% CI	p	Coeff.	95% CI	p	Coeff.	95% CI	p
Before									
Resiliency training	-1.77	-4.48 to 0.93	0.200	-0.83	-2.67 to 1.02	0.381	-1.19	-3.31 to 0.96	0.274
During									
Mental health support	-1.56	-3.41 to 0.29	0.099	-2.13	-4.38 to 0.12	0.064	-1.94	-4.54 to 0.65	0.143
After									
48 h coping support	-1.98	-4.87 to 0.91	0.179	-1.09	-3.11 to 0.94	0.292	-1.41	-3.47 to 0.63	0.173
Peer support	0.27	-1.90 to 2.44	0.806	-2.21	-3.09 to 0.67	0.207	-1.14	-3.17 to 0.89	0.272

Abbreviations: CI, confidence interval; HADS, Hospital Anxiety and Depression Scale; PCL-5, Posttraumatic Stress Disorder Checklist; PTSD, posttraumatic stress disorder.

<sup>a</sup>Adjusted for based in Fort McMurray, type of firefighter, mental ill health before the fire, serious property damage, years working as a firefighter (for depression and PCL-5 score), and particulate exposure (for anxiety and PCL-5 score). All models adjusted for clustering within fire service.

a major confounder included in the final models. Total exposure to particulates was a further element reflecting the intensity of the fire experience that, in a model adjusted for other confounders, related to anxiety disorders and to PTSD. Serious property damage, very largely in those from the Fort McMurray-based fire services, was independently predictive of depressive disorder, as reported previously in firefighters.<sup>27</sup> In choosing variables to reflect fire experience, priority was given to those least likely to be subject to bias by mental ill health post-fire. Access to administrative health records to determine mental ill health before the fire was a strength in reducing such bias. As with any observational study, there was the possibility of residual confounding if factors associated with both provisions of support and susceptibility of firefighters had not been adequately taken into account. Furthermore, the analysis included only 745

(60%) of the 1234 eventually recruited to the cohort, excluding a higher proportion of wildland than structural firefighters. Those agreeing to take part in the study may not be representative of all deployed to the fire, and this would limit the extent to which the results could be generalized.

The mental health screening questionnaires were completed some 30 months after the fire and in the intervening period almost all of the firefighters had been deployed to other fires (although none of the magnitude of the Fort McMurray fire). They will have been subjected to organizational stressors unrelated to the incidents themselves but which have been shown to be implicated in mental ill health in firefighters.<sup>28,29</sup> Some firefighters, perhaps particularly in fire services with good peer support services, may have had access to mental health interventions outside the provincial healthcare system. If so, these

**TABLE 5** Relation of cases of anxiety disorder, depressive disorder, and posttraumatic stress disorder to mental health support at four time periods in 67 fire services, by source of reporting of support available: linear regression analysis allowing for confounders

Disorder	Reported by fire chief			Reported by firefighter			Reported by both		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
<b>Anxiety<sup>a</sup> (N = 745)</b>									
Before									
Resiliency training	1.53	0.69 to 3.39	0.294	0.96	0.57 to 1.61	0.870	0.79	0.42 to 1.47	0.449
During									
Mental health support	0.58	0.33 to 1.02	0.058	0.53	0.27 to 1.04	0.065	0.54	0.26 to 1.13	0.101
After									
48 h coping support	1.17	0.50 to 2.75	0.717	0.61	0.33 to 1.14	0.122	0.59	0.31 to 1.11	0.103
Peer support	0.78	0.42 to 1.41	0.409	0.54	0.31 to 0.93	0.027	0.45	0.24 to 0.82	0.009
<b>Depressive<sup>a</sup> (N = 745)</b>									
Before									
Resiliency training	1.07	-0.35 to 3.21	0.909	0.56	0.25 to 1.25	0.156	0.58	0.22 to 1.54	0.272
During									
Mental health support	0.61	0.27 to 1.37	0.233	0.33	0.12 to 0.95	0.040	0.39	0.13 to 1.18	0.096
After									
48 h coping support	0.44	0.14 to 1.32	0.143	0.85	0.37 to 1.94	0.699	0.60	0.24 to 1.49	0.270
Peer support	1.18	0.48 to 2.94	0.718	0.21	0.08 to 0.55	0.001	0.22	0.08 to 0.61	0.004
<b>Posttraumatic stress<sup>a</sup> (N = 744)</b>									
Before									
Resiliency training	0.70	0.36 to 1.36	0.299	0.82	0.52 to 1.29	0.383	0.86	0.50 to 1.48	0.593
During									
Mental health support	0.87	0.54 to 1.40	0.568	0.55	0.31 to 0.96	0.036	0.66	0.36 to 1.20	0.172
After									
48 h coping support	0.79	0.39 to 1.59	0.509	0.89	0.55 to 1.46	0.649	0.84	0.51 to 1.38	0.484
Peer support	1.17	0.69 to 1.99	0.553	0.64	0.40 to 1.02	0.059	0.62	0.37 to 1.02	0.060

Abbreviations: CI, confidence interval; OR, odds ratio.

