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Exposures to Potentially Traumatic Events Among Public Safety Personnel in Canada

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Canadian Public Safety Personnel (e.g., correctional workers, dispatchers, firefighters, paramedics, and police) are regularly exposed to potentially traumatic events, some of which are highlighted as critical incidents warranting additional resources. Unfortunately, available Canadian public safety personnel data measuring associations between potentially traumatic events and mental health remains sparse. The current research quantifies estimates for diverse event exposures within and between several categories

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of public safety personnel. Participants were 4,441 public safety personnel (31.7% women) in 1 of 6 categories (i.e., dispatchers, correctional workers, firefighters, municipal/provincial police, paramedics, and Royal Canadian Mounted Police). Participants reported exposures to diverse events including sudden violent (93.8%) or accidental deaths (93.7%), serious transportation accidents (93.2%), and physical assaults (90.6%), often 11+ times per event. There were significant relationships between potentially traumatic event exposures and all mental disorders. Sudden violent death and severe human suffering appeared particularly related to mental disorder symptoms, and therein potentially defensible as critical incidents. The current results offer initial evidence that (a) potentially traumatic event exposures are diverse and frequent among diverse Canadian public safety personnel; (b) many different types of exposure can be associated with mental disorders; (c) event exposures are associated with diverse mental disorders, including but not limited to posttraumatic stress disorder, and mental disorder screens would be substantially reduced in the absence of exposures; and (d) population attributable fractions indicated a substantial reduction in positive mental disorder screens (i.e., between 29.0 and 79.5%) if all traumatic event exposures were eliminated among Canadian public safety personnel.

Public Significance Statement

Growing evidence suggests that many first responders and other public safety personnel in Canada may be experiencing substantial difficulties with symptoms of mental health disorders. There have been suggestions that such difficulties may be associated with increased exposure to potentially traumatic events as part of working in public safety, with some people suggesting specific types of events may be particularly problematic. The current results support both suggestions and may be important for informing the national action plan mandated by the Prime Minister of Canada.

Keywords: trauma, critical incidents, Public Safety Personnel, mental health disorders, operational stress injuries

An event is considered potentially traumatic when exposure includes direct or indirect experiences of actual or threatened death, serious injury, or sexual violence (American Psychiatric Association, 2013). Most of the North American general population (i.e., 50–90%) are exposed to one or more potentially traumatic events during their lifetime (Kilpatrick et al., 2013; Perrin et al., 2014). Posttraumatic stress disorder (PTSD) is one potential outcome from such exposures (American Psychiatric Association, 2013; Kilpatrick, Resnick, & Acierno, 2009); however, only 5–10% of persons in the general population develop PTSD as a result of such exposures (Ozer, Best, Lipsey, & Weiss, 2003). Other mental disorders are also thought to be possible sequelae to traumatic exposure (e.g., major depressive disorder, panic disorder; Nixon, Resick, & Griffin, 2004; O'Donnell, Creamer, & Pattison, 2004; Perkonigg, Kessler, Storz, & Wittchen, 2000; Shalev et al., 1998).

Revisions for the *Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition* (*DSM–5*) allow for cumulative exposures, instead of singularly identifiable exposures, to meet criteria for and contribute to mental health disorder symptoms (American Psychiatric Association, 2013; Kilpatrick et al., 2009). The *DSM* change may be extremely important for persons exposed to multiple traumatic events, such as those working to ensure the safety of our communities. Public safety personnel include, but are not limited to, persons working as correctional workers (security and nonsecurity roles), dispatchers, firefighters, paramedics, and police officers (Oliphant, 2016).

There is broad international evidence that public safety personnel may have substantially more difficulties with mental disorders than the general public (Berger et al., 2012; Faust & Ven, 2014; Haugen, Evces, & Weiss, 2012; Neria, DiGrande, & Adams, 2011; Oliphant, 2016; Stanley, Hom, & Joiner, 2016). Canadian public safety personnel have also reported substantial difficulties with clinically significant symptoms of one or more mental disorders (e.g., PTSD, major depressive disorder, and panic disorder; Asmundson & Stapleton, 2008; Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018; Corneil, Beaton, Murphy, Johnson, & Pike, 1999; Haugen et al., 2012; Horswill, Jones, & Carleton, 2015; Oliphant, 2016). A recent study (Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018) assessed a large sample of Canadian public safety personnel and found that approximately 44.5% screened positive for one or more mental health disorders, primarily PTSD (23.2%) or major depressive disorder (26.4%). There were also significant differences identified between public safety personnel categories (e.g., municipal/provincial police relative to Royal Canadian Mounted Police) that imply potential important differences in their experiences. In all cases, the screening rates starkly contrast the population diagnostic rates of one or more current diagnostic mental health disorders (i.e., 10.1%; Statistics Canada, 2012).

The apparent differences between mental health disorders across public safety personnel and between public safety personnel and the general population may be due, in part, to diversity in exposures to potentially traumatic events (Galatzer-Levy, Madan, Neylan, Henn-Haase, & Marmar, 2011; Komarovskaya et al., 2011; Turner, Taillieu, Carleton, Sareen, & Afifi, in press). There is an anecdotally reasonable presumption that public safety personnel experience higher exposure frequencies to potentially traumatic events than the general public; however, the published empirical data on such exposures using general population measures remains sparse, particularly for Canadians. General population estimates suggest as many as 50–90% of people will be exposed to one or

more potentially traumatic events during their lifetime, including unexpected death of a loved one (Kilpatrick et al., 2013; Perrin et al., 2014). The limited data available for public safety personnel exposures to potentially traumatic events as assessed among the general population suggests higher exposure frequencies. For example, a study assessing Canadian and American firefighters where the authors coded potentially traumatic events as being critical evidenced most participants (90%) are exposed to at least one potentially traumatic event within the past year, many involving encountering death by suicide, or graphic, deadly tragedies (Corneil et al., 1999).

Despite the limited empirical data on potentially traumatic events experienced by public safety personnel, the anecdotal expectation of higher exposure frequencies has led to the creation of a related category of events, called critical incidents, to distinguish relatively common potentially traumatic event exposures from exposures thought more likely to be problematic. Critical incidents are situations that cause public safety personnel, "to experience unusually strong emotional reactions which have the potential to interfere with their ability to function either at the scene or later" (Mitchell, 1983, p. 36) and can include "all physical custody (arrests), all vehicle and foot pursuits, all dispatched code responses (emergency), all motor vehicle accidents that require physical work and all calls which present an active threat to life and/or property" (Anderson, Plecas, & Segger, 2001, p. 18). There is no requirement for a critical incident to include direct or indirect experiences of actual or threatened death, serious injury, or sexual violence (American Psychiatric Association, 2013), but the context suggests an inherent overlap with potentially traumatic events experienced by public safety personnel.

A measure specifically assessing critical incidents among firefighters and paramedics ($n = 173$) was developed with an American firefighter sample (Beaton, Murphy, Johnson, Pike, & Corneil, 1998). The results suggested frequent exposures to potentially traumatic events and that critical incidents typically involved one or more of the following categories: (a) catastrophic injury to self or coworker; (b) gruesome victim incidents, render aid to seriously injured people; (c) vulnerable victims; (d) minor injury to self and death; and (e) dying exposure as categories. In addition, research using critical incident inventories with public safety personnel, rather than potentially traumatic event inventories used with general population measures, remains sparse and homogeneous. Corneil and colleagues (1999) reported on data from a large sample of Canadian firefighters wherein exposure to suicides (39%) and persons dead on arrival because of other than natural causes (25%), as the top two critical incidents based on the Beaton and colleagues' (1999) critical incidents inventory. Another study allowed participants to subjectively identify their own number of critical incidents, but did not present the incident details (Brazil, 2017). A more recent study with firefighters detailed the percentages of exposure to each critical incident and suggested that 85% were exposed to at least one critical incident in the past two months (MacDermid et al., in press). A South African sample of diverse public safety personnel reported critical event exposures averaged from 4.55 to 20.59 times within the preceding 2 months alone (Ward, Lombard, & Gwebushe, 2006). A small sample ($n = 31$) of United Kingdom firefighters reported between 16 and 100% had experienced each type of critical incident from a list of nine adapted options (Haslam & Mallon, 2003). Among a sample of American paramedic personnel, the five most common critical incidents had significant overlap with the five most distressing potentially traumatic events—seeing someone die, a recently dead body, badly beaten adult, or a severely neglected child; completing a death notification; and involving someone familiar to the crew (Donnelly & Bennett, 2014).

