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Alysha Duivesteyn, HBKin

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TITLE: Contextualizing an Inventory for Identifying Critical Incident Exposure Among Northwestern Ontario Paramedics

AUTHOR: Alysha Duivesteyn, HBKin[1]

SUPERVISORS: Dr. Kathryn Sinden[1] and Dr. Paolo Sanzo[1]

COMMITTEE MEMBER: Dr. Joy MacDermid[2]

1 School of Kinesiology, Lakehead University

2 School of Physical Therapy, Western University

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Abstract

Background: As first responders, paramedics provide pre-hospital care to the public and experience exposure to critical incidents. Critical incidents are events that produce strong emotional reactions in emergency service personnel and may impact their usual coping process. This exposure is thought to contribute to mental health disorders. When exploring paramedic's exposure to critical incidents, existing measures such as the Critical Incident History Questionnaire (for law enforcement personnel) or the Critical Incident Inventory (for fire-emergency workers) are often adapted for context to capture the occupational demands of paramedicine. Northwestern Ontario paramedics serve an area that has higher crime rates compared to the rest of Canada leading to the potential for greater exposure to critical incidents. Northwestern Ontario is also reported to have reduced access to mental health support. The *purpose* of this study was to contextualize the existing Critical Incident Inventory and EMS Critical Incident Stress Inventory for paramedics working in Northwestern Ontario.

Method: Data were collected using semi-structured, recorded individual interviews over Zoom©. Interviews were transcribed verbatim into text and underwent a cognitive interview analysis using a verbal probing technique.

Results: An inventory contextualized to Northwestern Ontario paramedics integrating components from both the Critical Incident Inventory and the EMS Critical Incident Stress Inventory was developed. It includes 32 items and is divided into two sections: timeline of events and impact on respondent's life. Respondents are required to indicate the frequency of exposure to the listed critical incidents within the provided timeline and self-report the perceived impact that the cumulative exposure to each experienced event is currently having on their life.

Conclusion: Overall, exposure to critical incidents is a potential contributing factor in the manifestation of mental disorders among paramedics. The proposed inventory will assist in assessing the types of events Northwestern Ontario paramedics encounter throughout their careers, the frequency of those events, and how they are perceived to impact their life. This information could inform strategies to provide early mental health interventions for paramedics. Future research is recommended to assess the validity and reliability of this proposed inventory as an effective measure.

Keywords: paramedics, measurement development, critical incident exposure, Northwestern Ontario

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List of Abbreviations

CI – Critical Incident

CIE – Critical Incident Exposure

COVID-19 – Coronavirus

PROM – Patient Reported Outcome Measure

PTSD – Post-traumatic Stress Disorder

SNEMS – Superior North Emergency Medical Service

Chapter One: Background Information

Paramedics are healthcare professionals who provide pre-hospital care as part of the communities' emergency response team (Bigham et al., 2014; Regehr et al., 2002). They are responsible for responding to a broad range of emergencies including natural disasters, motor vehicle accidents, as well as minor injuries and illnesses (Bigham et al., 2014; Lawn et al., 2020; Regehr et al., 2002). To become an Ontario paramedic, a unique skill set (e.g., physical strength and mental resiliency) is required along with at least two years of post-secondary education (Ontario Paramedic Association, 2021). It is a physically demanding occupation with the potential for musculoskeletal disorders (e.g., low back strain) as paramedics are required to lift, lower, and carry patients and equipment (Canadian Centre for Occupational Health and Safety, 2021; Fani & Bebetsos, 2016; Lawn et al., 2020; Maguire et al., 2014; Nirel et al., 2008; Ontario Paramedic Association, 2021). They are also required to work in awkward postures as well as in unstable environments such as a high-speed moving ambulance (Lawn et al., 2020; Maguire et al., 2014). According to Maguire et al. (2014), in the United States of America, the rate of non-fatal occupational injuries among paramedics was 34.6 per 100 full-time workers per year. Additionally, mental resiliency is encouraged as paramedics experience abrupt transitions from being in sedentary positions to responding to highly pressured emergencies where they make rapid decisions regarding patient care (Harvey et al., 2016; Lawn et al., 2020). Upon scene arrival, they are responsible for administering immediate treatment and performing advanced, medical, and life-saving procedures (Regehr et al., 2002). It has been suggested that the nature of paramedicine including routine callouts, time pressures as well as exposure to trauma, vicarious trauma (indirect exposure; Behnke et al., 2019), and critical incidents (CIs; defined later in the document) can reduce job satisfaction and contribute to psychological injuries (Fani & Bebetsos,

2016; van der Ploeg & Kleber, 2003). For example, Canadian first responders (e.g., paramedics, firefighters, and law enforcement personnel) demonstrate a four times greater prevalence of mental health disorders in comparison to the general population (Carleton et al., 2018a). Possible adverse mental health conditions experienced by paramedics include post-traumatic stress disorder (PTSD), depression, anxiety, and suicidal ideation as well as substance abuse, addiction, anger, and isolation (Bentley et al., 2013; Carleton et al., 2018b; Eiche et al., 2019; Fjeldheim et al., 2014; Ricciardelli et al., 2018).

Psychological Injuries: Post-traumatic Stress Disorder, Depression, and Anxiety

In North America, the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (DSM-5), established by the American Psychiatric Association, determines the diagnostic criteria for various mental health conditions (American Psychiatric Association [APA], 2020). The following will outline characteristics associated with PTSD, depression, and anxiety.

Post-traumatic Stress Disorder

Post-traumatic stress disorder is an anxiety condition that may develop after an individual has experienced extremely traumatic events (APA, 2021a; APA, 2021b). Individuals with PTSD may relive the event through intrusive recollections, avoid stimuli that remind them of the trauma, and experience negative altered moods and hyper-arousal that disrupt their lives (refer to Figure 1). To be diagnosed with PTSD, symptoms must last longer than four weeks (APA, 2021a). Predicting who will develop this condition is challenging as experienced events are not always indicative of PTSD (Bisson et al., 2015). If two people experience the same trauma, they may not necessarily develop this condition (Bisson et al., 2015). Some risk factors for PTSD include gender and previous exposure to trauma (Paré, 2011; Veterans Affairs Canada, 2019). For example, women in the general population are more likely to develop PTSD after exposure

to trauma compared to their male counterparts (Paré, 2011; Veterans Affairs Canada, 2019; Ward et al., 2006) and those who experienced trauma in the past are more likely to develop PTSD later in life (Veterans Affairs Canada, 2019).

Figure 1

Symptoms of Post-traumatic Stress Disorder

Intrusion	Avoidance	Altered Mood	Hyper-arousal
- Intrusive thoughts (e.g., repeated, involuntary memories) - Distressing dreams - Flashbacks of trauma	- Avoiding reminders of the traumatic event (e.g., people, places, objects, activities) - Avoid thinking of the event	- Inability to remember important aspects of the trauma - Negative thoughts and feelings - Distorted thoughts leading to wrongly blaming self or others - Ongoing fear, horror, anger, guilt, or shame - Feeling detached from others	- Irritability - Anger outbursts - Reckless behaviour - Being easily startled - Having trouble sleeping or concentrating

Note. This figure represents some of the symptoms associated with PTSD. Adapted from *What is Posttraumatic Stress Disorder?,* by American Psychiatric Association, 2021, https://www.psychiatry.org/patients-families/ptsd/what-is-ptsd

Depression

Depression is a complex mood disorder caused by a variety of factors including an individual's personality, levels of stress, and brain chemistry (Centre for Addiction and Mental Health, 2020). The DSM-5 describes it as a loss of pleasure or depressed mood where symptoms occur most of the day, nearly every day for at least two weeks, and disrupt normal functioning (APA, 2013; Centre for Addiction and Mental Health, 2020). Symptoms include lack of energy, sleep disturbances, loss of interest, irritability, fatigue, significant weight loss or gain, feelings of worthlessness, and difficulty making decisions (APA, 2021c; Centre for Addiction and Mental

Health, 2020). Depression may develop depending on different factors including family history, psychological vulnerability, biological factors, gender, or exposure to major stress events (Centre for Addiction and Mental Health, 2020). It is a common mental health disorder with available treatment options (APA, 2021c).

Anxiety

Anxiety is an emotion that is associated with feelings of tension, worried thoughts, and physical changes (e.g., increased blood pressure; APA, 2021d). Specifically, generalized anxiety disorder (GAD) is excessive anxiety and worry about a number of things (APA, 2021d; National Institute of Mental Health, 2016). Generalized anxiety disorder is diagnosed when individuals find it difficult to control worry for at least six months (APA, 2021d; Anxiety and Depression Association of America, 2020). Symptoms include worrying a lot over everyday things, having trouble controlling worry, feeling restless, having difficulty concentrating, irritability, being easily startled, insomnia, dizziness, and sweating (APA, 2021d; National Institute of Mental Health, 2016). The exact cause of GAD is unknown, but it may develop due to biological factors, family history, gender, and stressful life experiences (Anxiety and Depression Association of America, 2020).

Psychological Injuries Among Paramedics

In Canada, the prevalence rate for lifetime PTSD has been reported at 25% for paramedics (Regehr et al., 2002), compared to the predicted lifetime rate of 9.2% for the general Canadian population indicating that paramedics have a higher chance of developing PTSD (Van Ameringen et al., 2008). Compared to other first responder groups in Canada (e.g., firefighters, law enforcement officers, and dispatchers) except for correctional officers, paramedics have reported statistically significantly higher past-year and lifetime suicidal rates, as well as higher

rates compared to correctional officers (but not statistically significantly higher; Carleton et al., 2018a). Carleton et al. (2018a) conducted a study analyzing Canadian first responders' mental health profiles. The results indicated that paramedics had the highest rates of PTSD (24.5%; Carleton et al., 2018a). Additional findings indicated that paramedics had high rates of depression (29.6%) and anxiety (20.5%; Carleton et al., 2018a). Furthermore, a systematic review by Petrie et al. (2018) investigated the prevalence of PTSD and other common mental health disorders amongst ambulance personnel. The review estimated prevalence rates at 11% for PTSD, 15% for depression, 15% for anxiety, and 27% for general psychological distress using quantitative information of 30,878 ambulance personnel (Petrie et al., 2018). Similar results have been identified with a sample of 131 paramedic trainees in South Africa (Fjeldheim et al., 2014). These researchers conducted a study to assess and determine the frequency, nature, and severity of direct trauma exposure and its relationship to associated mood disorders (Fjeldheim et al., 2014). The results indicated that 16% of the respondents had outcomes indicative of PTSD, and 28% had scores suggesting depression (Fjeldheim et al., 2014). Participants meeting PTSD criteria experienced greater exposure to trauma, depression, perceived stress, and physical health symptoms compared to those not meeting the PTSD criteria (Fjeldheim et al., 2014). This suggests that occupational demands of paramedicine, including exposure to trauma, or CIs, may be a contributing factor in the manifestation of mental disorders (Alexander & Klein, 2001; Boland et al., 2018; Carleton et al., 2018a; Fjeldheim et al., 2014; Halpern et al., 2012; Lawn et al., 2020; Petrie et al., 2018).

Critical Incident Exposure

The term, CI, was first coined by Mitchell in 1983 (Halpern et al., 2012; Mitchell, 1983). It refers to events that have the potential to produce strong, abnormal emotional reactions in

emergency service personnel, and impacts their usual coping method and ability to operate either at the event or later (Halpern et al., 2012; Mitchell, 1983). Each paramedic has a unique life experience that may contribute to how they react when responding to a CI, which may increase the difficulty when quantifying CIs and identifying the impact of that exposure (Alexander & Klein, 2001; Donnelly & Bennett, 2014; Maunder et al., 2012). For example, early life trauma, gender, and more frequent exposure to trauma are thought to influence an individual's perception of the severity of an event (Frissa et al., 2016; Maunder et al., 2012). This may result in discrepancies when completing reports on critical incident exposure (CIE). The subjective interpretation of the severity of events may cause some individuals to feel that the listed event does not produce emotional reactions or impact their ability to cope, and therefore, would not be considered a CI whereas others may feel that the listed event is a CI (Frissa et al., 2016). In the realm of paramedicine, events that may constitute as CIs include actual or threatened death, severe injury, incidents involving children, and failed rescue efforts (Donnelly & Bennett, 2014; Halpern et al, 2012).