<sup>a</sup>Adjusted for based in Fort McMurray, type of firefighter, mental ill health before the fire, years as a firefighter (for PTSD), serious property damage (for depressive disorder), and for particulate exposure (for anxiety disorder and PTSD). All models adjusted for clustering within fire service.

interventions may be reflected in lower scores on the screening questionnaires. Furthermore, events, since the fire may have led to bias in the recall (by both firefighters and fire chiefs) of mental health, supports offered, but we believe that taking concordant reports will have reduced any such effect. We are not able to comment on how much such intervening factors have affected the results reported here.

A further limitation of the study was uncertainty about whether, in a fire service where a fire chief reported the provision of support and a firefighter did not, this arose from a failure to reach all deployed firefighters, from an impact so low that the firefighter did not recall it or some psychological mechanism whereby the firefighter was unwilling to acknowledge that support had been given. A recent publication on public safety personnel (including firefighters) reported a marked

unwillingness to access mental health resources<sup>30</sup> and something similar may be reflected here. Furthermore, firefighters reported on mental health supports some months after the fire chiefs, and this may have increased discordance. We are confident that the information from the fire chief interview represented a sincere attempt by the chief to describe their understanding of the components that were in place for firefighters from that service. Inevitably some firefighters may have missed out on elements of training, not have been aware of attempts at support that were on offer or have avoided efforts at peer support. Equally, most fire chiefs were not deployed to the fire and could not speak with certainty about supports provided during the fire. Some firefighters were deployed with a service other than their own. Nevertheless, it does appear that to be effective, simply offering a

support is not enough; it must be recognized and acknowledged by the first responders intended as recipients.

The data collected from the fire chief did not include information about the nature of the peer support received from external sources. As external peer support was of particular importance for the structural firefighters based in Fort McMurray, the analysis was carried out contrasting those with any peer support against those with none. As such, we cannot say with confidence whether any particular element of peer support was central to the success of the intervention, or whether the effect simply reflected an unspecific enhancement of social support. Moreover, we cannot comment on whether any intervention was associated with increased distress as has been suggested for some elements of "psychological debriefing"<sup>16</sup> but, on balance, effects here appear to have been beneficial.

The impact of peer support was measured here by comparing mental health outcomes where both the firefighter and fire chief reported peer support with the same outcome in other firefighters, with the difference (reduction) in poor mental health outcomes being tentatively ascribed to the peer support. The marked reduction in cases of mental health disorders many months after the fire suggests long-term benefit arising from peer support reported by both firefighters and fire chiefs. Fire experiences related to PTSD appeared to be somewhat less readily mitigated than those resulting in anxiety or depressive disorders. In the analysis reported here, PTSD, but not anxiety or depressive disorders, was related to years as a firefighter, with increased risk in those working 10 years or more. A study of first responders from New York City<sup>31</sup> found that cumulative exposures to work-related trauma were specifically related to PTSD and not to depression. If PTSD in firefighters deployed to Fort McMurray did reflect cumulative traumas, it is unlikely that steps taken to mitigate the impact of a single fire, however devastating, would be wholly protective. Although substance use disorder was more prevalent in this cohort post-fire than either anxiety or depression,<sup>25</sup> no screening scale for alcohol abuse was included in the 2018–2019 follow-up and we were not able to assess whether mental health interventions affected this end point as has been seen previously.<sup>10</sup>

There is no wide body of literature in which to place these results, but the effectiveness of post-deployment peer support is consistent with a study of Ohio soldiers<sup>32</sup> where perceived strength of post-deployment support reduced the likelihood of PTSD. The findings of lower PTSD, anxiety, and depression in public safety personnel with some mental health support training<sup>30</sup> suggest that exposure to such concepts may reduce risk. In a study of Washington State firefighters<sup>33</sup> those who reported having attended critical incident debriefing sessions, had fewer PTSD symptoms.

To our knowledge, this is the first study that has been able to assess the effectiveness of such interventions across a wide range of services and patterns of provision after a major disaster. Although complicated by the discordance in reports from fire chiefs and firefighters, and limited in the extent to which it can identify essential components on an intervention, the study nevertheless provides

evidence of a role for peer support in mitigating mental ill health effects in firefighters.

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## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

## DISCLOSURE BY AJIM EDITOR OF RECORD

John D. Meyer declares that he has no conflict of interest in the review and publication decision regarding this article.

## AUTHOR CONTRIBUTIONS

Nicola Cherry and Bryan Sluggett participated in the design of the study and carried out the fire chief interviews. All authors were involved in the preparation of the data and analysis and helped in drafting the report. All have reviewed the manuscript and approved the version submitted. All agree to be accountable for the accuracy and integrity of the work.

## DATA AVAILABILITY STATEMENT

The authors will endeavor to make available deidentified data in response to any agreed proposal for further analysis.

## ETHICS APPROVAL AND INFORMED CONSENT

The study was carried out at the University of Alberta and approval was obtained from the University of Alberta Health Ethics Board (Pro00065284). All participants gave informed written consent before taking part.

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## SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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