Efforts at creating inventories of potentially traumatic events and critical incidents that are specific to public safety personnel (Beaton et al., 1998) remain extremely laudable and important; however, understanding event exposure frequencies using general population measures (e.g., the PTSD life events checklist; Blevins, Weathers, Davis, Witte, & Domino, 2015; Weathers et al., 2013) would provide important insights for researchers, public safety personnel leaders, and policymakers who are trying understanding the experiences of public safety personnel.

The presumed frequent exposure of public safety personnel to diverse potentially traumatic critical incidents, coupled with the apparent higher risk for mental health sequelae (Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018; Oliphant, 2016; J. D. Richardson, Darte, Grenier, English, & Sharpe, 2008), led to the development of strategies intended to minimise the impact of critical incidents—specifically, critical incident stress management programs and, therein, critical incident stress debriefing programs (Canadian Institute for Public Safety Research and Treatment [CIPSRT], 2016). The critical incident stress management programs were intended to bolster mental health before, during, and after exposures to potentially traumatic critical incidents. Critical incident stress debriefing programs are intended to be components of critical incident stress management programs that follow a specific event designated as a critical incident (CIPSRT, 2016; Mitchell, 1983). There remains a great deal of debate about critical incident stress management and critical incident stress debriefing (CIPSRT, 2016); nevertheless, identifying the most common potentially traumatic events experienced by public safety personnel as the "worst event," whether or not those events would be considered critical incidents, would be important for understanding public safety personnel experiences and for determining when to engage additional mental health resources. In addition, understanding the relationships between different potentially traumatic events and different mental health disorders may also help to inform when additional resources should be engaged and with what kinds of symptom focus.

Overall, the previously published results represent important, but very preliminary, data elucidating public safety personnel experiences, as well as providing some direction for public safety personnel leaders regarding when to engage additional mental health services. However, there are currently no empirical assessments using general population measures to inventory the frequency or diversity of potentially traumatic events, or which event types public safety personnel perceive as the worst event, in large heterogenous samples of Canadian public safety personnel. There is also no currently available evidence assessing the relationships between different potentially traumatic event types and different mental health disorders in large heterogenous samples of Canadian public safety personnel. The current research was designed to (a) better understand the relative frequencies of potentially traumatic events encountered by diverse Canadian public safety personnel; (b) better understand which potentially traumatic events are most likely to be considered worst and therein potentially critical inci-

dents; (c) assess for differences between categories of public safety personnel; (d) assess for relationships across public safety personnel categories between potentially traumatic events and positive screenings for diverse mental disorders; and (e) assess the population attributable fractions associated with different potentially traumatic event exposures among public safety personnel. Doing so is critical for educating the general public and informing public safety personnel leadership at all levels about the experiences of Canadian public safety personnel.

Method

Data and Sample

The current data were collected using a Web-based self-report survey made available to public safety personnel participants in English or French as part of a larger study (Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018). The research followed established guidelines for Web-based surveys (Ashbaugh, Herbert, Butler, & Brunet, 2010). Participation was solicited through emails sent to actively working public safety personnel, including civilian members working for police and volunteer firefighters. A total of $N = 8{,}520$ began the survey (Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018), of whom $N = 4{,}441$ public safety personnel participants could be definitively placed into one of the six public safety personnel categories of interest in this study (i.e., municipal/provincial police; Royal Canadian Mounted Police (RCMP); corrections workers; firefighters; paramedics; and call centre operators/dispatchers) and responded to the traumas and stressors module in the survey, producing a completion rate of 52.1%. The study was approved by R. Nicholas Carleton's University of Regina institutional research ethics board (File #2016–107).

Sample representativeness was determined by comparing the demographic proportions for sex, age, and provincial region in the current sample to data provided by Statistics Canada for public safety personnel using the 2011 National Household Survey and the National Occupational Classification (Statistics Canada, 2012). The results demonstrated that the sex distribution was similar among firefighters, municipal/provincial police, paramedics, Royal Canadian Mounted Police; that the age distribution was similar with regard to municipal/provincial police, paramedics, Royal Canadian Mounted Police; and that the provincial distribution was similar for correctional officers, firefighters, municipal/provincial police, Royal Canadian Mounted Police. Further details are available in previous studies (i.e., Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018, Carleton, Afifi, Turner, Taillieu, LeBouthillier, et al., 2018).

Traumatic Exposures

The Life Events Checklist for the *DSM–5* (LEC-5; Blevins et al., 2015; Weathers et al., 2013) was used to assess participants' lifetime exposure to any of the 16 different potentially traumatic events (see Table 1 for specific traumatic events). There were two items from the LEC-5 that were modified slightly to differentiate experiences that are relatively more common for public safety personnel—specifically, "natural disaster" was revised to "a life-threatening natural disaster" and "transportation accident" was revised to "a serious transportation accident." Participant responses were coded as having been exposed to a specific traumatic event if they reported that: (a) it happened to them personally, (b) they witnessed it happen to someone else, (c) they learned about it happening to a close family member or close friend, and/or (d) they were exposed to it as part of their jobs as public safety personnel. Respondents could select all that applied, left blank, or checked off "does not apply" for events to which they were not exposed. The total number of different traumatic exposures was also computed by summing exposures across the 16 items. Although the percentage of missing responses on each individual potentially traumatic event item was small (range from 1.4 to 11.0%), cumulatively missing values compromised computation of the exact number of different traumatic exposures for several participants. Therefore, we allowed up to two missing values in the calculation of the total number of different traumatic exposures variables. An additional 721 respondents, or 16.2% of the final sample, were excluded from the total number of traumatic exposures variable because of three or more missing values. These analytic choices likely resulted in a slightly more conservative estimate of the total number of different traumatic exposures for this sample. Cronbach's α for the scale assessing the total number of traumatic events was 0.81.

Participants were also asked to identify which traumatic event was, for them, the worst or most distressing event. That is, if more than one of the events happened, the participant was asked to identify the one event that currently causes them the most distress (i.e., "Please think about the events that you have experienced in your lifetime and consider which event from the list was the worst, most distressing event. If more than one of these events happened to you, select the one event that currently causes you the most distress"). The potentially traumatic events most frequently identified as the worst, most distressing events can reasonably be considered for inclusion in a list of critical incidents.

Mental Disorder Symptoms

Current mental disorder symptoms were assessed using several reliable, validated self-report mental disorder screening measures. PTSD was assessed with the PTSD Check List 5 (PCL-5; Ashbaugh, Houle-Johnson, Herbert, El-Hage, & Brunet, 2016; Blevins et al., 2015; Bovin et al., 2016; MacIntosh, Séguin, Abdul-Ramen, & Randy, 2015; Weathers et al., 2013) based on a past-month timeframe. A positive screen for PTSD was indicated if the participant reported at least one traumatic exposure on the LEC-5 (PTSD follow up questions based on single worst traumatic event, most distressing event, or event that was currently causing the most distress), met minimum criteria on each PTSD cluster, and had a total score >32 on the PCL-5 (Weathers et al., 2013). Depression was assessed with the 9-item Patient Health Questionnaire (PHQ-9; Beard, Hsu, Rifkin, Busch, & Björgvinsson, 2016; Kroenke, Spitzer, & Williams, 2001; Kroenke, Spitzer, Williams, & Löwe, 2010; Löwe et al., 2004) based on a past 14-day timeframe and was indicated by a total score >9 (Manea, Gilbody, & McMillan, 2015). Generalised anxiety was assessed with the 7-item Generalised Anxiety Disorder scale (GAD-7; Beard & Björgvinsson, 2014; Kroenke et al., 2010; Spitzer, Kroenke, Williams, & Löwe, 2006) based on a past 14-day timeframe and was indicated by a total score >9 (Swinson, 2006). Social anxiety was

Table 1
Prevalence of Potentially Traumatic Exposure Types Across Canadian Public Safety Personnel Categories