Critical Incident Exposure and Psychological Injuries

Critical incidents are stressful (Jacobsson et al., 2015). A study by Alexander and Klein (2001) reported that Scottish ambulance personnel (n=110) who experienced a particularly stressful event (82%) within the past six months were more likely to experience adverse mental health conditions, especially if the event involved children, victims known to the person, or if they felt helpless. These findings are supported by other research suggesting that paramedics who experience CIE are at an increased risk for developing PTSD, depression, anxiety, and suicidal ideation (Halpern et al., 2012; Jacobsson et al., 2015; Ward et al., 2006). Other consequences associated with CIE include developing negative attitudes towards patients,

increased absenteeism, increased early retirement, and decreased job satisfaction (Courtney et al., 2013; Donnelly & Bennett, 2014; Kleim & Westphal, 2011). It is difficult to determine if adverse mental health among paramedics is solely related to exposure to CIEs or if it represents a co-influence of factors including CIE. For example, PTSD may be a risk factor for individuals who develop major depression and alcohol use disorders (Breslau et al., 1997). Regardless, it is clear that CIE is an important contributor to mental disorders among paramedics and other first responders.

As mentioned, some research has suggested that paramedics are at an increased risk for adverse mental health conditions due to their exposure to CIs (Alexander & Klein, 2001; Gallagher & McGilloway, 2009; Halpern et al., 2012; van der Ploeg & Kleber, 2003; Ward et al., 2006). For example, 85% of ambulance workers in the Netherlands reported responding to a call that resulted in CIE in the past five years, and 12% reported experiencing PTSD symptoms (van der Ploeg & Kleber, 2003). Regehr et al. (2002) also explored paramedics' exposure to traumatic events and levels of distress with 86 paramedics in a longitudinal study. The results indicated that 100% of the participants experienced exposure to at least one CI throughout their career (Regehr et al., 2002). Furthermore, 2.3% reported severe depression levels, 5.8% had moderate-to-high levels of depressive symptoms, 12.8% had mild-to-moderate symptoms, and 77.9% had mild-to-no depressive symptoms (Regehr et al., 2002). As for PTSD, 25.5% of the 86 participants had severe-or-high symptoms, 14% had moderate symptoms, and 44% were in the low range of symptoms (Regehr et al., 2002). Overall, paramedics are exposed to CIs and develop symptoms of adverse mental health conditions.

Along with adverse mental health conditions, paramedics may also experience occupational burnout. Occupational burnout refers to prolonged exposure to stressors on the job

and has three dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach, 2001). Critical incident exposure and occupational burnout among United States of America Emergency Medical Service (EMS) workers were explored with 209 participants (Boland et al., 2018). The results suggested an 18% prevalence of burnout (Boland et al., 2018). Additionally, the results indicated that the total number of CIs experienced was positively correlated with years in emergency service and that career frequency and severity of events were inversely related (Boland et al., 2018). No evidence supported that cumulative exposure to CIs was associated with burnout (Boland et al., 2018). The researchers, however, noted that an inventory to assess cumulative CIE was lacking and recommended it as an area for future research (Boland et al., 2018). One limitation for consideration when reviewing the results from this study was that the participants were not solely paramedics but also dispatchers, emergency medical technicians, and support staff (Boland et al., 2018). This affects the generalizability of the findings and prevents researchers from fully understanding the impact of the variables on paramedics and their unique job demands. Regardless, the results still indicated symptoms of PTSD, further suggesting that CIE can have an impact on personal health and well-being (Boland et al., 2018; Gallagher & McGilloway, 2009).

Despite the available research indicating that paramedics experience CIE and self-report having high levels of adverse mental health conditions (Bentley et al., 2013; Carleton et al., 2018a; Carleton et al., 2018b; Eiche et al., 2019; Fjeldheim et al., 2014; Gallagher & McGilloway, 2009; Ricciardelli et al., 2018), more research is needed to identify the potential risk for adverse mental health conditions (Boland et al., 2018; Donnelly & Bennett, 2014). In turn, this may contribute to earlier interventions and access to treatment allowing paramedics to receive support to reduce disability associated with exposure. Recent research has highlighted

the need to support first responder's mental health, calling for new action plans (Government of Canada, 2019). For these action plans to be successful, they need to be embedded and based on relevant research. Therefore, patient reported outcome measures (PROMs) may be used by researchers to inform these strategies.

Patient Reported Outcome Measures

A PROM is a measurement tool or instrument that measures outcomes, including a patient's current status based on the patient's self-reported interpretation of the outcome being measured at a particular time (Black, 2013; Meadows, 2011; Weldring & Smith, 2013). For example, self-completed PROMs can be used in research or clinical practice to monitor progress, establish baseline status data, and assess the quality of interventions (Black, 2013; Meadows, 2011). They are measured from the patient's perspective and can be used to capture their functional status, quality of life, symptoms, personal experiences of care, and health-related behaviours (Black, 2013; Meadows, 2011; Weldring & Smith, 2013). When selecting PROMs, the researcher or clinician needs to consider the measure's reliability and validity (Meadows, 2011; Velentgas et al., 2013).

Reliability refers to the degree to which the feature being tested remains consistent upon test and retests or across different assessors (Velentgas et al., 2013). For example, when weighing a participant, the researcher should expect to have a similar reading after multiple times weighing the same individual (McLeod, 2013). Validity can be defined as the degree to which a tool measures what it is intended to measure (Rodrigues et al., 2017). For example, a weight scale would be used to record bodyweight not height as it is intended to provide bodyweight values (McLeod, 2013).

Measurement Tools assessing Critical Incident Exposure for Paramedics

In the available scientific literature, various PROMs are used when conducting CIE research with paramedics to provide researchers with the desired information (e.g., frequency of exposure to CIs, types of experienced CI). For example, some researchers develop inventories specifically for their research (Behnke et al., 2019; Declercq et al., 2011; Halpern et al., 2012; van der Ploeg & Kleber, 2003) while others have adapted CI inventories developed for other first responder occupational groups (Donnelly & Bennett, 2014; Ward et al., 2006). Although first responders generally experience greater exposure to CIs compared to the general population (Carleton et al., 2018a), it is important to have measures contextualized between first responder personnel and their distinct service role to accommodate for occupational differences (Carleton et al., 2019; Donnelly & Bennett, 2014; Jones, 2017). The Critical Incident Inventory (CII) by Monnier et al. (2002), which was originally developed for fire-emergency personnel, has been adapted to reflect the language relevant to South African paramedics and used in research by Ward et al. (2006). Similarly, the Critical Incident History Questionnaire (Weiss et al., 2010), originally developed for law enforcement officers, has been adapted and used for quantifying CIE for paramedics (Boland et al., 2018; Donnelly & Bennett, 2014). Specifically, the Critical Incident History Questionnaire (Weiss et al., 2010) was adapted and converted into the EMS Critical Incident Stress Inventory by Donnelly and Bennett (2014) to reflect occupational demands contextualized to EMS work. The CII and EMS Critical Incident Stress Inventory are described in more detail below.

Critical Incident Inventory. The CII is a self-report measure developed by Monnier et al. (2002) to assess fire-emergency workers' exposure to CIs. Defined by Monnier et al. (2002), fire-emergency workers refer to firefighters, emergency medical technicians, and paramedics.

This measure was developed through a multi-step process involving a literature review and firefighter input (Monnier et al., 2002). It is a 24-item questionnaire with six subscales (trauma to self, victims known to fire-emergency worker, multiple casualties, incidents involving children, unusual or problematic tactical operations, and exposure to severe medical trauma) used to quantify fire-emergency workers' exposure to CIs that could be experienced as part of their job demands (Monnier et al., 2002). In combination with other inventories, the CII can be used to assess possible relationships between exposure to CIs and psychological functioning. To complete this questionnaire, respondents are required to indicate whether they experienced each item within the past two months, and if they had, note the occurrence, "one time", "two times", "three or more times", or "none". Along with establishing face validity by having key informants endorse the items included in the CII, Monnier et al. (2002) assessed their inventory for convergent validity by examining if the scores on the CII were related to anger and depressive symptoms for fire-emergency workers with a significance of $p < .05$. Pearson correlations were completed where symptoms of depression were significantly related to the full CII scale (r=.20, p<.05, n=150; Monnier et al., 2002). Next, outward anger, which refers to the frequency of anger being directly outwardly towards other people or objects (Goulart et al., 2020), was significantly related to the full CII scale (r=.24, p<.05, n=150; Monnier et al., 2002). Finally, state anger, which refers to the intensity of anger feelings at a given time (Goulart et al., 2020), was related to the full CII scale (r=.36, p<.05, n=150; Monnier et al., 2002). Furthermore, Pearson correlations were completed between depression symptomology, anger out, and state anger and the subscales of the CII with identified significant relationships (e.g., trauma to self was significantly related to depression symptomology (r= .22, p<.05), anger out (r= .17, p<.05) and state anger (r=.27, p<.05); Monnier et al., 2002). Overall, it is a validated measure designed to

assess the extent to which fire-emergency workers are exposed to CIs (Monnier et al., 2002; Ward et al., 2006). Therefore, it is an effective measure for examining the impact of fire-emergency workers' exposure to stress on the job (Monnier et al., 2002).

Emergency Medical Service Critical Incident Stress Inventory. The language in the Critical Incident History Questionnaire (Weiss et al., 2010) for law enforcement personnel was adjusted to reflect EMS work (Donnelly & Bennett, 2014). Items were removed that did not directly apply to the occupational demands of EMS (Donnelly & Bennett, 2014). The first revision of the measure was sampled among EMS personnel in North Carolina (Donnelly & Bennett, 2014). Results prompted further modifications and the second revision was reviewed by 1,633 EMS personnel via a confidential online survey that gathered data on CIE and the associated perceived stress (Donnelly & Bennett, 2014). For the targeted population, the researchers developed a 37-item inventory that assessed relevant and appropriate items as well as identified which CIs were most stressful and common (Donnelly & Bennett, 2014). When completing this inventory, individuals are required to indicate "yes" or "no" to whether they experienced the event and then indicate how much stress each experienced event has caused in the past six months (Donnelly & Bennett, 2014). This measure was designed for EMS workers with the intended purpose of measuring stress associated with CIE (Donnelly & Bennett, 2014). The researchers used a partial correlation to assess potential relationships between CIE and PTSD (Donnelly & Bennett, 2014). The results indicated that CIE and PTSD symptoms were significantly related (r=.078, p = .005), and CI stress also had a significant relationship (r=.322, p<.001) with PTSD (Donnelly &Bennett, 2014). Donnelly and Bennett (2014) noted that future research could explore events identified in the qualitative aspects of their study to create a more thorough list of CIs. Additionally, when considering CIE measures and thorough lists of CIs,

geographical background, as suggested by Behnke et al. (2019), should be taken into consideration as it may influence the types and rates of experienced CIs (Behnke et al., 2019; Ward et al., 2006).

Geography: Northwestern Ontario and Potential for Critical Incident Exposure

An important factor to consider when measuring CIE is the geographical location as different parts of the world may experience different rates and types of exposure to CIs such that increased exposure may result in higher rates of adverse mental health conditions (Behnke et al., 2019; Ward et al., 2006). Therefore, international research on CIE among first responders needs to be viewed with discretion as differences in population and training may impact exposure (Behnke et al., 2019; Lord, 1998). This study focuses on paramedics in Northwestern Ontario, Canada; a vast region with a small and scattered population (Government of Canada, 2018; World Population Review, 2021). Additionally, it has the lowest gross domestic product per capita among all regions in Canada, suggesting that inhabitants lack financial security, which can negatively impact individual health and well-being (Government of Canada, 2018; Weida et al., 2020). Furthermore, police-reported crime in 2018 in Thunder Bay (located in Northwestern Ontario, Canada) was 5,778 incidents per 100,000 population, which is 40% higher than the rest of Ontario, and 5% higher than Canada (Statistics Canada, 2020). When considering the crime rate, a link between high crime levels and increased exposure to CIs may exist. For example, if crime levels are high, first responders are more likely to experience greater exposure to crime associated with CIE, especially if they are violent crimes (Oster & Doyle, 2000). In 2018, 1,545 incidents of violent crime (e.g., attempted murder, sexual assault, etc.) per 100,000 population was reported in Thunder Bay (an urban centre in Northwestern Ontario), which was 72% higher than the rest of Ontario and 35% higher than Canada (Statistics Canada, 2020). This report

indicated that Thunder Bay had the third-highest violent crime rate in Canada (Statistics Canada, 2020). Despite this, no research to date has investigated Northwestern Ontario paramedics' exposure to CIs, despite the high levels of crime.

Another factor that may influence paramedicine in Northwestern Ontario is that hospitals are geographically dispersed and may not be located within each community (Canadian Mental Health Association, 2021; City of Thunder Bay, 2018). This is something to consider as it may contribute to longer transport times to reach definitive care as paramedics treat and care for their patients. Additionally, mental health-related services and supports in Northwestern Ontario are less comprehensive, available, and accessible to the residents (Canadian Mental Health Association, 2021). Compared to other residents in Ontario, Northwestern Ontario residents self-reported having higher rates of "fair or poor" mental health scores as well as high rates of depression (Canadian Mental Health Association, 2021). Furthermore, hospitalization rates for Northern Ontario (which includes Thunder Bay) are twice that of the provincial rate (Canadian Mental Health Association, 2021). This suggests that paramedics in this area may be overworked and that the paramedics have less access to mental health services. Therefore, research with Northwestern Ontario paramedics is indicated to provide insight into their experiences, including exposure to CIs, to assess potential relationships to mental disorders to inform early mental health intervention strategies.