Type of exposure	Total % (*n*)	Municipal/provincial police[a] % (*n*)	RCMP[b] % (*n*)	Correctional workers[c] % (*n*)	Firefighters[d] % (*n*)	Paramedics[e] % (*n*)	Call centre operators/ dispatchers[f] % (*n*)	χ^2	Significant differences between public safety personnel categories
Life threatening natural disaster	66.4 (2,832)	61.2 (676)	70.2 (804)	51.0 (276)	71.4 (484)	74.9 (445)	73.1 (147)	109.08***	a < b, d, e, f b < e c < a, b, d, e, f
Fire or explosion	86.0 (3,727)	85.8 (965)	88.4 (1,026)	61.8 (337)	98.0 (687)	89.2 (534)	86.8 (178)	357.76***	a < d, e b < d c < a, b, d, e, f e < d f < d
Serious transportation accident	93.2 (4,084)	94.7 (1,071)	95.9 (1,129)	74.1 (409)	98.3 (693)	97.2 (590)	92.3 (192)	382.36***	a < d, e b < d c < a, b, d, e, f f < b, d, e
Serious accident at work, home, or during recreational activity	81.6 (3,430)	81.0 (878)	79.2 (882)	75.0 (408)	87.0 (587)	88.4 (520)	77.9 (155)	53.44***	a < d, e b < d, e c < a, d, e f < d, e
Exposure to toxic substance	67.4 (2,664)	61.7 (623)	67.3 (705)	49.6 (247)	89.6 (592)	73.1 (396)	52.1 (101)	262.99***	a < b, d, e b < d, e c < a, b, d, e e < d f < a, b, e, d
Physical assault	90.6 (3,931)	95.3 (1,082)	95.4 (1,120)	88.7 (496)	75.7 (504)	93.7 (564)	80.5 (165)	268.26***	c < a, b, e d < a, b, c, e f < a, b, c, e
Assault with a weapon	83.9 (3,639)	90.2 (1,017)	91.7 (1,078)	78.8 (439)	64.6 (437)	83.2 (496)	82.3 (172)	283.12***	c < a, b d < a, b, c, e, f e < a, b f < a, b
Sexual assault	71.2 (3,035)	75.6 (849)	80.7 (939)	65.9 (355)	44.5 (287)	75.4 (445)	78.1 (160)	303.58***	a < b c < a, b, e, f d < a, b, c, e, f e < b
Other unwanted or uncomfortable sexual experience	67.3 (2,803)	69.5 (765)	75.0 (852)	69.3 (368)	39.2 (246)	73.6 (416)	76.5 (156)	276.51***	a < b, f c < b d < a, b, c, e, f
Combat	18.8 (791)	19.0 (207)	20.6 (231)	19.8 (106)	13.1 (87)	21.8 (129)	15.4 (31)	21.77***	d < a, b, c, e
Captivity	30.5 (1,279)	33.8 (370)	36.5 (416)	42.2 (225)	8.9 (58)	20.6 (117)	46.7 (93)	254.27***	a < c, f b < c, f d < a, b, c, e, f e < a, b, c, f
Life threatening illness or injury	76.7 (3,301)	73.9 (828)	75.5 (870)	77.9 (430)	74.0 (502)	83.8 (498)	84.0 (173)	31.91***	a < e, f b < e, f c < e d < e, f
Severe human suffering	79.1 (3,234)	79.7 (844)	79.4 (859)	71.2 (371)	80.5 (528)	85.5 (502)	70.7 (130)	43.23***	a < e b < e c < a, b, d, e d < e f < a, b, d, e
Sudden violent death	93.8 (4,101)	95.2 (1,080)	95.7 (1,126)	85.6 (475)	93.2 (647)	95.7 (578)	93.8 (195)	79.79***	c < a, b, d, e, f d < b
Sudden accidental death	93.7 (4,063)	95.0 (1,070)	95.1 (1,113)	80.6 (435)	96.7 (669)	97.0 (585)	92.3 (191)	186.68***	c < a, b, d, e, f f < d, e
Serious injury, harm, or death you caused to someone else	36.2 (1,485)	48.1 (511)	43.1 (479)	29.0 (154)	20.1 (129)	30.3 (169)	21.7 (43)	198.15***	b < a c < a, b d < a, b, c, e e < a, b f < a, b, c, e
Total number of different types of potentially traumatic exposures, *M* (*SD*)	11.08 (3.23)	11.36 (3.16)	11.64 (3.04)	9.88 (3.88)	10.22 (2.84)	11.59 (2.86)	10.96 (3.56)	$F = 32.76$***	c < a, b, e, f d < a, b, e, f f < b, e

Note. RCMP = Royal Canadian Mounted Police. Different lettered superscripts indicate public safety officer categories than differ from one another at $p \leq .05$. Differences in prevalence estimates across categories were tested by changing the reference group in logistic regression models. Differences in mean scores across public safety personnel categories were tested by changing the reference group in linear regression models.
*** $p \leq .001$.

assessed with the 14-item Social Interaction Phobias scale (SIPS; Carleton et al., 2009, 2014; Duranceau, Peluso, Collimore, Asmundson, & Carleton, 2014; Menatti et al., 2015; Reilly, Carleton, & Weeks, 2012) based on current symptoms and was indicated by a total score >20 (Carleton et al., 2009). Panic disorder was assessed with the 7-item Panic Disorder Symptoms Severity scale (PDSS; Furukawa et al., 2009; Shear et al., 1997, 2001) based on a past 7-day timeframe and was indicated by a total score >7 (Shear et al., 1997). Alcohol use disorder was assessed with the Alcohol Use Disorders Identification Test (AUDIT; Gache et al., 2005; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) based on a past 12-month timeframe and was indicated by a total score >15 (Gache et al., 2005). Participants were also asked whether they had been diagnosed with several other mental disorders including obsessive–compulsive disorder, persistent depressive disorder, bipolar I, bipolar II, and cyclothymic disorder. The low prevalence of these disorders precluded the examination of each specific self-reported mental disorder with traumatic events. As such, these mental disorders were only included in the any positive mental disorder screen variable. A dichotomous any positive mental disorder screen was computed based on whether the participant had a positive screen on one or more screening measures and/or self-reported mental disorders.

Sociodemographic Covariates

Sociodemographic covariates included sex (male or female), age (19 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, or 60 years and older), marital status (married/common-law, remarried, separated/divorced/widowed, or single), race/ethnicity (White or other), education (high school or less, some postsecondary less than 4 year college/university program, or university degree/4-year college or higher), urban versus rural work location (urban or rural), province of residence (Western Canada, Eastern Canada, Atlantic Canada, Northern Territories), and total years of service (less than 4 years, 4 to 9 years, 10 to 15 years, or more than 15 years).

Statistical Analyses

First, cross tabulations with χ^2 tests for associations were computed to examine the distribution of traumatic exposures, the frequency of different traumatic exposures, and the worst traumatic exposures across the six public safety personnel categories. Differences across public safety personnel categories were tested by changing reference groups in a logistic regression model. Differences in mean scores on the total number of different traumatic exposures across public safety personnel categories were calculated using a one-way analysis of variance (ANOVA), and differences across categories were tested using coefficients derived from a linear regression model. We also present the reported frequency of lifetime exposure for each different potentially traumatic event type among respondents who reported having ever been exposed to that specific trauma. The frequency options ranged from 1 to 10, and then included an 11+ option; however, the results were grouped from 1 to 5, 6 to 10, and 11+ to facilitate analytic comparisons.

Second, a series of multivariate logistic regression models were run to examine the association of each type of traumatic exposure with positive mental disorder screens. The models were adjusted for sociodemographic covariates (i.e., sex, age, marital status race/ethnicity, education, urban/rural work location, province of residence, and total years of service) and public safety personnel category.

Third, there is a statistical procedure called population attributable fractions that can be used to estimate the proportion of the mental health disorders that might be decreased if the potentially traumatic event exposure had not occurred (Last, 2001). The population attributable fraction size depends on the relationship strength between the potentially traumatic event exposure and mental health disorders (Young, 1998). Researchers have used population attributable fractions in previous research with civilian and military populations to understand the impact of childhood abuse on mental health and suicide (Cougle, Resnick, & Kilpatrick, 2009; Najavits & Capezza, 2014; O'Donnell et al., 2004; Stein & Kennedy, 2001). Population attributable fractions were computed from estimates derived from the multivariate logistic regression models to estimate the extent to which positive mental disorder screens might be reduced if traumatic exposures were eliminated. All population attributable fraction analyses were conducted using the *punaf* module in Stata Version 15. Results at $p < .05$ were considered statistically significant.

Results

Exposure Frequencies to Potentially Traumatic Events

Details of exposure frequencies to potentially traumatic events as self-reported by participants are provided in Table 1. There were significant differences identified across many, but not all, of the public safety personnel category comparisons. The most commonly reported potentially traumatic event types across the public safety personnel categories were: sudden violent death (93.8%), sudden accidental death (93.7%), serious transportation accident (93.2%), physical assault (90.6%), fire or explosion (86.0%), assault with a weapon (83.9%), and serious accident at work, home, or during a recreational activity (81.6%).