In Ontario, there are three levels of paramedics (primary care, advanced care, and critical care) who perform different controlled medical acts (City of Thunder Bay, 2018). In Thunder Bay, five paramedic stations service the City of Thunder Bay, and there are 14 stations located in the surrounding district (City of Thunder Bay, 2018). The emergency response team is collectively known as Superior North EMS (SNEMS), where they have primary and advanced

care paramedics who provide care 24 hours a day, seven days a week (City of Thunder Bay, 2018). Superior North EMS employs approximately 170 paramedics, and they are responsible for providing medical services to 169,000 people (City of Thunder Bay, 2018). The city locations are staffed 24 hours a day with rotating 12-hour shifts whereas the district stations have some combination of on-site and on-call staffing working 12-hours on-site and 12-hours on-call for 4-7 consecutive days (City of Thunder Bay, 2018). These paramedics have continued to serve Northwestern Ontario communities 365 days a year, including during a global pandemic.

Coronavirus Consideration

Another important contextual factor to consider in relation to the current working conditions of paramedics is the coronavirus (COVID-19). Around the world, the COVID-19 pandemic continues to present as an infectious and overwhelming crisis (Awais et al., 2020). It is a disease caused by the SARS-CoV-2 virus and impacts the respiratory system (Centers for Disease Control and Prevention, 2021). It is a fast-spreading virus transmitted through close contact from person to person (Centers for Disease Control and Prevention, 2021). This virus has resulted in a global pandemic because it spreads easily and does not affect everyone in the same manner (Centers for Disease Control and Prevention, 2021). Paramedics are among the healthcare workers who are directly at risk of being exposed to the virus due to their day-to-day interactions with community members (Awais et al., 2020). Paramedics may face dilemmas regarding patient care and challenges with personal protective equipment that increases their potential of contracting the virus and bringing it home to their loved ones (Awais et al., 2020). Not only were paramedics required to continue working by directly interacting with community members during the pandemic, but they also faced the already existing stressors of the job (e.g., shift work, family-life imbalance, and CIE; Shahzad et al., 2020). Therefore, understanding how

COVID-19 has impacted these frontline workers is an important component of paramedicine to consider when developing a measure for assessing CIE.

Research Objective

Before researchers can quantify CIE, a measurement tool needs to be contextualized for the target population: in this study, the focus is on Northwestern Ontario paramedics. As a measurement tool for CIE contextualized for Northwestern Ontario has not been developed, the goal of this project was to collaborate with SNEMS paramedics to work towards developing a contextually relevant measure of CIs that could be adapted and integrated into practice (Behnke et al., 2019; Canadian Mental Health Association, 2020). Therefore, the *research objective* was to contextualize a measure for CIE with SNEMS by validating the existing North American measures: the CII (Monnier et al., 2002) and EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014). These inventories were selected for this analysis because although they are constructed differently, they both quantify CIE. More specifically, the measures differ in terms of the constructs, item list, wording of the items, and period prevalence. The CII by Monnier et al. (2002) was chosen because the questionnaire was a measure developed for fire-emergency workers (e.g., firefighters, emergency medical technicians, and paramedics) and, therefore, an appropriate measure for the targeted population (Monnier et al., 2002). The questionnaire design assessed a single construct (quantifying exposure to CIs) where respondents recall events over the past two months (Monnier et al., 2002). Items in this measure capture more general CIs. Next the EMS Critical Incident Stress Inventory was selected because it was designed specifically for paramedics (Donnelly & Bennett, 2014). It recognized specific incidents related to their occupational demands while also adding another construct: perceived stress from exposure to an incident (Donnelly & Bennett, 2014). Respondents are required to recall events over their careers

while reflecting on how much stress they have experienced in the past six months. Items listed in this event are more specific. Therefore, these measures were selected to elicit conversations from paramedic participants to contextualize a measure representative of their experiences as both have been used previously in research with paramedics; however, researchers modified them for their studies (Boland et al., 2018; Ward et al., 2006).

Therefore, the *purpose* of this thesis was to contextualize an inventory that measured CIE experienced by SNEMS paramedics by contextualizing the existing inventories. The *specific research question* that guided the study was: Do the CII (Monnier et al., 2002) and EMS Critical Incident Stress Inventory (Donnelly & Bennett 2014) reflect the context experienced by paramedics serving the Northwestern Ontario region? Therefore, the specific research question seeks to establish content validity for an evidence-based, comprehensive contextualized measure. Overall, this thesis outlines item selection and generation, and questionnaire construction phases for clinical measurement development.

Chapter Two: Methods

For clinical measurement development of a Northwestern Ontario CI measure, an adapted cognitive interviewing approach employing a verbal probing technique was applied.

Recruitment and Participants

A paramedic from SNEMS performed as a designated knowledge user. The individual facilitated participant recruitment including the distribution of the recruitment email to all SNEMS paramedics, which identified the purpose of the study, inclusion / exclusion criteria, and researcher contact information. Participants were included based on the criteria that they were a paramedic with SNEMS, employed for at least one year with SNEMS, and able to read, write, speak, and understand English. Participants were excluded if they self-identified as having a formal diagnosis or were undergoing treatment for depression, anxiety, and PTSD for the purpose of not causing further harm to their mental health. A sample of five paramedics from SNEMS was recruited. It is important to note that recruitment occurred during a COVID-19 spike in February and March 2021 in Thunder Bay where paramedics were taxed to respond to the city's needs (Jackson, 2021), and consequently may have been less likely to participate. Participant ages ranged from 32 to 42 (M=36, SD=4.42) where 80% self-identified as male (n = 4) and 20% self-identified as female (n = 1).

Data Collection

Phase 1 – Item Selection and Generation

This study was approved by the Research Ethics Board at Lakehead University. A recruitment email and poster were sent to the designated knowledge user at SNEMS who forwarded the information to all SNEMS paramedics. Interested individuals emailed the student researcher who provided the information letter, eligibility form, and consent form via email. If

eligible and after the potential participant provided written informed consent, an electronic demographic form was sent to the participant using an online platform, Google Forms. The participant was also forwarded the CII and EMS Critical Incident Stress Inventory for review, and a time was scheduled for the individual interview. The demographic questionnaire was researcher-developed and collected data on the paramedic's age, date of birth, sex, gender, number of years served as a paramedic at SNEMS, number of years served as a paramedic prior to SNEMS, job title / rank, area of service, and the presence of, or seeking formal treatment for, adverse mental health conditions, which served as another measure to ensure participants included in the study met the inclusion / exclusion criteria (Appendix A).

The scheduled individual interviews occurred over Zoom© with the student researcher, participant, and one research supervisor. They were completed over Zoom© to ensure compliance with Lakehead University's Research Ethics Board COVID-19 protocols. Furthermore, Zoom© interviews were viewed as an acceptable alternative to in-person interviews selected by Lakehead University for research because of its convenience, ease of use, security, and interactivity via screen share that allowed the student research to review the information letter and consent form (Archibald et al., 2019; Gray et al., 2020). After verbal consent was provided, the interviews were recorded using the Zoom© recording function.

A semi-structured interview guide, with verbal probes, developed by the student researcher was used to facilitate the conversation and ensure that the research question was answered (Appendix B), which started by reviewing the information letter and obtaining verbal informed consent. The semi-structured interview guide was developed as a multi-part study that assessed the lived experiences of Northwestern Ontario paramedics. Consequently, the semi-structured interview guide included questions related to lived experiences of Northwestern

Ontario paramedics while also allowing participants to review items in the existing questionnaires by Monnier et al. (2002) and Donnelly and Bennett (2014) for the purpose of contextualizing them relative to their experiences in Northwestern Ontario. Refer to Appendix B to view the questions and corresponding probes that guided the interviews. The duration of the interviews ranged between 50 and 92 minutes (M=67.6, SD=17.92). As the interviews came to an end, the interview guide followed Krueger's (2002) three-step conclusion with a summary, review of the purpose, and a thank you to the participants for their time where they were told to expect a follow-up email to ensure results captured their conversation.

To prepare for Phase 2, the interviews from Phase 1 were transcribed verbatim. A finalized version of a measure contextualized for Northwestern Ontario paramedics was developed using three-step decision-making criteria outlined in the data analysis section of this paper: 1) literature review, 2) transcript analysis, and 3) member-checking. Member-checking is the method of returning data to the participants to validate, verify, and assess the trustworthiness of the results (Brit et al., 2016).

Phase 2 – Member-Checking

After individual interviews were completed, the researchers modified the existing measures to create a contextually relevant measure for Northwestern Ontario paramedics. Participants were sent an email with the option to provide feedback via a Word document on the contextualized measure. In this study, 3 out of 5 (60%) participants provided feedback. Data corresponding to the member-checking is reported in the results section of this document. Refer to Figure 2 to view the feedback form. This feedback form was constructed with the supervisory researcher for the purpose of obtaining feedback on the current version of the contextualized measure.

Figure 2

Feedback Form for the Critical Incident Inventory – Northwestern Ontario Paramedic Version

1. The instructions provided for the **Critical Incident Inventory - Paramedic Version** were clear and easy to understand.

   Strongly Disagree 1 2 3 4 5 Strongly Agree

2. I think that this tool will assist in measuring critical incident exposure for paramedics in **Northwestern Ontario**.

   Strongly Disagree 1 2 3 4 5 Strongly Agree

3. The proposed **Timeline of Events** was clear and would be easy to complete as a paramedic.

   Strongly Disagree 1 2 3 4 5 Strongly Agree

4. After reflecting on our interview, do you feel that an event is missing? If so, please provide an example.

5. What was the most difficult part of the **Critical Incident Inventory - Paramedic Version** to understand?

6. Do you have any feedback / suggestions?

Note. This figure represents the feedback form that was administered to participants to obtain feedback on the current version of the contextualized Northwestern Ontario measure.

Data Analysis

Phase 1 – Item Selection and Generation

Demographic data was gathered from the demographic questionnaire and represented as percentages of the sample. This allowed the student researcher to identify and summarize patterns within the data to gain a better understanding of who was participating in the study. Next, the interviews were transcribed verbatim into text by the student researcher and analyzed using the cognitive interviewing method with a verbal probing technique.

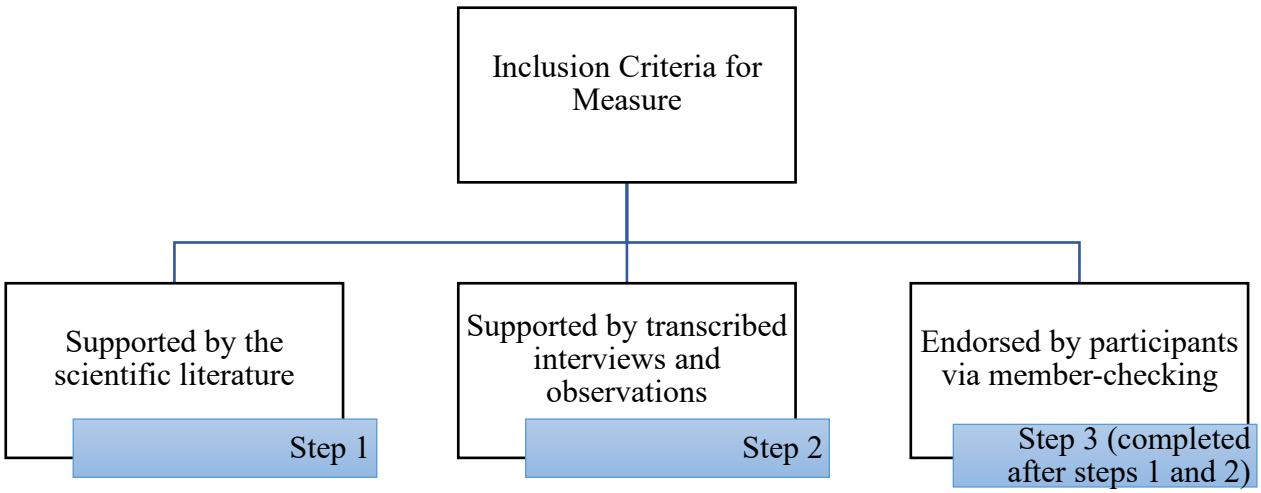
Clinical Measurement Development. An adapted cognitive interviewing approach using a probing technique was selected for the clinical measurement development as it has reported application for developing PROMs (Willis & Artino, 2013; Patrick et al., 2011). According to Willis and Artino (2013), this evidence-based approach may be used to investigate measures to determine if they fulfill the intended purpose, are comprehendible, and are easy to answer; thereby assessing the content validity of the measure and achieving the purpose of this study. This technique can be completed through multiple rounds of interviews and traditionally encompassed four cognitive processes: 1) comprehension of the question; 2) retrieval from memory to answer the question; 3) decision processes that may influence the respondent's processing of a response; and 4) response process (Willis & Miller, 2011). Additionally, it is used to assess all other components of a measure including the readability, period prevalence, and written instructions to ensure that it can be understood by the intended target population (Patrick et al., 2011). Typically, cognitive interviewing is conducted using two procedures that can be used separately or in unison to characterize the method: think-aloud and verbal probing (Willis & Artino, 2013). Think-aloud requires that participants verbalize their thoughts as they answer the questions in the measures (Willis & Artino, 2013). Verbal probing occurs where the interviewers ask probes designed to elicit detailed information (Willis & Artino, 2013). These probes may be developed prior to completing the interview or in response to participants during the interview (Willis & Artino, 2013). This thesis employed a verbal probing technique, which is often acceptable when evaluating a self-administered measure (the intended delivery method for the contextualized CI for Northwestern Ontario paramedics; Willis & Artino, 2013). Verbal probes were developed prior to the interviews and indicated in the interview guide, which allowed the interviewers to elicit further information based on the intended purpose of the

interview (refer to Appendix B; Willis & Artino, 2013). Additional probes were asked during the interviews in relation to the participant responses. According to Willis and Miller (2011), the analysis for cognitive interviews can include both a coding scheme and successive aggregation. Successive aggregation involves the interviewer summarizing the items based on all interviews (Willis & Miller, 2011). Next, it is further synthesized to produce a single set of observations for each item (Willis & Miller, 2011). This thesis represents the initial round of interviews for a Northwestern Ontario-specific CI inventory.

For this thesis, all interviews were reviewed where the student researcher (AD) specifically looked at each evaluated item, searching for common themes and identifying key findings that suggested variations in the interpretation when considering the intended purpose of the measure (Willis & Artino, 2013). Successive aggregation was completed for each questionnaire (CII and EMS Critical Incident Stress Inventory), and this provided the initial boundaries during the analysis. To do this, the student researcher completed an item-by-item analysis of the existing CI inventories and reflected on participant responses stratified by area of service (e.g., district vs city paramedic) as well as the interviewer's observations (Willis, 1999). This analysis considered both problems that emerged repeatedly and singular problem discoveries considering comprehension and the cognitive processes (Willis, 1999). According to Willis (1999), even if discoveries occur in a single interview, they should still be considered as they may threaten the data quality. After the initial analysis of the transcripts and observations, the student researcher employed three-step decision-making criteria (Figure 3) regarding the content of the items, as well as the readability of the items, instructions, and period prevalence (Willis & Miller, 2011). *First*, a literature review was conducted to ensure that the items in the selected measures (CII by Monnier et al., 2002, and EMS Critical Incident Stress Inventory by

Donnelly and Bennett, 2014) and proposed items from the participants were relevant for Canadian paramedics allowing an evidence-based tool to be contextualized. *Secondly*, the transcribed interviews were systematically reviewed. The original CII (Monnier et al., 2002) and EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) were printed. Transcripts were reviewed and referenced to the originals where feedback pertaining to each measure was documented. The items were modified if the majority of the participants agreed to an item construct or word change. Modifications were also made to improve the interpretation of the items to reflect the purpose of the study. *Lastly*, after modifications were made, member-checking was completed to verify that the changes reflected the interviews and experiences of Northwestern Ontario paramedics. This three-step approach informed the decision-making process included in the final contextualized measure: the Critical Incident Inventory – NWO Paramedic.

Figure 3



Note. This figure illustrates the decision-making criteria that were used to contextualize the measure for Northwestern Ontario paramedics.

Phase 2 – Member-Checking

Returned feedback forms were reviewed and the median was determined. Additionally, the open-ended responses were reviewed. Suggestions were applied to the measure if they contributed to the readability of the final contextualized measure and supported the purpose of the study (contextualize an inventory that measured CIE experienced by Thunder Bay paramedics by contextualizing the existing inventories by reviewing the item relevance, language, and readability).

Chapter Three: Results

The following results are presented as *Phase 1 – Item Selection and Generation* and *Phase 2 – Member-Checking*. It will provide initial demographics to describe the participants included in this thesis. Next, the results will present the components that emerged as part of the new measure contextualized for Northwestern Ontario paramedics.

Phase 1 – Item Selection and Generation

1. Demographics

Table 1 provides a review of demographic characteristics of interview participants. All participants identified as primary care paramedics (*n*=5; 100%) and 40% (*n*=2) identified as city paramedics for SNEMS and 60% (*n*=3) identified as district paramedics for SNEMS.

Table 1

Demographic Data from Participating Paramedics

Measures	(*n*=5)	(%)
Mean Age (SD)	36 (4.42)	
Sex		
Female	1	20
Male	4	80
Gender		
Female	1	20
Male	4	80
Number of Years of Service with SNEMS		
Less than 1 year	0	0
1-5 years	1	20
6-10 years	0	0
Greater than 10 years	4	80
Number of Years of Service prior to SNEMS		
Less than 1 year	4	80
1-5 years	1	20
6-10 years	0	0
Greater than 10 years	0	0
Area of Service		
City of Thunder Bay	2	40
District of Thunder Bay	3	60
Level of Paramedicine		
Primary Care Paramedic	5	100

Note. This table provides a summary of the participant's demographic information where *n*=5 and, on average, the participants were 36 years old (*SD*=4.42).

2. Final Items Included in Contextualized Inventory

The final measure contextualized for Northwestern Ontario paramedics includes 32 items that outline CIs relevant to their occupational job demands as determined when analyzing individual interviews (refer to Appendix C). As mentioned, two primary measures (the CII by Monnier et al., 2002 and the EMS Critical Incident Stress Inventory by Donnelly and Bennett, 2014) were reviewed with the participants and were the templates that guided the new contextualized measure for SNEMS paramedics. During the interviews, participants reflected

that it might be beneficial to combine elements from each inventory to create another one. One participant indicated that "if they were combined so that […] you can see any kind of correlation between the frequency and severity of events that are experienced by the individual [might be ideal]" (Participant 04, *district paramedic*). As a result, a new measure was contextualized for SNEMS using different components from the existing measures.

Items from the CII (Monnier et al., 2002), EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014), and missing items identified by the participants made up the 32 items presented in the contextualized measure. Specifically, the CII was used as the initial template: 11 items were retained, 12 were adapted (two were combined as one), and one was completely removed (Tables 2 and 3). The participants indicated that items from the EMS Critical Incident Stress Inventory should also be incorporated into a contextualized measure to develop a more comprehensive measure. Therefore, two items were retained from the EMS Critical Incident Stress Inventory, four were adapted, 18 were covered by the CII, and 13 were removed because they were irrelevant or redundant (Tables 4 and 5). Four additional items were included in the contextualized measure based on participant interviews and the literature (Table 6). The contextualized measure includes a period prevalence modified from one of the participants' suggestions, and an impact scale adapted from the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014).

Strategies for Contextualizing the Measure

As outlined in the data analysis section of the manuscript and Figure 3, a three-step decision-making criterion was employed. After the interviews were transcribed verbatim, the items were referenced against the existing literature to ensure that the measurement was evidence-based. Next, the feedback corresponding to the existing CI measures and interviewer

notes were reviewed. Modifications to item wording and measure constructs were completed if the majority of the participants voiced similar feedback or if it aided in the readability of the measure. Member-checking was used as the final decision-making criterion.

a. Item Generation and Selection from the Critical Incident Inventory. For a review of items retained, adapted, and removed from the CII, please refer to Tables 2 and 3 as well as Appendix D for a review of the CII.

i. Adapted and Removed Items. In general, participants provided positive feedback regarding the wording used in the CII by Monnier et al. (2002). The overall wording and language used in the item list appeared to be more sensitive to the nature of paramedicine when compared to the EMS Critical Incident Stress Inventory. For example, one participant noted that they "like the wording on [the CII] better" (Participant 01, *district paramedic*) when compared to the EMS Critical Incident Stress Inventory. Therefore, it was used as the initial template for the contextualized inventory. Additionally, the items listed were thought to be appropriate for the scope of practice for paramedics in Northwestern Ontario as the items "all happened, so […] they're definitely relevant" (Participant 05, *city paramedic*). Refer to Appendix E for more information about the participant's overall impression of the CII. The following will outline support for the adaption and / or removal of line items from the CII with quotations from the SNEMS paramedic participants.

Serious Line of Duty Injury to Self (Retained Item). The first item on the CII (Monnier et al., 2002) is a "serious line of duty injury to self". Two suggestions were provided regarding this item (refer to Appendix E for direct quotations) where one participant indicated that a distinction could be provided between the type of injury (e.g., physical, or mental) whereas another participant indicated that the item itself did not make sense within the two-month

timeframe of the inventory. The participant indicated that "I don't think it would be possible to come back […] from a serious injury and have like multiple attempts [of injuring themselves]" (Participant 05, *city paramedic*). During each of these interviews, the supervisory researcher explained the subjective interpretations available with this item. As a result, the line item was retained in the contextualized measure as originally presented in the CII.

Emergency Worker Term (Adapted Item). Participants had varying thoughts on the term "emergency worker" found in items 3, 4, 5, and 6 on the CII. One participant indicated that it should be "changed to paramedic or […] to colleague" (Participant 01, *district paramedic*). Other participants, however, indicated that "emergency worker" was an appropriate term as "we work very closely with the fire department and the police department, so if one of the firefighters got hit on scene at one of our accidents, kind of things like that, that would have just as much impact" (Participant 02, *district paramedic*). Similarly, one participant said that "emergency worker" was an appropriate term as being:

> Called standby for a fire and [a] firefighter falls through and dies. That would be […] be a stressor because it's a […] slightly different context from [the] general civilian population, as opposed to a fellow emergency worker doing what you do (Participant 04, *district paramedic*).

Therefore, using the term "emergency worker and / or colleague" was suggested as a revision to the inventory to capture the participant's opinions (refer to Appendix E). As a result, the new inventory reflects this change with the line items reflecting "PSP", meaning Public Safety Personnel, referring to colleagues that the paramedics know or work with when protecting the public.

Threat of Serious Line of Duty Injury (Adapted Item). One of the participants indicated that using the term "threat" influenced their interpretation of this line item. The participant said that when "I read *threat* I think of like actual, like a verbal threat" (Participant 01, *district paramedic*) and suggested that the term "threat" be changed to "near miss", a familiar term among paramedicine. The individual suggested that:

> You could put in like air quotes around that threat question. Kind of tune people into like what you're saying, like, was there a threat of injury to you, […] like a near miss […] like you almost had an accident or there was an accidental injury, like those kinds of things (Participant 01, *district paramedic*).

Therefore, line items with the word "threat" were changed to "near miss" where the definition of a near miss provided by the participant supported the literature (e.g., an event that has the potential to lead to serious incidents and risk to patient safety; Ishimaru et al., 2019). The contextualized measure reflects this as a "threat of serious line of duty injury or threat of death to self, also known as a 'near miss' (that did not result in actual serious injury)" as well as "threat of serious line of duty injury or threat of death to PSP, also known as a 'near mis' (that did not result in actual serious injury or death)".

Incident Requiring Police Protection (Adapted Item). A participant indicated that the term "police protection" was unclear and suggested that it change to "police intervention". The participant indicated that:

> The one thing in question 10 [on the CII] that seems a little vague is requiring police protection. Um. I'm not 100% what [that means]. A lot of the times police show up on our calls and just their presence […] calms things down […]. Whether or not that's protection or not I'm not sure, and there are incidents also where police actually have to

> get involved and restrain and put someone in custody. And I would constitute that as protection for sure (Participant 03, *city paramedic*).

This comment suggests that individuals may have different interpretations of what "police protection" means and that revisions are appropriate to clarify the item. As a result, the item was adapted to reflect this participant's suggestion and is reflected as an "incident requiring police intervention while on duty".

Failed Mission After Extensive Effort (Adapted Item). Item number 15 on the CII, "failed mission after extensive effort", elicited discussions from participants where they felt that the language was not appropriate for paramedics, but the concept was still relevant (refer to Appendix E). Participants agreed that paramedics "don't refer to calls as missions" (Participant 01, *district paramedic*). Suggested rephrasing was provided including "failed resuscitation" (Participant 05, *city paramedic*) and "prolonged contact with the patient that passed away" (Participant 01, *district paramedic*). The literature supports that long transport times with patients to hospitals can negatively impact patient outcomes through lower survival rates (Gonzalez et al., 2006). Therefore, "prolonged contact" with a negative outcome is an event that paramedics in Northwestern Ontario may encounter. Further, prolonged patient care with extensive effort is relevant as a CI where paramedics may develop emotional ties to patients, especially if the patient dies in their care (Regehr et al., 2002). After further discussions with participants, the final version of the item is reflected as "prolonged patient care with extensive effort and a negative trajectory / outcome".