On average, public safety personnel reported exposure to 11.08 (SD = 3.23) out of 16 different types of potentially traumatic events. There were significant mean differences across public safety personnel categories as detailed in the bottom row of Table 1. Public safety personnel who were RCMP (11.64), paramedics (11.59), and municipal/provincial police (11.36) tended to report the highest mean levels of diverse exposures; in contrast, correctional workers (9.88), firefighters (10.22), and call centre operators/dispatchers (10.96) reported lower mean levels of diverse exposures. There were also several statistically significant differences across public safety personnel categories in the frequency of different types of exposure, indicating substantial variability across occupational groups. For example, relative to some other public safety personnel categories, firefighters were often more commonly exposed to life threatening natural disasters; fires or explosions; serious transportation accidents; serious accidents at work, home, or during recreational activity; severe human suffering; sudden accidental death; and toxic substances, but less commonly exposed to physical assault, assault with a weapon, sexual assault, or other unwanted or uncomfortable sexual experiences. Despite the significant differences between the public safety personnel

categories, the prevalence of exposure to all types of potentially traumatic events, including combat and captivity, were all substantial and appear to warrant concern.

The frequencies of exposure for each potentially traumatic event type are provided in Table 2. The potentially traumatic event identified as occurring most frequently across all public safety personnel was a serious transportation accident (i.e., 71.3% who reported being exposed to that event type reported the exposures occurred 11 or more times during their life span). In contrast, exposure to a life-threatening natural disaster occurred least frequently (i.e., 91.7% who reported being exposed to that event type reported the exposures occurred fewer than six times). There was substantial variability with respect to exposure frequency to each potentially traumatic event type, suggesting that while most public safety personnel will be exposed to most types of potentially traumatic event (see Table 1), the frequency of exposure appears influenced by their most typical duties (see Table 2). For example, 89.0% of firefighters exposed to fire or explosion reported 11+ exposures, whereas 82.7% of correctional workers exposed to fire or explosion reported fewer than six exposures.

Worst, Most Distressing Potentially Traumatic Events—Critical Incidents

Table 3 presents how frequently each type of potentially traumatic event was identified as the worst event, and therein considered a possible critical incident, either for the entire sample or for each public safety personnel category. Across the entire sample, the potentially traumatic events most commonly identified as the worst event were sudden violent death (28.0%), followed by sudden accidental death (14.0%), and serious transportation accident (13.9%). Across public safety personnel categories the percentages for each of three events most commonly identified as worst were generally comparable, except for correctional workers. Correctional workers most commonly identified sudden violent death as the worst event, but appeared to more commonly identify a physical assault as the worst event relative to other public safety personnel categories and to less commonly identify a serious transportation accident or a sudden accidental death as the worst event. Despite the general comparability, there were important differences in other areas that may also warrant careful consideration. For example, firefighters appeared to more commonly to identify a fire, an explosion, or a serious transportation accident as the worst event relative to some other public safety personnel categories, followed by sudden accidental death, but less commonly identified physical assault, assault with a weapon, or sexual assault as the worst event. Municipal/provincial police and RCMP more commonly identified a sudden violent death as the worst event relative to other public safety personnel categories, whereas firefighters and paramedics more commonly identified a sudden accidental death as the worst event relative to other public safety personnel categories. Indeed, a sudden violent death was reported as the worst event for all groups except firefighters. The patterns of differences may be driven primarily by work-related duties, but other factors such as perceived responsibility and available support may also be critical determinants.

Potentially Traumatic Events and Positive Screens for Mental Disorders

The relationships between potentially traumatic events and positive screens for mental disorders are presented in Table 4. All of the models were adjusted for sociodemographic covariates as well as public safety personnel category to facilitate reliable comparisons. Most exposures to potentially traumatic events were associated with significantly increased odds of screening positive for several mental disorders. There was substantial diversity across the results; nevertheless, there were several fairly consistent patterns. Positive screening for PTSD was significantly associated with all types of trauma except for serious transportation accidents and sudden accidental death (significant Adjusted Odds Ratios [AORs] ranged from 1.23 for natural disaster to 2.51 for severe human suffering). Positive screening for depression was significantly associated with all types of trauma except for fire or explosion (significant AORs ranged from 1.19 for serious injury, harm, or death they caused to someone else to 2.01 for severe human suffering). Positive screening for generalised anxiety disorder was significantly associated with all types of trauma except captivity, life threatening illness or injury, and serious injury, harm, or death they caused to someone else (significant AOR ranged 1.27 for natural disaster to 2.07 for severe human suffering). Positive screening for panic disorder was significantly associated with all types of trauma except for serious transportation accident, life threatening illness or injury, and sudden violent death (significant AOR ranged 1.29 for captivity to 2.77 for severe human suffering). There were also several dose-response relationships such that the odds of screening positive for PTSD (AORs 1.10, 95% confidence interval, CI [1.09, 1.16], $p < .001$), depression (AOR 1.10, 95% CI [1.07, 1.13], $p < .001$), generalised anxiety disorder (AOR 1.08, 95% CI [1.05, 1.11], $p < .001$), and panic disorder (AOR 1.16, 95% CI [1.10, 1.21], $p < .001$) all increased as the total number of exposures to different types of potentially traumatic events increased.

The associations between potentially traumatic events and screening positive for social anxiety disorder appeared more variable. Screening positive for social anxiety disorder was only significantly associated with exposure to a toxic substance (AOR 1.29, 95% CI [1.05, 1.59], $p < .05$), physical assault (AOR = 1.43, 95% CI [1.01, 2.03], $p < .05$), sexual assault (AOR = 1.26, 95% CI [1.02, 1.56], $p < .05$), other unwanted or uncomfortable sexual experience (AOR = 1.33, 95% CI [1.08, 1.63], $p < .01$), captivity (AOR = 1.22, 95% CI [1.002, 1.47], $p < .05$), and severe human suffering (AOR = 1.52, 95% CI [1.20, 1.94], $p < .001$). Despite several nonsignificant relationships, there was nonetheless a dose-response relationship such that the odds of screening positive for social anxiety disorder increased as the total number of exposures to different types of potentially traumatic events increased (AOR 1.04, 95% CI [1.01, 1.07], $p < .05$).

The associations between potentially traumatic events and screening positive for an alcohol use disorder also appeared more variable. Screening positive for an alcohol use disorder was only significantly associated with exposure to physical assault (AOR = 2.10, 95% CI [1.19, 3.17], $p < .05$) and sudden violent death (AOR = 3.39, 95% CI [1.36, 8.43], $p < .01$). In contrast, screening positive for an alcohol use disorder was significantly inversely associated with combat exposure (AOR = 0.61, 95% CI [0.41,

Table 2
Prevalence of Potentially Traumatic Exposures Among Canadian Public Safety Personnel Categories