Critical (Negative) Media Interest (Adapted Item). Two of the district paramedics in this sample indicated that item number 16, "critical (negative) media interest" did not reflect their experiences in Northwestern Ontario (refer to Appendix E). One individual said that "we

don't get negative media attention here. We just don't have the […] paper or anything like that, but I guess it's not to say it […] couldn't happen, but we've never ever had that here, since I've been here [over 20 years]" (Participant 02, *district paramedic*). Similarly, another participant indicated that "as paramedics, we don't deal with media" (Participant 04, *district paramedic*). After consulting the literature (Boland et al., 2018; Declercq et al., 2011; Ward et al., 2006), the item was retained in the contextualized measure but adapted and combined with another line item "verbal or physical threat by public while on duty (that did not result in police protection)". In the contextualized inventory, both items are reflected as "verbal or physical threat by the public while on duty, including critical (negative) media attention".

Removing Dead Body or Bodies (Adapted Item). Participants agreed that item number 18, "removing dead body or bodies" was relevant as a CI; however, it was suggested that transporting be added to the clause to tailor it for paramedics. A participant explained that "transporting would be, maybe more appropriate like removing isn't like that seems like you're recovery operations, which would be more fire-more police" (Participant 01, *district paramedic*). Therefore, the new line item reflects this suggestion and is presented as "removing and / or transporting dead body or bodies".

Incident Necessitating Search or Rescue Involving Serious Risk to Yourself (Removed Item). Although paramedics are not often involved in search and rescues, some of the participants indicated that they may behave in risky behaviours while on the job. One individual indicated that paramedics:

> Wouldn't be involved in something like [search and rescue], but that's not to say that we don't get ourselves involved in things like that. Typically, we're supposed to wait for the fire department to do things but I […] have found myself jumping in the water […],

> [pulling] people out of vehicles or [getting] them out of a […] hazardous space to be able to do our work, so it's not out of the realm of possibility (Participant 03, *city paramedic*).

That being said, since search and rescue is not part of the scope of practice for paramedics, it was removed from the list. The student researcher removed this item from the list as it appeared to be misunderstood by the participants where they focused on the part "involving serious risk to [self]" versus the incident "necessitating search and rescue". If respondents feel that they are in risky search and rescue scenarios that constitute as a CI, they can indicate so under item 32 "other" or under the item that discusses a near miss.

Prolonged Extrication of Trapped Victim (Adapted Item). Participants suggested that item number 20 undergo language modification to better represent paramedicine (refer to Appendix E). According to the participants, extrications are not within the scope of paramedicine; however, they may be required to treat patients during the process of an extrication. Therefore, the language in the contextualized inventory reflects this suggestion and says, "prolonged time caring for a patient that required extrication or was trapped in a potentially life-threatening situation".

Table 2

Exploring Contextualization of the Critical Incident Inventory

Retained Items	Removed Items
- Serious line of duty injury to self (1) - Responded to incident involving three or more deaths (7) - Responded to incident involving one or two deaths (8) - Responded to incident involving multiple serious injuries (three or more victims sustained serious injuries; 9) - Incident involving serious injury or death to children (12) - Incident involving severe threat to children (that did not result in actual serious injury or death to children; 13) - Close contact with burned or mutilated victim (17) - Use of deadly force by police at an incident (21) - Direct exposure to extremely hazardous materials (22) - Direct exposure to blood and body fluids (23) - Critical equipment failure or lack of equipment in any of the above situations (24)	- Incident necessitating search or rescue involving serious risk to yourself (19)

Note. This reflects the items from the CII that were retained or removed in the contextualized inventory. The numbers in the chart refer to the item number presented in the CII.

Table 3

Adaptations to the Critical Incident Inventory for the Contextualized Measure

Original Items	Revised Wording
- Threat of serious line of duty injury or threat of death to self (that did not result in actual serious injury; 2)	- Threat of serious line of duty injury or threat of death to self, also known as a "near miss" (that did not result in actual serious injury)
- Line of duty death of a fellow emergency worker (3)	- Line of duty death of a PSP.
- Serious line of duty injury to fellow emergency worker (that did not result in death; 4)	- Serious line of duty injury to PSP (that did not result in death).
- Threat of serious line of duty injury or threat of death to fellow emergency worker (that did not result in actual serious injury or death; 5)	- Threat of serious line of duty injury or threat of death to PSP, also known as a "near miss" (that did not result in actual serious injury or death)
- Suicide or attempted suicide by fellow emergency worker (6)	- Suicide or attempted suicide by PSP
- Incident requiring police protection while on duty (10)	- Incident requiring police intervention while on duty
- Verbal or physical threat by public while on duty (that did not result in police protection; 11)	- Verbal or physical threat by the public while on duty, including critical (negative) media attention
- Victim(s) known to you (14)	- Victim(s) known to you (family, friends, or others known to the crew)
- Failed mission after extensive effort (15)	- Prolonged patient care with extensive effort and a negative trajectory/outcome
- Critical (negative) media interest (16)	-Verbal or physical threat by the public while on duty, including critical (negative) media attention
- Removing dead body or bodies (18)	- Removing and/or transporting dead body or bodies

- Prolonged extrication of trapped victim with life-threatening injuries (20)	- Prolonged time caring for a patient that required extrication or was trapped in a potentially life-threatening situation

Note. The left column represents the items obtained from the CII, where the numbers refer to the item number presented in the CII. These items were adapted in the contextualized measure to the corresponding items on the right column.

b. Item Generation and Selection from the Emergency Medical Service Critical Incident Stress Inventory. For a review of items retained, adapted, and removed from the EMS Critical Incident Stress Inventory, please refer to Tables 4 and 5 as well as Appendix F for a review of the EMS Critical Incident Stress Inventory.

***i. Adapted and Removed Items*.** Participants suggested few modifications for this inventory. One participant noted that they "almost prefer the […] EMS Critical Incident Stress Inventory because it's more of like a how I feel about things versus […] actually quantifying what I have [experienced]" (Participant 05, *city paramedic*). This suggests that the participants liked the rating scale (discussed in more detail in section *ii. Impact on Respondent's Life Rating Scale*) available in this inventory as it allowed them to assess whether the event had personally impacted them. The language, however, was found to be "a little blunt. […] little harsh" (Participant 01, *district paramedic*). When presented with the scenario of administering this questionnaire to an individual with an adverse mental health condition, Participant 02 indicated that the language might not be appropriate (refer to Appendix G). The following will outline the line items from the EMS Critical Incident Stress Inventory that were replicated in the CII, removed, or retained with supporting quotations from the SNEMS paramedic participants.

Present when a Fellow Emergency Medical Technician was Killed (Item Replicated in Critical Incident Inventory). It was suggested that throughout the inventory, the language of "EMT" change to represent paramedics in Ontario, as "we don't have EMTs in Ontario" (Participant 01, *district paramedic*). Additionally, one individual suggested that the language of this item change to reflect *killed* in more humanely. The individual asked if the item could, "just say […] the death of a paramedic" (Participant 01, *district paramedic*). During the analysis

process, it was determined that this item was replicated in the CII and is reflected in the Northwestern Ontario contextualized inventory as a “line of duty death of a PSP”.

Taken Hostage (Removed Item). On the EMS Critical Incident Stress Inventory, one item that some of the participants thought should be removed was “taken hostage” (refer to Appendix G). The participants indicated that in their line of work, they “would not expect to [be] like taken hostage” (Participant 03, *city paramedic*). A brief internet search of Canadian paramedics was performed, and few-to-no incidents were located suggesting that it is rare for Canadian paramedics to be taken hostage. As a result, the item was removed and not included in the contextualized inventory.

Language Around Children (Item Replicated in Critical Incident Inventory). The inventory by Donnelly and Bennett (2014) has a section that focuses on injuries related to children (items 19, 21, 22, 24-27). Based on the observations during the conversations with participants, this focus on children has the potential to trigger respondents during the process of completing this inventory. Therefore, it was suggested that individual items around children be grouped together (refer to Appendix G) as represented in the CII. Therefore, the contextualized measure captures these events with two items, “incident involving serious injury or death to children” and “incident involving severe threat to children (that did not result in actual serious injury or death to children)”.

ii. Impact on Respondent’s Life Rating Scale. One notable difference between the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) and the CII (Monnier et al., 2002) is the rating scale for how much stress each incident caused the respondent in the past six months (refer to Appendices D and F). Participants indicated that the EMS Critical Incident Stress Inventory stress rating scale allowed them to reflect on their answers where they “liked

having the yes or no, and the […] stress level because it actually made…made me think about well does this actually like affect me day-to-day or not" (Participant 02, *district paramedic*). The rating scale was also thought to better reflect different paramedic responses to CIs and how they are personally impacted. For example, one paramedic indicated that "different people respond to incidents differently, and I think this [rating scale] reflects that" (Participant 04, *district paramedic*). Therefore, the sample of paramedics used in this study provided positive opinions on the rating scale as it allowed them to indicate on a personal level whether an event was impactful to them. Previous researchers (Declercq et al., 2011; Regehr et al., 2002) have included impact scales in their measures of CIs. Based on this, a version of the stress rating scale was included in the new inventory as a rating for the combined impact of line items on the participant's life using response options as "none", "a little", "moderate", and "a lot".

Table 4

Exploring Contextualization of Emergency Medical Service Critical Incident Stress Inventory

Retained Items	Removed Items	Items Covered in the CII
- Was assaulted by a patient (11) - Made a mistake that led to the serious injury or death of a patient (12)	- Seriously beaten (4) - Taken hostage (5) - Received serious threats towards loved ones as retaliation for your work in EMS (6) - Threatened with a gun or other weapon (7) - Saw someone dying (14) - Encountered a decaying corpse (16) - Encountered a mutilated body or human remains (17) - Encountered a SIDS death (2) - Encountered an adult who had been badly beaten (23) - Encountered an elderly person who was severely	- Seriously injured (1) - Present when a fellow EMT/Paramedic was seriously injured (suggested rephrase: present when a fellow EMT/Paramedic or other first responder was seriously injured; 2) - Present when a fellow EMT/Paramedic was killed. (Suggested rephrase: present when a fellow EMT/Paramedic or other first responder was killed; 3) - Trapped in a potentially life-threatening situation (8 - Exposed to a life-threatening toxic substance (10)

	abused or neglected or in dire need of medical attention because of abuse or neglect (28) - Saw animals that had been severely neglected, intentionally injured, or killed (29) - Responded to an aggressive crowd or riot (32) - Encountered a drowning victim (37)	- Was in a serious car accident (Suggested rephrase: was in a serious accident with an ambulance or other emergency response vehicle; 13) - Encountered the body of someone recently dead (15) - Encountered a child who had been sexually assaulted (19) - Encountered a child who had been badly beaten (22) - Encountered a child that had been accidently severely injured (24) - Encountered a child that had been accidentally killed (25) - Encountered a child that had been murdered (26) - Encountered a child who was severely neglected or in dire need of medical attention because of neglect (27) - Had to respond to a large-scale disaster (30) - Had your life endangered in a large-scale disaster (31) - Responded to a scene involving family, friends, or others known to the crew (33) - Responded to a mass casualty incident (34) - Encountered a patient that was severely burned (35)

Note. This reflects the items in the EMS Critical Incident Stress Inventory and explains how they were used (or not used) in the contextualized inventory. The numbers reflect the item numbers from the EMS Critical Incident Inventory.