Type of exposure	Total % (*n*)	Municipal/provincial police % (*n*)	RCMP % (*n*)	Correctional workers % (*n*)	Firefighters % (*n*)	Paramedics % (*n*)	Call centre operators/ dispatchers % (*n*)
Life threatening natural disaster							
1 to 5 times	91.7 (2,376)	96.7 (590)	93.5 (700)	94.0 (236)	80.4 (360)	93.2 (369)	88.3 (121)
6 to 10 times	3.5 (90)	2.1 (13)	3.7 (28)	−[1]	6.5 (29)	2.8 (11)	3.7 (5)
11 or more times	4.8 (125)	1.2 (7)	2.8 (21)	4.4 (11)	13.2 (59)	4.0 (16)	8.0 (11)
Fire or explosion							
1 to 5 times	50.4 (1,805)	62.7 (584)	59.8 (596)	82.7 (253)	7.4 (50)	50.8 (257)	39.2 (65)
6 to 10 times	10.1 (361)	13.4 (125)	12.8 (127)	4.6 (14)	3.7 (25)	11.1 (56)	8.4 (14)
11 or more times	39.6 (1,419)	23.9 (222)	27.5 (273)	12.8 (39)	89.0 (605)	38.1 (193)	52.4 (87)
Serious transportation accident							
1 to 5 times	22.7 (907)	18.6 (194)	19.4 (216)	85.8 (331)	7.7 (53)	12.8 (74)	21.2 (39)
6 to 10 times	6.0 (241)	8.1 (84)	7.1 (79)	6.5 (25)	3.5 (24)	4.2 (24)	2.7 (5)
11 or more times	71.3 (2,845)	73.4 (766)	73.5 (818)	7.8 (30)	88.8 (611)	83.0 (480)	76.1 (140)
Serious accident at work, home, or during recreational activity							
1 to 5 times	66.6 (2,091)	69.2 (553)	74.3 (602)	83.1 (310)	60.9 (332)	47.5 (228)	49.6 (66)
6 to 10 times	6.5 (205)	8.0 (64)	6.1 (49)	4.8 (18)	7.7 (42)	5.2 (25)	5.3 (7)
11 or more times	26.9 (844)	22.8 (182)	19.6 (159)	12.1 (45)	31.4 (171)	47.3 (227)	45.1 (60)
Exposure to toxic substance							
1 to 5 times	61.3 (1,439)	75.5 (407)	63.8 (398)	72.6 (146)	34.3 (191)	71.6 (247)	61.0 (50)
6 to 10 times	7.4 (174)	6.7 (36)	7.5 (47)	4.5 (9)	8.4 (47)	8.1 (28)	8.5 (7)
11 or more times	31.3 (735)	17.8 (96)	28.7 (179)	22.9 (46)	57.3 (319)	20.3 (70)	30.5 (25)
Physical assault							
1 to 5 times	41.8 (1,543)	36.5 (377)	36.3 (397)	53.9 (243)	60.8 (262)	44.3 (236)	18.7 (28)
6 to 10 times	9.5 (350)	11.4 (118)	8.8 (96)	8.9 (40)	8.4 (36)	10.3 (55)	3.3 (5)
11 or more times	48.7 (1,797)	52.0 (537)	54.9 (600)	37.3 (168)	30.9 (133)	45.4 (242)	78.0 (117)
Assault with a weapon							
1 to 5 times	57.6 (1,797)	57.7 (519)	54.7 (531)	64.8 (228)	69.2 (225)	60.6 (252)	26.9 (42)
6 to 10 times	9.4 (294)	9.0 (81)	10.4 (101)	5.7 (20)	8.0 (26)	12.5 (52)	9.0 (14)
11 or more times	32.9 (1,027)	33.3 (299)	34.9 (338)	29.6 (104)	22.8 (74)	26.9 (112)	64.1 (100)
Sexual assault							
1 to 5 times	47.1 (1,089)	38.6 (253)	34.0 (248)	73.1 (187)	75.7 (140)	61.2 (208)	36.3 (53)
6 to 10 times	11.0 (255)	12.2 (80)	11.2 (82)	3.1 (8)	11.9 (22)	14.1 (48)	10.3 (15)
11 or more times	41.9 (968)	49.2 (322)	54.8 (400)	23.8 (61)	12.4 (23)	24.7 (84)	53.4 (78)
Other unwanted or uncomfortable sexual experience							
1 to 5 times	55.2 (1,225)	52.0 (314)	50.1 (335)	64.3 (198)	76.8 (129)	61.8 (205)	31.4 (44)
6 to 10 times	7.7 (171)	8.3 (50)	6.1 (41)	4.9 (15)	5.4 (9)	11.1 (37)	13.6 (19)
11 or more times	37.2 (825)	39.7 (240)	43.8 (293)	30.8 (95)	17.9 (30)	27.1 (90)	55.0 (77)
Combat							
1 to 5 times	78.4 (349)	74.4 (99)	78.3 (94)	82.1 (55)	73.2 (30)	83.6 (61)	90.9 (10)
6 times or more	21.6 (96)	25.6 (34)	21.7 (26)	17.9 (12)	26.8 (11)	16.4 (12)	−[1]
Captivity							
1 to 5 times	78.9 (712)	74.6 (209)	77.2 (237)	82.2 (120)	96.6 (28)	92.4 (61)	76.0 (57)
6 times or more	21.2 (191)	25.4 (71)	22.8 (70)	17.8 (26)	−[1]	7.6 (5)	24.0 (18)
Life threatening illness or injury							
1 to 5 times	54.2 (1,594)	57.9 (424)	60.8 (465)	79.0 (300)	48.7 (219)	27.9 (126)	36.6 (60)
6 to 10 times	6.3 (184)	8.2 (60)	7.2 (55)	6.3 (24)	4.4 (20)	3.3 (15)	6.1 (10)
11 or more times	39.6 (1,165)	33.9 (248)	32.0 (245)	14.7 (56)	46.9 (211)	68.8 (311)	57.3 (94)
Severe human suffering							
1 to 5 times	41.8 (1,187)	44.6 (332)	49.1 (372)	55.6 (163)	31.6 (149)	27.8 (128)	38.7 (43)
6 to 10 times	6.2 (177)	6.6 (49)	7.4 (56)	3.8 (11)	6.6 (31)	4.8 (22)	7.2 (8)
11 or more times	51.9 (1,473)	48.8 (363)	43.5 (329)	40.6 (119)	61.9 (292)	67.4 (310)	54.1 (60)
Sudden violent death							
1 to 5 times	36.4 (1,426)	25.6 (268)	30.8 (337)	75.3 (323)	40.4 (249)	33.4 (183)	36.1 (66)
6 to 10 times	13.1 (512)	13.3 (139)	12.6 (138)	10.0 (43)	16.9 (104)	13.5 (74)	7.7 (14)
11 or more times	50.5 (1,977)	61.1 (639)	56.5 (618)	14.7 (63)	42.7 (263)	53.1 (291)	56.3 (103)
Sudden accidental death							
1 to 5 times	34.6 (1,321)	31.2 (316)	29.7 (319)	86.0 (319)	27.0 (171)	26.8 (149)	27.3 (47)
6 to 10 times	10.7 (408)	13.4 (136)	10.6 (114)	5.7 (21)	12.2 (77)	8.4 (47)	7.6 (13)
11 or more times	54.8 (2,092)	55.4 (561)	59.7 (642)	8.4 (31)	60.8 (385)	64.8 (361)	65.1 (112)

Table 2 (*continued*)

Type of exposure	Total % (*n*)	Municipal/provincial police % (*n*)	RCMP % (*n*)	Correctional workers % (*n*)	Firefighters % (*n*)	Paramedics % (*n*)	Call centre operators/ dispatchers % (*n*)
Serious injury, harm, or death you caused to someone else							
1 to 5 times	64.4 (580)	67.1 (230)	65.5 (201)	74.1 (60)	51.6 (33)	56.2 (50)	35.3 (6)
6 to 10 times	6.8 (61)	6.7 (23)	7.5 (23)	8.6 (7)	1.6 (1)	5.6 (5)	—[a]
11 or more times	28.9 (260)	26.2 (90)	27.0 (83)	17.3 (14)	46.9 (30)	38.2 (34)	52.9 (9)

Note. RCMP = Royal Canadian Mounted Police.
[a] Not presented because of insufficient sample size (i.e., $n < 5$).

0.91], $p < .05$), which may be related to evidence that military may report lower past-year prevalence of alcohol use disorders than civilians (e.g., Waller, McGuire, & Dobson, 2015). There was no significant dose-response relationship between screening positive for an alcohol use disorder and the total number of exposures.

Population Attributable Fractions

The relationships between population attributable fractions for types of trauma exposures and positive screenings for mental disorders are presented in Table 5. There are many assumptions that need to be considered when interpreting a population attributable fraction. These assumptions include: (a) a causal relationship between an exposure and outcome, which cannot be assessed with cross-sectional data; and (b) population attributable fractions are influenced by the prevalence of exposure in the population such that higher prevalence produces a higher population attributable fraction. For the current results, the population attributable fraction nonetheless provides an initial estimate of the proportion of an outcome (i.e., a positive screen for a mental disorder) that might be reduced if the exposure (i.e., the specific traumatic event) never occurred. Doing so allows for theoretically relative comparisons of the relationship between each type of trauma and each type of exposure. The population attributable fractions were only calculated where there was a significant association between a positive screening for the mental disorder and exposure to the specific type of trauma (see Table 4).