Table 5

Adaptations to the EMS Critical Incident Stress Inventory for the Contextualized Measure

Original Items	Revised Wording
- *Exposed to serious risk of AIDS or other life-threatening disease (9)	- *Direct exposure to a potentially life-threatening virus (e.g., COVID-19, SARS, AIDS)
- *Made a death notification (18)	- *Made a death notification and/or interacted with deceased's family
- Encountered an adult who had been sexually assaulted (20)	- Responded to a victim who was sexually assaulted
- Encountered a suicide victim (Suggested rephrase: Encountered the body of someone who died by suicide; 36)	- Encountered the body of someone who died by suicide

Note. The left column represents items from the EMS Critical Incident Stress Inventory with the item numbers in brackets. These items were adapted and integrated into the contextualized inventory where the modified items are displayed in the corresponding right column. *Items represent items that some participants had identified as missing and / or needing more clarification.

c. Additional Items and Components Included in the Measure. During the interviews, participants provided suggestions to improve the list of CIs and make it more relevant to their experiences in Northwestern Ontario (refer to Appendix H). Suggested items identified by the participants to be incorporated into the inventory included focusing on COVID-19, interacting with family members after a death, and responding to routine calls also known as frequent fliers. The following will provide supporting quotations and literature for the added and revised items. Refer to Table 6 to view the additional items integrated into the contextualized measure.

i. Coronavirus. COVID-19 was identified as a CI for participants because it produced a new level of stress in the workplace where individuals were not only facing the effects of COVID-19 at work but also at home. For example, paramedics who were parents may have had to take on the role of teacher when they were home with their kids, which adds to their stress. When asked if any events were missing from the initial measures, one participant noted that "you could have a, you know, direct exposure to COVID [item]" (Participant 01, *district paramedic*). While at work, paramedics are still required to directly interact with community members who may have COVID-19, placing them at an increased risk for self-infection. They also are faced with the possibility of bringing COVID-19 home to their families. Furthermore, paramedics are still responsible for responding to calls that they would have seen before the pandemic *plus* COVID-19 calls. As such, the participants felt that COVID-19 had changed the feeling of going to work, which added another layer of stress to their occupational demands (refer to Appendix H). A scientific literature search was also completed to verify that this was a CI, thereby establishing an evidence-based measure. The threat of COVID-19 has reportedly resulted in increased workload and fears of contagion for healthcare professions as well anxiety, depression,

emotional exhaustion, and sleep disturbances (Pappa et al., 2020; Zolnikov & Furio, 2020). These findings are consistent with other public health emergencies (e.g., SARS), which resulted in greater levels of stress (McAlonan et al., 2007). Further, a qualitative approach by Zolnikov and Furio (2020) noted that first responders (e.g., firefighters and paramedics) felt that they experienced symptoms of anxiety, depression, and stress from COVID-19. Based on this, COVID-19 was added to the inventory by adapting one of the items originally on the EMS Critical Incident Stress Inventory. It was modified to allow consideration if other new viruses emerge. It reads as "direct exposure to a potentially life-threatening virus (e.g., COVID-19, SARS, AIDS)".

ii. Interacting with Family Members after a Death. When asked if any items were missing from the CII or the EMS Critical Incident Stress Inventory, one participant indicated that "dealing with family […] surrounding […] a patient's death [could be a critical incident] because...it gets pretty crappy sometimes and that's not something we really trained very well in" (Participant 02, *district paramedic*). Although this item was reflected on the EMS Critical Incident Stress Inventory, the participant felt that more detail was needed as it is important to have this event, especially as paramedics are now able to stop resuscitations (refer to Appendix H). The participant also noted that due to the limited resources in terms of allied first responders in Northwestern Ontario, paramedics may be the only first responders on scene with family members after a death and must wait for others to arrive. Therefore, this event was adapted to capture the perceived pressure to support family members with a reported lack of training. The literature supports the stressful nature of delivering death notifications indicating that it may cause strong emotional reactions (De Leo et al., 2020; Donnelly & Bennett, 2014; Douglas et

al., 2013; Hobgood et al., 2013). In the new inventory, it captures this concept as “made a death notification and / or interacted with deceased’s family”.

iii. Frequent Fliers. As one of the interviews wrapped up, a participant told the researchers that when looking at their stress levels on the EMS Critical Incident Stress Inventory, their overall scores:

> Were like not applicable. […] I don't know if that's worth mentioning at all like because […] I think that they are really relevant […] What stresses individuals in this job […] it's not like the critical, critical high acuity stuff it's like […] the lower acuity things that happened overall (Participant 05, *city paramedic*).

The participant felt that seemingly lower acuity calls such as responding to frequent fliers were not represented as a CI on the CII or EMS Critical Incident Stress Inventory. They explained that repeated calls to the same patient had a unique impact on paramedics. For example, if the frequent flyer patient dies, “[their death may] hit me different […]. You're used to getting sworn at and spit and yelled at […], and now [they are gone and you wonder] […] who's gonna be the next one?” (Participant 01, *district paramedic*). The notion of including frequent fliers on a CI inventory is a newer concept. It is, however, indicated by the literature (Schaulis & Snoey, 2001). In a case study, healthcare providers reported that a frequent flyer became part of their family resulting in deeper levels of attachment, meanwhile, others developed anger (Schaulis & Snoey, 2001). Furthermore, research with drug overdose patients noted added stress when responding to frequent fliers as they felt frustrated or emotionally involved with repeat interactions (Williams-Yuen et al., 2020). Another concept associated with frequent fliers that should be considered is the notion of becoming numbed to an event. One participant explained that:

> You can definitely be numbed toward something. [….] [For] example, I mentioned the narcotic overdoses. Those used to be a high acuity interesting call, and now we do [a lot]. Everyone says they're kind of a basic. We're kind of used to it now, to the point where they're almost mundane. And that can be the same thing with higher acuity calls. If we're constantly […] [seeing] trauma from a specific place or for a specific group of people, then we can just kind of get used to seeing it. The first few times, you might see it, […] you might be a little shook by it and you might be a little taken aback […]. The second, third, fourth, fifth time […] you don't feel it-you don't notice it as much (Participant 03, *city paramedic*).

This suggests that paramedics may become numbed or develop a tolerance towards calls with frequent fliers despite call acuity. This is represented in the literature where Boland et al. (2018) reported an inverse relationship between frequency and severity rating for CIs (r=-.72) suggesting that frequent exposure may foster resilience. This was also supported by Weiss et al. (2010) when exploring cumulative exposure and severity of CIs among law enforcement officers. Despite developing a tolerance towards events, individuals may still be impacted by frequent fliers. Therefore, an item was added to the contextualized measure for Northwestern Ontario paramedics where frequent fliers may elicit strong emotional reactions where paramedics may be impacted by their death. The item is captured as “repeated exposure with same patient (multiple times a shift or week) and a poor patient outcome (e.g., frequent flyer)”.

iv. Unstable and Unpredictable Patients. Based on the conversations with the participants, an item was included to represent a scenario where paramedics respond to patients who are unstable and unpredictable due to psychiatric or drug / alcohol-related issues. When discussing CIs and other events that frequently occur in Northwestern Ontario, this type of event

was mentioned as the paramedics "do a lot of alcohol intoxication calls […] substance misuse" (Participant 05, *city paramedic*). This type of event was also identified as a stressor absent from the EMS Critical Incident Stress Inventory when Donnelly and Bennett (2014) qualitatively asked respondents to identify CIs that they felt were not included in their list. Furthermore, events around psychiatric patients were included in research that explored CIE among paramedics (Behnke et al., 2019; van der Ploeg & Kleber, 2003). As a result, the conversations from the participants and the supporting literature suggest that this event should be included as a CI. It is reflected in the contextualized inventory as "responded to a patient who is unstable and unpredictable due to psychiatric or drug / alcohol-related issues".

v. Drug Overdose. Overdose response has become an increasingly relevant component of paramedicine bringing added stressors to these first responders including occupational burnout and PTSD (Elliott et al., 2019; Lawn et al., 2020). The conversations during individual interviews with the paramedics suggested that drug overdoses were incidents that should be considered as CIs as those types of events seemed to stick in their minds. When asked about events common in Northwestern Ontario, one participant provided a detailed account of a drug overdose. The participant said that:

> Yesterday [they had] a really bad batch of purple down that we were called for a VSA, but the patient ended up having a pulse, but he di- his outcome is not going to be great and, just as I was leaving the other crew was called to almost an identical call within seven hours (Participant 04, *district paramedic*).

Compared to other first responders, paramedics are equipped with the medical knowledge to support these patients and are more involved with the patient when transporting them to further medical care (Williams-Yuen et al., 2020). Therefore, drug overdoses were included on this list

of CIs because of the possible impact that these events may have on paramedics and the increasing calls associated with these events. The item is presented as “responded to a drug overdose”.

vi. Other. An option for respondents to provide other events not listed on the new inventory was also included to capture how lived experiences can influence what events are CIs for each person (van der Ploeg & Kleber, 2003). This was adapted from Behnke et al. (2019) who created a German-specific CI measure where the researchers included an additional “other” option as a free text for their respondents.

Table 6

List of Relevant Critical Incidents for Northwestern Ontario Missing from other Inventories

Missing Items	Revised Items
- Responded to a patient who is unstable and unpredictable due to psychiatric or drug / alcohol-related issues (17) - Responding to a drug overdose (18) - Repeated exposure with same patient (multiple times a shift or week) and a poor patient outcome (e.g., frequent flyer) (28) - Other: _____ (32)	- Direct exposure to a potentially life-threatening virus (e.g., COVID-19, SARS, AIDS) (27) - Made a death notification and/or interacted with deceased’s family (30)

Note. These items represent the wording presented in the contextualized inventory for Northwestern Ontario paramedics. The numbers refer to the order they appear in said inventory. Items in the “Revised Item” column represent adaptations made to items in the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) that were identified by participants as missing or needing more detail.

d. Period Prevalence. The period prevalence integrated into the new inventory asks respondents to reflect on their entire career as a paramedic and indicate if any of the listed events have occurred and provide the number of times each experienced event occurred. Period prevalence refers to gathering a measure over a specified time (Loney & Stratford, 1999). In this case, respondents were required to provide the number of times each listed item occurred in set timeframes (e.g., "never", "past 2 months", "2-6 months", "6 months to 2 years", and 2+ years"). To determine this period prevalence, the participants were asked to reflect on the timeframes presented in the CII (past two months) and the EMS Critical Incident Inventory (entire career for the occurrence of the event and the past six months to reflect if the event has caused them stress).

The CII by Monnier et al. (2002) asks respondents to indicate the frequency of CIs over a two-month timeframe. Upon period prevalence discussion, some district paramedics in this sample thought that the period prevalence should be expanded to cover more time. For example, one individual indicated that "I would think longer […] because […] we might not get as many calls. […] Northwestern Ontario [might] be better suited to […] six months, maybe a year" (Participant 04, *district paramedic*). Other paramedic participants, however, indicated that the two-month timeframe was appropriate as "not too many people remember much past two months, so two months is probably a reasonable timeline (Participant 03, *city paramedic*). Another participant, a city paramedic, noted that:

> If say [I had to remember events in] the past year, I would have a real tough time narrowing down how many incidents that I've been to, so I think having a shorter timeframe […] is beneficial. And if it's only two months that I have to think about (Participant 05, *city paramedic*).

The EMS Critical Incident Stress Inventory by Donnelly and Bennett (2014) asks respondents to indicate whether they experienced stress from an event within the past six months. This six-month period prevalence was elicited positive feedback from the participants (refer to Appendix G). For example, one participant said that "six months is also really reasonable timeline, especially when you consider most of these incidents are pretty severe incidents, they tend to stick in your memory" (Participant 03, *city paramedic*). Based on these conversations, a new timeline was established to allow researchers to capture cumulative frequency based on the suggestion to provide set timeframes and the fact that most individuals will remember dates of serious CIs. Respondents are asked to provide the frequency of events over the "past 2 months", "2-6 months", "6 months – 2 years", and "2+ years" while also having a "never" option. This was adapted from a suggestion by one of the participants who indicated that the frequencies in the CII could be changed to:

> 'One time,' 'two times,' or 'three or more times' to 'past two months,' 'past six months to a year,' 'past […] one to two years,' and then, 'ever […]'. And then you will be able to look at it and you would have a better […] perspective of [the] types of incidents [that] occur (Participant 01, *district paramedic*).

Although participants identified different opinions related to the timeframe, there was an overall consensus that this was an important construct to include in the questionnaire.

Phase 2 - Member-Checking

Participants were presented with an opportunity to provide feedback after reviewing the contextualized measure via email. Those who responded indicated that the contextualized measure accurately captured relevant and appropriate CIs for Northwestern Ontario where no additional items were identified as CIs that should be included in the revised list. For the first

question that asked whether the instructions were clear and easy to understand, the median was five (*M*=5, SD=0) out of a possible 5. The second question, which asked if the respondent felt that the measurement tool will assist in measuring CIE for Northwestern Ontario paramedics, had a median of five (*M*=4.67, SD=.58) out of a possible 5. The median for the third question was five (*M*=4.67, SD=.58) out of a possible 5, and it asked if the proposed timeline of events was clear and easy to complete. When provided the opportunity to identify what they found to be the most difficult part of the new inventory, one participant indicated that they were confused as to if the inventory was capturing the frequency of exposure or if the events occurred at any point. Based on this, the instructions were modified to clearly ask the respondents to report the number of CIs experienced within each timeframe. It was modified to read as "to the best of your knowledge, identify approximately the number of times you experienced each event (below) in the provided timelines during your experience as a paramedic. Subsequently, provide a rating regarding how the combined frequency of exposure to each event is currently having an impact on your life. When it asks about PSP (Public Safety Personnel), it is referring to colleagues you know or work with when protecting the public". Additionally, the participants were able to provide additional feedback and / or suggestions. One participant asked that the "Impact on my Life" column be separated where "none" is an option as its own. This is now reflected in the inventory. Another participant indicated that "prolonged patient care" may be a subjective measure where prolonged may refer to 20 minutes or an hour. The researchers have left this phrase as is to be subjectively interpreted by the respondents.

Chapter Four: Discussion

This thesis sought to evaluate the existing measures used by researchers to quantify CIE for paramedics and contextualize a measurement tool for the sample of paramedics in Northwestern Ontario. Other researchers exploring CIE among paramedics adapted existing measurement tools, and therefore, it was suspected that a new measure would be recommended (Boland et al., 2018; Ward et al., 2006). Specifically, this thesis conducted a cognitive interviewing analysis to assess the content from the CII (Monnier et al., 2002) and EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) within a Northwestern Ontario context where items were retained, adapted, or removed. Additionally, participants suggested combining facets from each existing measure to format one applicable to them, which aided in the questionnaire construction of the contextualized measure ensuring that it was readable and comprehendible. After further research is completed regarding the contextualized measure's reliability and validity, it is anticipated that this measure be used to obtain data on the types of CIs, frequency of exposure, and the impact of the events on the respondent's life. To assess impact, it is anticipated that the contextualized measure be used in combination with other mental health inventories (e.g., PCL-5 for PTSD). Overall, the findings of this thesis project provided insight into paramedics' experience in relation to what they consider as CIs while working in Northwestern Ontario. Based on the conversations, a new measure with 32 items was suggested that includes a timeline of events to capture cumulative exposure and a section that assesses how the events have impacted the respondent's life.

Phase 1 - Item Selection and Generation

When developing an inventory / outcome measure, new items included need to be a) commonly experienced by city and district SNEMS paramedics, and b) understandable by most

respondents (MacDermid et al., 1998). These two factors were kept in the forefront during the interviews as well as reflected on during the analysis process. After the interviews, repeat items between the CII (Monnier et al., 2002) and the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) were identified and reworded to reduce duplication (refer to Appendices D and F). Additional events deemed irrelevant during the interviews were removed (refer to Appendices E and G). Next, items were reworded based on the interviews to reflect SNEMS paramedic's experiences as well as restructured to improve the readability so that they could be understood by multiple readers. The revisions are reflected in the results section of this paper where the participant's feedback is provided to support the revisions. The final inventory can be viewed in Appendix C. In general, revisions to items were made to make the contextualized measure more consistently understood by different respondents (e.g., adjusting the language to reduce different interpretations of the items) and achieve its intended purpose. Components from the cognitive interviewing analysis technique used in this thesis project can also be seen in the studies by Donnelly and Bennett (2014), and Monnier et al. (2002). All studies used existing measures and / or literature to guide item generation and selection (Donnelly & Bennett, 2014; Monnier et al., 2002). Also, discussions were made with potential end-users to ensure contextual relevance for target populations (Donnelly & Bennett, 2014; Monnier et al., 2002). One aspect that varied when contextualizing the measure compared to these other researchers (Donnelly & Bennett, 2014; Monnier et al., 2002) was that the thesis asked respondents to highlight components of two measures that had distinct differences (e.g., number of constructs and period prevalence). This garnered conversations and allowed researchers to contextualize an initial measure based on their preferences. Additional items in the contextualized measure were included based on the interviews and literature review.

Additional Items Included in Inventory

As part of the three-step decision-making criteria to determine items included in the contextualized measure, a literature review was completed. Additionally, items included in the contextualized measurement tool were endorsed by SNEMS paramedics with least one year of experience (80% had greater than 10 years of experience with SNEMS) in that geographical location thereby supporting their relevance (Behnke et al., 2019). Based on responses gleaned from the participants during the first half of the interviews, it was initially thought that two measures may be required to reflect different job demands experienced by district and city SNEMS paramedics. Superior North EMS is an organization that reportedly responds to calls in both the city and district of Thunder Bay where the city paramedics have five stations with staff members working 12-hour rotating shifts (City of Thunder Bay, 2018). The district paramedics have 14 stations in the surrounding district around Thunder Bay serving more dispersed communities (City of Thunder Bay, 2018). Depending on the location, district paramedics work some combination of on-site and on-call staffing, which may be 12 hours on-shift and 12 hours on-call between four and seven consecutive days (City of Thunder Bay, 2018). Therefore, the different geographical areas and organizational structure of work were thought to indicate separate measures as implied by Behnke et al. (2019). Behnke et al. (2019) noted that it is important to consider socio-cultural, religious, or geographic backgrounds as the type and frequency of CIs may differ. The district paramedics in this sample, however, provided preliminary evidence suggesting that the potential to encounter most items in the measures exists, just less frequently (refer to Appendices E and G). As such, one measure is proposed to represent CIE for Northwestern Ontario paramedics, but future research is needed to support these findings. After removing and adapting items in the CII (Monnier et al., 2002) and EMS

Critical Incident Stress Inventory (Donnelly & Bennett, 2014), participants were allowed to identify common CIs that they felt were not represented. The following will discuss items generated from the interviews and a literature search that were incorporated into the contextualized measure.

i. Coronavirus

The ongoing global COVID-19 pandemic prompted one participant to suggest that an item be included to reflect this phenomenon. Since 2019, the world has been battling COVID-19, a viral respiratory syndrome that is highly infectious (Shahzad et al., 2020). Despite the physical distancing recommendations, paramedics are required to directly interact with patients, which increases their perceived threat of COVID-19 while dealing with personal protective equipment challenges (Awais et al., 2020; Shahzad et al., 2020). This increases the paramedic's risk of developing anxiety, depression, and emotional exhaustion (Awais et al., 2020; Shahzad et al., 2020). Its direct influences on paramedicine and the emotional toll it has indicates COVID-19 as a CI. As defined by Mitchell (1983), CIs are events that have the potential to produce strong emotional reactions and impact an individual's ability to cope. Paramedics are not only directly threatened at work by COVID-19 through direct exposure, but also by the potential of bringing it home to their families, which increases their stress levels (Shahzad et al., 2020). These individuals are working overload and are also at risk of self-infection proposing that COVID-19 has the potential to have a lasting emotional impact on first responders (Shahzad et al., 2020). Furthermore, when Donnelly and Bennett (2014) created the EMS Critical Incident Stress Inventory, an item was included regarding being "exposed to serious risk of AIDS or other life-threatening diseases". This supports the inclusion of COVID-19 on the contextualized measure where that item was adapted to include COVID-19.

ii. Interacting with Family Members after a Death

Another incident that needed more clarification for inclusion on the contextualized measure was the process of interacting with a deceased patient's family while waiting for other public safety personnel to arrive at the scene (refer to Appendix H). Participant 02 indicated that interactions with a deceased patient's family may cause a paramedic emotional distress, especially in Northwestern Ontario when waiting for a longer period of time for other first responders to arrive on scene. Similarly, Donnelly and Bennett (2014) found that one of the five most frequently reported exposures that caused stress for paramedics was making a death notification. Participants in the study by Ward et al. (2006) also noted that death notifications and dealing with family members of injured patients were common stressors for EMS personnel. Although the process of making a death notification and interacting with the deceased family members may be a common component of paramedicine, paramedics do not have the existing education or resources to support family members (Cameron et al. 2020). The need for developing training for providing death notifications is ever more important due to the ability to terminate resuscitations in the field (Hobgood et al., 2013). Training such as the GRIEV_ING learning module has shown a statistically significant improvement in EMS personnel's confidence and competence when delivering death notifications (Hobgood et al., 2013). Therefore, future research should consider structured death notification training as part of paramedic education. As no such training is currently provided, this item was adapted from the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) and included on the contextualized measure to address the participant's feedback and supporting scientific literature.

iii. Frequent Fliers

In the realm of paramedicine, the term “frequent flyer” is well-known and refers to individuals who use services more frequently than others in the general population and often for less significant calls (Smith, 2007). The participants in this thesis indicated that the existing measurement tools did not capture responding to frequent flyer calls (Appendix H). Participant 05 felt that frequent fliers could be a potential CI due to the regular and frequent exposure to one patient and the associated feelings of frustration, suggesting that responding to the same patient multiple times in a shift may contribute to stress. Frequent fliers are often lowest regarding patient hierarchies, where they may be overlooked and viewed as a routine call regardless of call acuity (Meisel et al., 2015). It may also impact the paramedic’s frame of mind when responding to a known frequent flyer call. Repeated calls and the cycle where those patients are healthy may cause paramedics to develop anger / frustration or anticipate that the patient is fine when on route to their call. This in turn could impact paramedic performance. In a case study, a frequent flyer visited the hospital over a thousand times in three years (Schaulis & Snoey, 2001). During the constant care of the frequent flyer, healthcare professionals reported developing a deeper level of involvement and attachment, which may have affected how they cared for that individual (Schaulis & Snoey, 2001). Some healthcare professionals reported learning the frequent flyer’s name and treated the individual with extra kindness whereas others paid the individual not to call 911 during their shift (Schaulis & Snoey, 2001). This concept of frequent fliers may be viewed as unconventional with regards to what has traditionally been viewed as a CI as it does not result from exposure to a single event. Rather it captures the continued exposure and interactions with a single person, noting a possible frustration with the system and / or inability to treat the patient. Additionally, when these frequent fliers pass away, it may have

a different impact on the paramedic's mental health as they have become a regular patient and others known to the crew. For example, Donnelly and Bennett (2014), noted that friends, family, and others known to the crew are some of the most difficult calls to respond to. In this thesis, Participant 01 indicated interactions with frequent fliers could have a different impact on their life compared to the one-time exposure to a patient. The paramedics may develop an emotional attachment to the patient with regular interactions where they may anticipate calls with a frequent flyer, an individual they may have come to develop an emotional connection with. More research is needed to explore the impact of responding to frequent fliers as well as how their death may impact paramedics' mental health.

iv. Unstable and Unpredictable Patient

Responding to unstable and unpredictable patients was included in the contextualized measure based on the literature review and observations from the interviews. It was also endorsed by the participants via member-checking. Previous research identified this event as a stressor where it was included in researcher-developed CI measures for their specific study purposes (Behnke et al., 2019; van der Ploeg & Kleber, 2003). Additionally, the qualitative component by Donnelly and Bennett (2014) noted that unstable and unpredictable patients was a CI missing from their EMS Critical Incident Stress Inventory.

v. Drug Overdose

Similar to unstable and unpredictable patients, drug overdose was included in the contextualized measure based on the literature review with support from participants via observations during the interviews and member-checking. Drug overdose response, specifically opioid overdose, is becoming more common and relevant for paramedics (Williams-Yuen et al., 2020). With drug overdoses and other self-harm emergencies, paramedics are the first health-

care professional who directly interact with them (Rees et al., 2018). This type of care is uniquely complex where paramedics may develop an emotional strain (Pike et al., 2019; Rees et al., 2018; Williams-Yuen et al., 2020). In a qualitative study by Williams-Yuen et al. (2020), the emotional burden of the drug overdose crisis was identified as a theme where the participants experienced increased stress in relation to increased drug overdose calls. The participants also noted different emotions where they felt compassion, sadness, and frustration when responding to these calls while developing feelings of helplessness as they continually responded to drug overdoses (Williams-Yuen et al., 2020). They felt as if they were only responding to the symptoms rather than treating the problem (Williams-Yuen et al., 2020). Pike et al. (2019) also reported that first responders as a collective whole experienced burnout in relation to an opioid epidemic highlighting that this event can be considered as a CI. Therefore, the scientific literature supported the inclusion of responding to a drug overdose in the CI measure.

vi. Other

An open-ended item was included on the contextualized measure for individuals to identify a CI that may not be listed in the measurement tool. The concept of having an open-ended item was adapted from Behnke et al. (2019) where they included a free-text option in their Rescue and Emergency Situations Questionnaire. This open-ended free-text option allows respondents the ability to identify CIs unique to them, capturing the concept that different lived experiences can influence an individual's response to a CI (Declercq et al., 2011; Frissa et al., 2016; Regehr et al., 2002).

Chronic Exposure to Critical Incidents. After reviewing the additional items that were included in the list of CIs contextualized for Northwestern Ontario paramedics, frustration with the system is something to take into consideration as it may contribute to moral injury. Moral

injury describes the effects of witnessing the aftermath of violence, human suffering, or the failure to prevent a negative outcome from occurring (Murray, 2018). Furthermore, participation in, or observation of a situation that conflicts with personal values may contribute to moral injury (Lentz et al., 2021). Therefore, the inability to prevent a negative outcome and not being able to help patients may speak to a wider construct of moral injury. Future research is needed to explore this concept where the contextualized Northwestern Ontario CI measure attempts to capture this phenomenon via the inclusion of the frequent flyer and drug overdose items.