The results suggest that eliminating all trauma exposures in this population might produce estimated reductions in positive screens for PTSD of 68.0%, depression of 56.8%, generalised anxiety disorder of 51.1%, panic disorder of 79.5%, and social anxiety disorder of 29.1% (see Table 5). There were several specific potentially traumatic events that, if eliminated, would have produced reductions in positive screenings. For example, if we eliminated exposure to severe human suffering in this population, we might see estimated reductions in positive screens for PTSD of 45.6%, for generalised anxiety disorder of

Table 3
Prevalence of Worst Potentially Traumatic Exposures Across Canadian Public Safety Personnel Categories

Type of worst exposure	Total % (*n*)	Municipal/provincial police % (*n*)	RCMP % (*n*)	Correctional workers % (*n*)	Firefighters % (*n*)	Paramedics % (*n*)	Call centre operators/ dispatchers % (*n*)
Life threatening natural disaster	2.0 (77)	1.0 (10)	1.4 (15)	1.5 (7)	2.7 (17)	3.5 (19)	4.9 (9)
Fire or explosion	3.2 (123)	2.2 (22)	2.5 (26)	—[a]	8.0 (51)	3.0 (16)	3.2 (6)
Serious transportation accident	13.9 (540)	12.9 (128)	14.4 (151)	5.9 (28)	22.2 (141)	13.6 (73)	10.3 (19)
Serious accident at work, home, or during recreational activity	3.4 (130)	2.5 (25)	2.5 (26)	4.6 (22)	4.6 (29)	3.7 (20)	4.3 (8)
Exposure to toxic substance	.5 (18)	—[a]	—[a]	1.1 (5)	—[a]	—[a]	—[a]
Physical assault	4.9 (190)	3.9 (39)	5.1 (53)	13.0 (62)	1.3 (8)	3.4 (18)	5.4 (10)
Assault with a weapon	6.3 (245)	8.4 (84)	8.8 (92)	8.4 (40)	1.3 (8)	2.6 (14)	3.8 (7)
Sexual assault	5.1 (196)	5.2 (52)	4.9 (51)	8.2 (39)	1.3 (8)	5.2 (28)	9.7 (18)
Other unwanted or uncomfortable sexual experience	1.4 (53)	.9 (9)	.9 (9)	3.4 (16)	—[a]	2.6 (14)	—[a]
Combat	1.1 (43)	1.6 (16)	1.0 (10)	1.7 (8)	.9 (6)	—[a]	—[a]
Captivity	.6 (25)	.7 (7)	.7 (7)	1.9 (9)	—[a]	—[a]	—[a]
Life threatening illness or injury	6.6 (255)	6.0 (60)	5.5 (58)	12.0 (57)	4.7 (30)	6.1 (33)	9.2 (17)
Severe human suffering	7.0 (272)	6.9 (69)	4.3 (45)	6.9 (33)	8.7 (55)	11.5 (62)	4.3 (8)
Sudden violent death	28.0 (1,086)	32.6 (324)	32.9 (344)	24.0 (114)	21.7 (138)	21.4 (115)	27.6 (51)
Sudden accidental death	14.0 (542)	11.5 (114)	12.3 (129)	6.3 (30)	20.4 (130)	20.5 (110)	15.7 (29)
Serious injury, harm, or death you caused to someone else	2.1 (81)	3.2 (32)	2.7 (28)	.8 (4)	.9 (6)	1.9 (10)	—[a]

Note. RCMP = Royal Canadian Mounted Police.
[a] Not presented because of insufficient sample size (i.e., $n < 5$).

Table 4
Relationship Between Trauma Exposures and Positive Screens for Mental Disorders Among Canadian Public Safety Personnel

Type of exposure	PTSD AOR [95% CI]	Depression AOR [95% CI]	Generalized anxiety disorder AOR [95% CI]	Social anxiety disorder AOR [95% CI]	Panic disorder AOR [95% CI]	Alcohol use disorder AOR [95% CI]	Any mental disorder AOR [95% CI]
Total sample							
Life threatening natural disaster	1.23* [1.04, 1.46]	1.32*** [1.12, 1.55]	1.27** [1.06, 1.53]	1.00 [.82, 1.21]	1.54*** [1.18, 2.00]	.91 [.68, 1.21]	1.15 [.99, 1.33]
Fire or explosion	1.37** [1.08, 1.74]	1.24 [.996, 1.55]	1.38* [1.07, 1.77]	.85 [.66, 1.10]	1.92*** [1.30, 2.82]	1.17 [.76, 1.79]	1.07 [.87, 1.31]
Serious transportation accident	1.30 [.93, 1.81]	1.46* [1.07, 2.01]	1.49* [1.05, 2.13]	.92 [.65, 1.30]	1.24 [.77, 1.99]	1.37 [.75, 2.52]	1.21 [.91, 1.63]
Serious accident at work, home, or during recreational activity	1.65*** [1.32, 2.07]	1.62*** [1.32, 2.00]	1.49*** [1.18, 1.88]	1.16 [.91, 1.47]	1.56** [1.11, 2.18]	1.26 [.86, 1.84]	1.59*** [1.32, 1.91]
Exposure to toxic substance	2.12*** [1.75, 2.57]	1.62*** [1.36, 1.93]	1.44*** [1.19, 1.75]	1.29* [1.05, 1.59]	1.88*** [1.41, 2.50]	.98 [.71, 1.35]	1.49*** [1.27, 1.76]
Physical assault	1.74*** [1.24, 2.43]	1.95*** [1.44, 2.64]	1.55* [1.11, 2.18]	1.43* [1.01, 2.03]	2.19** [1.24, 3.85]	2.10* [1.19, 3.71]	1.65*** [1.28, 2.13]
Assault with a weapon	1.65*** [1.28, 2.12]	1.75*** [1.39, 2.20]	1.48** [1.14, 1.91]	1.08 [.83, 1.39]	1.64* [1.12, 2.39]	1.30 [.88, 1.93]	1.36** [1.12, 1.66]
Sexual assault	1.50*** [1.24, 1.81]	1.46*** [1.23, 1.74]	1.41*** [1.15, 1.72]	1.26* [1.02, 1.56]	1.66*** [1.24, 2.23]	1.28 [.93, 1.75]	1.44*** [1.23, 1.70]
Other unwanted or uncomfortable sexual experience	1.50*** [1.25, 1.80]	1.58*** [1.33, 1.87]	1.49*** [1.23, 1.82]	1.33** [1.08, 1.63]	1.74*** [1.30, 2.32]	1.34 [.99, 1.82]	1.51*** [1.29, 1.77]
Combat	1.43*** [1.18, 1.73]	1.34** [1.12, 1.61]	1.31** [1.07, 1.61]	1.09 [.87, 1.36]	1.51** [1.15, 1.98]	.61* [.41, .91]	1.24* [1.04, 1.49]
Captivity	1.32*** [1.12, 1.56]	1.36*** [1.16, 1.60]	1.19 [.99, 1.42]	1.22* [1.002, 1.47]	1.29* [1.01, 1.65]	1.05 [.77, 1.42]	1.31*** [1.12, 1.53]
Life threatening illness or injury	1.43*** [1.17, 1.73]	1.35*** [1.13, 1.62]	1.13 [.93, 1.38]	1.21 [.97, 1.50]	1.33 [.99, 1.77]	1.25 [.90, 1.73]	1.21* [1.03, 1.43]
Severe human suffering	2.51*** [1.99, 3.18]	2.01*** [1.63, 2.47]	2.07*** [1.63, 2.64]	1.52*** [1.20, 1.94]	2.77*** [1.88, 4.08]	1.30 [.90, 1.87]	1.77*** [1.48, 2.12]
Sudden violent death	1.99*** [1.30, 3.05]	1.83*** [1.27, 2.64]	1.63* [1.09, 2.43]	1.26 [.85, 1.88]	1.78 [.96, 3.29]	3.39** [1.36, 8.43]	1.46* [1.07, 2.00]
Sudden accidental death	1.28 [.90, 1.82]	1.63** [1.16, 2.29]	1.60* [1.10, 2.35]	1.09 [.75, 1.58]	1.89* [1.06, 3.37]	1.44 [.76, 2.74]	1.12 [.83, 1.53]
Serious injury, harm, or death you caused to someone else	1.39*** [1.18, 1.64]	1.19* [1.01, 1.39]	1.14 [.95, 1.36]	1.02 [.84, 1.24]	1.34* [1.05, 1.71]	1.16 [.87, 1.55]	1.15 [.99, 1.33]
Total number of different types of potentially traumatic exposures	1.13*** [1.09, 1.16]	1.10*** [1.07, 1.13]	1.08*** [1.05, 1.11]	1.04* [1.01, 1.07]	1.16*** [1.10, 1.21]	1.05 [.997, 1.10]	1.07*** [1.05, 1.10]

Notes. AOR = odds ratio adjusted for sex, age, marital status, race/ethnicity, education, urban/rural work location, province of residence, total years of service, and public safety officer category; PTSD = posttraumatic stress disorder; CI = confidence interval.
* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

Table 5
Population Attributable Fractions (PAF) for Types of Trauma Exposures on Positive Screens for Mental Disorders Among Canadian Public Safety Personnel

Type of exposure	PTSD PAF % [95% CI]	Depression PAF % [95% CI]	Generalized anxiety disorder PAF % [95% CI]	Social anxiety disorder PAF % [95% CI]	Panic disorder PAF % [95% CI]	Alcohol use disorder PAF % [95% CI]	Any mental disorder PAF % [95% CI]
Total sample							
Life threatening natural disaster	9.96 [1.63, 17.59]	12.73 [5.17, 19.68]	12.32 [2.83, 20.88]	—	23.38 [8.93, 35.54]	—	—
Fire or explosion	18.53 [4.28, 30.66]	—	19.98 [3.93, 33.34]	—	39.84 [17.41, 56.17]	—	—
Serious transportation accident	—	23.11 [3.35, 38.83]	26.30 [2.40, 44.35]	—	—	—	—
Serious accident at work, home, or during recreational activity	27.66 [15.75, 37.89]	25.89 [15.04, 35.36]	23.60 [9.79, 35.29]	—	28.32 [6.82, 44.86]	—	19.78 [11.69, 27.13]
Exposure to toxic substance	33.32 [25.25, 40.51]	21.56 [13.75, 28.67]	18.00 [8.39, 26.60]	13.32 [2.30, 23.09]	32.60 [18.24, 44.44]	—	14.12 [8.34, 19.53]
Physical assault	33.09 [13.21, 48.41]	37.45 [21.32, 50.28]	28.60 [6.47, 45.49]	24.33 [.00, 42.92][a]	48.79 [15.16, 69.08]	47.28 [12.03, 68.41]	23.48 [11.12, 34.11]
Assault with a weapon	28.54 [14.45, 40.31]	30.35 [18.36, 40.58]	24.06 [8.18, 37.19]	—	32.02 [7.49, 50.05]	—	13.75 [4.60, 22.03]
Sexual assault	20.69 [11.14, 29.21]	18.50 [9.93, 26.25]	18.86 [7.70, 28.67]	13.40 [.79, 24.40]	29.53 [12.60, 43.18]	—	13.98 [7.73, 19.81]
Other unwanted or uncomfortable sexual experience	19.72 [10.82, 27.72]	20.93 [13.05, 28.11]	20.85 [10.62, 29.91]	15.45 [3.81, 25.68]	30.66 [14.95, 43.47]	—	14.78 [9.03, 20.17]
Combat	5.31 [2.33, 8.19]	4.02 [1.41, 6.57]	4.27 [.89, 7.54]	—	7.36 [1.93, 12.50]	—	2.15 [.37, 3.90]
Captivity	6.74 [2.51, 10.80]	6.97 [3.22, 10.58]	—	5.13 [.00, 10.15][a]	7.32 [.00, 14.34][a]	—	4.45 [1.87, 6.97]
Life threatening illness or injury	19.10 [8.64, 28.36]	15.83 [6.40, 24.32]	—	—	—	—	7.84 [.86, 14.33]
Severe human suffering	45.63 [35.32, 54.30]	34.84 [25.09, 43.32]	39.18 [27.28, 49.14]	24.84 [10.74, 36.72]	54.55 [37.00, 67.21]	—	23.34 [15.90, 30.13]
Sudden violent death	40.62 [16.28, 57.88]	35.24 [14.02, 51.22]	31.76 [5.15, 50.91]	—	—	67.29 [22.16, 86.25]	18.59 [2.36, 32.13]
Sudden accidental death	—	29.02 [8.72, 44.80]	30.72 [5.70, 49.11]	—	41.90 [3.08, 65.16]	—	—
Serious injury, harm, or death you caused to someone else	9.11 [4.37, 13.62]	4.44 [.23, 8.47]	—	—	9.49 [1.11, 17.15]	—	—
Total number of different types of potentially traumatic exposures	68.02 [55.80, 76.86]	56.77 [43.24, 67.07]	51.11 [33.26, 64.19]	29.06 [3.66, 47.76]	79.46 [64.73, 88.04]	—	39.31 [26.14, 50.13]

Note. PTSD = posttraumatic stress disorder; CI = confidence interval. Population attributable fractions (PAFs) were based on estimates derived from multivariate logistic regression models that adjusted for sex, age, marital status, race/ethnicity, education, urban/rural work location, province of residence, total years of service, and public safety officer category.
[a] Borderline statistical significance. Em dash (—) = population attributable fractions not computed because of nonsignificant adjusted odds ratio.

39.2%, for panic disorder of 54.6%, and for social anxiety disorder of 24.8%. Similarly, if we eliminated exposure to physical assault in this population, we might see estimated reductions in positive screens for depression of 37.5% and for alcohol use disorder of 67.3%. If we eliminated exposures to toxic substances in this population, we might see estimated reductions in positive screens for social anxiety disorder of 13.3% and alcohol use disorder (67.3%).

Discussion

The current research provides novel results that can inform a better understanding of exposure patterns for potentially traumatic events among diverse Canadian public safety personnel, help identify which exposures are potentially critical incidents, and assess for relationships between exposures to potentially traumatic events and positive screenings for diverse mental disorders. Most of the general population report exposure to one or more potentially traumatic events (i.e., 89.7%; Kilpatrick et al., 2013); however, the current results indicate substantial proportions of public safety personnel report a larger number of exposures to many different potentially traumatic events. Most public safety personnel reported being exposed to most of the types of trauma listed in the LEC for *DSM–5* (Blevins et al., 2015; Weathers et al., 2013), and at levels that appear much higher than available estimates from the general population (*Mean* = 11.08, *SD* = 3.23 vs. *Mode* = 3.3, *SD* = 2.32; Kilpatrick et al., 2013, p. 7). Almost all public safety personnel (i.e., more than 90%) reported exposures to each of sudden violent death, sudden accidental death, serious transportation accident, and physical assault. In contrast, among the general population 51.8% report exposure to "death of family/close friend because of violence/accident/disaster" and 53.1% report exposure to "physical or sexual assault" (Kilpatrick et al., 2013, p. 18). Among public safety personnel exposed to a potentially traumatic event type, the frequencies of exposure ranged from 96.6% experiencing the event fewer than 6 times up to 89% experiencing the event 11+ times. Accordingly, the results appear to support the contention that public safety personnel are exposed to a diversity of potentially traumatic events more frequently than the general population (Oliphant, 2016).

There were also significant differences between public safety personnel categories with respect to frequencies of different exposure types. The differences were generally congruent with what may be expected for each type of work. For example, firefighters were more commonly exposed to life threatening natural disasters, fires or explosions, whereas police were more likely to report exposures to serious injury, harm, or death they caused to someone else. Despite the differences, there was also clear overlap in frequency of exposure to each type of event across public safety personnel categories. The overlap is also congruent with what may be expected for public safety personnel work, given that a serious transportation accident, for example, is likely to involve many different public safety personnel categories working interactively to manage the event.

The current results also provide the first information about the events diverse Canadian public safety personnel identified most often as the worst, most distressing events, which can inform decisions regarding designating events as critical incidents. The potentially traumatic event most commonly identified as the worst event was sudden violent death, which was identified twice as often as the next most common events that were sudden accidental death and serious transportation accident. The results are consistent with previous notions that critical incidents typically involve death or gruesome injurious incidents (Beaton et al., 1998; Donnelly & Bennett, 2014) and suggest such events should be considered defensible candidates for critical incidents. The identified events also imply an important role played by uncertainty in perceiving an exposure as potentially traumatic or critical nature of events; specifically, the sudden and, therefore, unexpected nature of the event. Previous research has implicated a critical role for uncertainty in the experience of mental disorders (Carleton, 2016a, 2016b), particularly PTSD (Banducci, Bujarski, Bonn-Miller, Patel, & Connolly, 2016; Boelen, Reijntjes, & Smid, 2016; Fetzner, Horswill, Boelen, & Carleton, 2013; Oglesby, Boffa, Short, Raines, & Schmidt, 2016). Given the potentially moderating influence of an event being unexpected, exposures that are infrequent or inconsistent with expectations (e.g., a firefighter causing serious injury, harm, or death to someone else) should be considered defensible candidates for critical incidents.

Previous research has indicated that potentially traumatic events involving vulnerable victims may play a critical moderating role in whether firefighters and paramedics perceive an event as traumatic or critical (Beaton et al., 1998; Donnelly & Bennett, 2014). Accordingly, events that are particularly unexpected or that involve vulnerable populations (e.g., children) should also be considered defensible candidates for critical incidents. Previous research with firefighters exposed to children who were harmed supports the notion that potentially traumatic events involving vulnerable populations may be particularly likely candidates for critical incidents (Katsavouni, Bebetsos, Malliou, & Beneka, 2016; B. K. Richardson & James, 2017). There may even be sufficient justification to further delineate the types of potentially traumatic events assessed by the LEC (Blevins et al., 2015; Weathers et al., 2013) into adult and child categories to better understand what might constitute critical incident and the relationships between exposure and mental disorders.

There appears to have been a propensity to focus on PTSD as the hallmark mental disorder related to traumatic exposure (American Psychiatric Association, 2000, 2013; Oliphant, 2016). The current results support such biases in that exposures to almost all types of potentially traumatic events were associated with significantly increased odds of positive screening of PTSD; however, the current results also suggest that most exposures to potentially traumatic events were associated with significantly increased odds of screening positive for several different mental disorders, including comorbid indicators for PTSD and major depressive disorder per previous research (Cougle et al., 2009; Najavits & Capezza, 2014; O'Donnell et al., 2004; Stein & Kennedy, 2001). Exposure to sudden violent death was the event most commonly identified as the worst and was associated with increased odds of screening positive for any mental disorder. In contrast, the largest odds ratios for screening positive for any and all disorders, except alcohol use disorders, were associated with exposure to severe human suffering, which was not among the most commonly events identified as worst or most distressing; nevertheless, such exposures may be particularly detrimental to the mental health of public safety personnel and therein defensible as a candidate for critical incidents. Sudden accidental death and serious transportation accidents were

also commonly identified as the worst events. Sudden accidental death was only significantly related to positive screening for depression, generalised anxiety disorder, and panic disorder. Similarly, serious transportation accidents were only significantly related to depression and generalised anxiety disorder.

The current results also indicate a seemingly robust dose-response relationship. Specifically, the odds of screening positive for PTSD, generalised anxiety disorder, panic disorder, and social anxiety disorder all increased as the total number of exposures to different types of potentially traumatic events increased. The results help to inform a previously identified significant relationship between increasing years of public safety personnel service and increasing positive screens for one or more mental disorders (Carleton, Afifi, Turner, Taillieu, Duranceau, et al., 2018). In other words, more time spent in service appears to provide more time for exposure to potentially traumatic events, which appears to increase risk for screening positive for one or more mental disorders. The results also support the utility of the recent cumulative trauma revision to *DSM–5* (American Psychiatric Association, 2013; Kilpatrick et al., 2009).

The population attributable fraction results underscored a substantive and burdensome relationship between exposure to potentially traumatic events and positive screens for mental disorders. The results parallel those of previous research assessing the impact of child abuse on mental disorders and suicide in that the antecedent abuse appears to serve as a potentially critical risk factor (Afifi et al., 2008, 2014; Sareen et al., 2008). Eliminating potentially traumatic events for public safety personnel is likely impractical; nevertheless, the population attributable fraction results suggest doing so may be related to a reduction of positive screenings for PTSD, depression, generalised anxiety disorder, and panic disorder by more than half, as well as nearly one third of positive screenings for social anxiety disorder. The results also implicate exposure to severe human suffering, physical assault, toxic substances, and sudden violent death as defensible candidates for critical incidents. The incomplete association between positive screenings and potentially traumatic events suggests that other variables, such as other operational stressors (e.g., shift work, working alone), organisational stressors (e.g., interactions with coworkers and supervisors), familial stressors (e.g., difficulties caused by public safety personnel lifestyle), and individual differences (e.g., personality) may also be extremely important factors involved in public safety personnel mental health.

Limitations

There are several limitations to the current work that offer directions for future research. First, the public safety personnel sample was self-selected rather than being random and stratified, which means the results may not be broadly representative. Second, participants responded to an anonymous survey, which means potential problems with biased, erroneous, and missing data; furthermore, mental disorders screens are only approximations without diagnostic interviews. Future epidemiological researchers should consider using interviews for assessments and diagnoses. Third, the current results assessed frequencies of exposures to the diverse potentially traumatic events using retrospective recall and an artificially plateaued exposure at 11+ times. Future research should consider using more accurate methods for assessing exposure frequency and allow for no artificial ceiling. Fourth, the prevalence and impact of other operational, organisational, familial stressors, and individual difference variables were not assessed, and may be significant and substantial. Future researchers should assess the impacts of other stressors and individual difference variables on public safety personnel mental health. Fifth, the cross-sectional nature of the data does not allow for potentially important assessments of risk; for example, traumatic stressors could precede and increase vulnerability for other operational stressors, including behaviours requiring performance management, or the reverse could be true. In any case, future researchers should use longitudinal designs to assess for risk factors that can be targeted and to identify best practices for administering additional resources or interventions (e.g., critical incident stress debriefing).

Summary

Overall, the current results offer the first empirical evidence using a general population measure (i.e., LEC-5) with a large sample of diverse Canadian public safety personnel that potentially traumatic event exposures are heterogenous and frequent among Canadian public safety personnel. In addition, despite the frequent focus on PTSD among public safety personnel (Oliphant, 2016), many different types of potentially traumatic event exposure can be associated with many different mental disorders. The results support the growing evidence that traumatic exposures can be significantly associated with several mental disorders, including PTSD, but also depression, generalised anxiety disorder, panic disorder, and social anxiety disorder; accordingly, the results raise important questions about focusing resources exclusively on PTSD for public safety personnel. The current results are also the first empirical evidence of differences in patterns of potentially traumatic event exposure among diverse Canadian public safety personnel. The results suggest a complex interactive pattern between public safety personnel category, types of exposure, uncertainty, perceptions of exposure, and mental disorders.

More important, the current results also offer the first empirical evidence where diverse public safety personnel are assessed using a general population measure (i.e., LEC-5) to identify events perceived as worst and therein arguably candidates for being included as critical incidents (i.e., serious transportation accidents, sudden violent death, and sudden accidental death); however, the current results also evidence disparities between perceptions of specific potentially traumatic events as critical and relationships between specific potentially traumatic events and mental disorders. Specifically, serious transportation accidents and sudden accidental death were not associated with the largest adjusted odds ratios for any disorder; instead, severe human suffering and physical assault produced much larger adjusted odds ratios. In short, whether a specific event constitutes a critical incident and warrants a specific critical incident intervention may be heavily dependent on context; that said, exposures to sudden violent death and severe human suffering both appear to be broadly defensible as particularly problematic for all public safety personnel and their mental health. There also appears to be sufficient evidence that an event could be considered a critical incident whenever a public safety personnel perceives the incident as critical, therein justifying a specific intervention. As such, identifying a subset of criterion A

stressors as critical incidents may miss several important stressors that might otherwise be considered too germane to public safety personnel work to warrant additional resources. The results highlight the need for adequate, pervasive, and evidence-based mental health care treatments and supports to mitigate the negative impact of repeated exposures to diverse potentially traumatic event exposures on public safety personnel.

Résumé

Le personnel de sécurité publique canadien (p. ex. les travailleurs des services correctionnels, les répartiteurs, les ambulanciers et les policiers) sont régulièrement exposés à des événements au potentiel traumatique, certains desquels sont présentés comme des événements critiques justifiant le recours à des ressources additionnelles. Malheureusement, les données disponibles concernant le personnel de sécurité publique canadien qui permettraient de mesurer les associations entre les événements au potentiel traumatique et la santé mentale se font encore rares. La recherche actuelle quantifie les estimations liées à l'exposition à divers incidents parmi plusieurs catégories de personnel de sécurité publique. Au total, 4 441 membres du personnel de sécurité publique (dont 31,7 % de femmes) de six catégories différentes (répartiteurs, travailleurs des services correctionnels, pompiers, policiers municipaux/provinciaux, ambulanciers et agents de la Gendarmerie royale canadienne) ont pris part à l'étude. Parmi les événements rapportés par les participants, notons des morts violentes subites (93,8 %) ou accidentelles (93,7 %), des accidents de la route graves (93,2 %) et des agressions physiques (90,6 %). Souvent, les participants s'étaient retrouvés confrontés 11 fois ou plus à de tels événements. Des relations déterminantes ont été observées entre l'exposition à des événements traumatisants et l'ensemble des troubles mentaux. Les morts violentes subites et la souffrance humaine aiguë semblaient particulièrement reliées aux symptômes de trouble mental. Il était donc justifié de les considérer comme des incidents critiques. Les résultats actuels permettent d'entrée de jeu de conclure que (a) les expositions à des événements au potentiel traumatique sont diversifiées et fréquentes parmi l'ensemble du personnel de sécurité publique; (b) de nombreux types d'expositions peuvent être associés à divers troubles de santé mentale, notamment le trouble de stress post-traumatique, et les tests de dépistage de troubles mentaux seraient considérablement réduits en l'absence d'exposition; et (d) les fractions étiologiques du risque indiquaient une réduction substantielle des résultats positifs aux tests de dépistage de troubles mentaux (soit entre 29,0 % et 79,5 %) si toutes les expositions à des événements traumatisants étaient éliminées chez le personnel de sécurité publique canadien.

Mots-clés : traumatisme, incidents critiques, personnel de sécurité publique, troubles de santé mentale, blessures de stress opérationnel.

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