Questionnaire Construction

Questionnaire construction began after the item generation and selection phases (MacDermid et al., 1998). The checklist format for items used in the CII (Monnier et al., 2002) and EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) was maintained because participants found it easy to use and as has been noted as a best practice in previous research (Behnke et al., 2019). One difference between the two template measures (CII; Monnier et al., 2002; and EMS Critical Incident Stress Inventory; Donnelly & Bennett, 2014) was the inclusion of a stress rating scale as an additional construct in the EMS Critical Incident Stress Inventory.

Impact on Respondent's Life Rating Scale

Participants in this thesis voiced appreciation of the stress rating scale provided in the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) as it allowed them to reflect on the event and how it affected them (refer to Appendix G). This is echoed by previous research as individuals responding to the same CI may not necessarily react in the same manner (Bovin & Marx, 2011; Donnelly & Bennett, 2014). Since individuals have a unique response to exposure to CIs, it is important to assess their individual reactions to the event by assessing impact (Donnelly & Bennett, 2014). In the contextualized measurement tool "impact on my life" is a

subjective measure that provides respondents the opportunity to reflect on the cumulative exposure to a CI and indicate how they felt it has affected them.

Regehr et al. (2002) conducted a study with paramedics to assess their exposure to CIs, emotional distress, and coping strategies. These researchers developed their own measurement tool for measuring CIs, which included a component where the participants were asked to identify if the event caused them to experience emotional distress (Regehr et al., 2002). This construct was highly subjective and individually defined by the participants (Regehr et al., 2002). Despite reporting responding to significant CIs (e.g., being victims of violence and near-death experiences), the respondents did not report great amounts of distress (Regehr et al., 2002). Higher scores of emotional distress were reported with events involving children and multiple casualties (Regehr et al., 2002). In combination with this subjective measure, participants were also required to complete the Beck Depression Inventory (Beck & Beamesderfer, 1974) and the Impact of Event Scale (Zilberg et al., 1982) thereby allowing researchers to make inferences between CIs and mental health disorders (Regehr et al., 2002). The intent for the contextualized measurement tool for Northwestern Ontario paramedics is to follow the same format where individuals identify if they experienced a CI (the frequency), associated impact, and assess mental health indices with additional questionnaires.

Dutch nurses and ambulance personnel from a military facility participated in a study that explored the frequency of exposure to CIs and the subjective appraisal of that exposure in predicting PTSD symptoms (Declercq et al., 2011). A researcher-developed inventory, based on archival data and a literature review, containing 27 items and a scale for measuring the subjective impact of their fear, helplessness, or horror in response to each experienced CI was administered (Declercq et al., 2011). Additionally, the Davidson Trauma Scale was used to measure symptoms

of PTSD with 17-items that looked at frequency and severity (Declercq et al., 2011). The results indicated that the subjective experiences of fear, helplessness, or horror in relation to a CI contributed to PTSD symptoms (Declercq et al., 2011). These researchers, however, did not find a relationship between the frequency of CI and symptoms of PTSD (Declercq et al., 2011). These findings suggest that individual interpretations of a CI can play a role in the development of adverse mental health conditions as opposed to the number of CIs that they are exposed to. Therefore, previous research supports the suggested inclusion of an impact scale for a Northwestern Ontario paramedic contextualized measure: it offers respondents the ability to reflect on their exposure to CIs and how it has impacted them. Possible scoring methods will be discussed later in the paper. As mentioned earlier, it is still anticipated that the new inventory is completed in conjunction with other mental health index questionnaires to allow inferences to be made regarding CIE and adverse mental health conditions.

Period Prevalence

Another difference between the CII by Monnier et al. (2002) and the EMS Critical Incident Stress Inventory by Donnelly and Bennett (2014) is the period prevalence. District paramedics indicated that the two-month timeframe on the CII was too short of a period for recalling events (refer to Appendix E). Due to the smaller populations that they serve, they may not respond to any CIs during that timeframe. Therefore, the contextualized measure was modified based on that feedback: participants are required to indicate the number of events that occurred over the “past 2 months”, “2-6 months”, “6 months to 2 years” and “2+ years”. This timeline was adapted from a participant’s suggestion to include a cumulative exposure component. As a result, it seeks to address a gap in the literature identified by Boland et al. (2018), where few inventories capture career cumulative exposure of CIs. The cumulative nature

of exposure to CIs is an important component for consideration as it is something that differentiates first responders from the general population; first responders are regularly exposed to CIs (Carleton et al., 2018a). One other thing to consider when developing this timeframe was the potential for recall bias as the proposed structure requires respondents to recall all relevant CIs throughout their career (Donnelly & Bennett, 2014; Halpern et al., 2012). Recall bias is present when conducting research using self-report measures (Frissa et al., 2016). It refers to an individual's subjective interpretation of events and the type of events (Frissa et al., 2016). The participants from this study, however, felt that most individuals would remember the dates of significant CIs. Recalling the number of times smaller events such as being threatened were more likely to be an issue. Another factor to consider is underreporting where first responders are known to underreport CIs and adverse mental health conditions because of the stigma associated with looking weak (Carleton et al., 2018a; Donnelly & Bennett, 2014; Flannery, 2015; Karaffa & Koch, 2016). Another possibility for underreporting is that the first responders might not recognize the links associated with adverse mental health conditions (Krakauer et al, 2020). This, in turn, may also be a problem with cumulative CIE for paramedics.

Questionnaire Scoring

When using an outcome measure, researchers need to understand how to score and interpret the results. The following provides a suggested process that could be used to score the Northwestern Ontario measure for CIE. When examining the contextualized measure, two constructs are present: timeline of events and impact on the respondent's life. A suggested scoring method involves both a separate and combined approach. The frequency of exposure to CIs could be determined by summing the values provided in the timeline of events (e.g., calculating a summed total of all values provided in the timeline of events). Additionally, if

subscales are determined (discussed below as a factor analysis), it will provide information about the types of reported events that individuals experience. As for assessing the impact of events on the respondent's life, it could be scaled by assigning numerical values to the qualifiers (e.g., none = 1, a little = 2, moderate = 3, a lot = 4). It was thought that an impact of "none" should still receive a value of one because of the stigma associated with mental health among first responders, which may cause individuals to downplay how an event has impacted them (Crowe et al., 2015). Also, note that if no event was reported in the timeline section a score of 0 would be appropriate for the qualifier "none". Therefore, the associated impact could be determined by summing the values assigned to the qualifiers and each item.

Another facet to consider when scoring this inventory is the combination of exposure and impact. A suggested approach when combining the two constructs is using an algorithm that weighs the exposure and impact (e.g., timeline of events X impact on my life). When individuals experience more exposure (e.g., greater frequency) and indicate that it has had an impact on their life (e.g., none = 1, a little = 2, moderate = 3, a lot = 4), their score will be reported accordingly. The higher scores would suggest that CIE is having a greater effect on the individual. This concept was adapted from Weiss et al. (2010) where a variation of this algorithm was used in the Critical Incident History Questionnaire for law enforcement officers. More research is needed to verify this approach as an appropriate method for scoring the inventory especially if repeated frequency to an event contributes to resiliency. Some researchers have reported inverse relationships between frequency and severity rating suggesting that frequent exposure may foster resilience and item tolerance (Boland et al., 2018; Weiss et al., 2010). This would impact the scoring as the anticipated increase in the severity of the impact with more frequent exposure may

not occur. More research is needed to verify this suggested scoring method as well as the implications related to mental health.

Phase 2 – Member-Checking

The preliminary version of the contextualized measure was revised with an expert measure developer (JM) and later sent to the original participants for feedback (Behnke et al., 2019). The feedback from the participants was positive thereby suggesting that the new measure accurately captured the individual interviews of the sample of Northwestern Ontario paramedics.

Limitations

This study had a low response rate (e.g., five out of approximately 170 paramedics responded = 3%), which may be attributed to the COVID-19 pandemic. COVID-19 was reported to negatively impact the mental health of paramedics and the general population (Li et al., 2020; Vujanovic et al., 2021). As a result, potential participants may have been off work for mental health leave or not interested in discussing psychological health at this time. Furthermore, recruitment for participation in this thesis occurred during a COVID-19 spike in February and March in Thunder Bay where paramedics were taxed to respond to the city's needs (Jackson, 2021). As a result, the paramedics were working to meet the demands of COVID-19 in their communities and may not have had time to participate. That being said, incorporating SNEMS personnel in the development of items for the Northwestern Ontario contextualized measurement tool allowed integration of occupation-specific knowledge to guide the revisions and create a measure more appropriate for these paramedics (Behnke et al., 2019). This ensured that the revisions to the measure increased the perceived relevance of responses for future research. This supports the cognitive interviewing process where the sample characteristics should be similar to the respondents who will be completing the final version of the measure, and therefore represent

typical SNEMS paramedics (Patrick et al., 2011). The sample in this thesis was similar to the target audience of SNEMS paramedics where it represented both organizational sectors: the district (*n*=3) and the city (*n*=2) of Thunder Bay, thereby allowing researchers to glean information from different structural organizational settings. Previous research has noted that in rural communities responding to a call involving friends and family is a significant stressor and therefore may have been more prevalent among district paramedics in this sample due to the smaller communities that they serve (Alexander & Klein, 2001). In this sample, call volume varied between the district (low call volume) and city (high call volume) paramedics, which highlights the importance of including both sectors in the sample. Regardless, caution is warranted when interpreting the results as the sample only included primary care paramedics, which could impact exposure to CIs as practicing paramedicine may depend on the training and call distribution (Bowles et al., 2017). In this sample of paramedics, all participants were trained as primary care paramedics (100%).

As mentioned, a total of five paramedics were recruited to participate in this study. This makes it is challenging to transfer the results for the contextualized measure for paramedics in Northwestern Ontario (Korstjens & Moser, 2018). Transferability of data refers to results from a study that can be applied in other contexts or settings with other respondents (Korstjens & Moser, 2018). To allow other researchers to assess the transferability of these results, a rich description of the research process and the profile of the participants was included for their analysis (Korstjens & Moser, 2018). Nonetheless, additional research is required to assess the transferability of the results, especially as saturation was not always reached where participants provided mixed opinions during the interviews. Therefore, decisions for the contextually relevant

measure were made using a three-step decision-making criterion, which included making changes to the wording and items based on the majority of the participant's agreement.

According to Willis (1999), the purpose of cognitive interviews is not to gather statistical estimation, and therefore, a small sample of a variety of individuals is sufficient. When seeking to contextualize a measure, a finding based on one interview that points out a potential problem with the measure is sufficient to warrant change without verification from a large number of individuals in the same situation (Willis, 1999). Therefore, when completing cognitive interviews, a smaller sample size may be appropriate with as few as five or six participants as the results may still provide useful information if the researchers recognize potential for bias (Willis & Artino, 2013). The student researcher (AD) declares her biases. She has previous experience interacting with first responders including paramedics when exploring possible mental health support strategies. Additionally, she has viewed the news and mainstream media, subsequently informing her personal views about the occupational demands of paramedics. Therefore, she self reports having some predetermined expectations for this study thinking that occupational demands may be stressful for paramedics in Northwestern Ontario and consequently contribute to adverse mental health conditions. Despite this, the student researcher strove to manage her own views on paramedicine by continually referring to the study purpose and open-mindedly engaged in interviews with the participants. The data was also triangulated and sent back to the participants via member-checking to check for accuracy and resonance with their experiences (Birt et al., 2016).

Recommendations for Future Research

Future research is required to validate this measure across Northwestern Ontario paramedics as this represented the first iteration of cognitive interviews. With cognitive

interviewing, multiple rounds of interviews to analyze measures are suggested (Willis & Artino, 2013). Although this tool was contextualized specifically for Thunder Bay and Northwestern Ontario paramedics to reflect the occupational demands unique to that area, paramedicine is provincially regulated (Bowles et al., 2017) and future research is suggested for expansion of the measurement tool for all of Ontario. Conversations with the paramedic participants suggested that Ontario paramedics may respond to similar events, but the frequency of exposure may be different. This suggests that further research may be warranted to validate the tool for paramedic regions outside of Northwestern Ontario.

The contextualized measure should be pilot tested and undergo rigorous testing to ensure that it is reliable and valid (MacDermid et al., 1998; Rodrigues et al., 2017). A pilot test could be conducted to assess the new inventory's reliability by calculating the interclass correlation coefficient (ICC; MacDermid et al., 1998). The ICC can demonstrate the robustness of a scale as it is a measure of reliability that reflects both the degree of correlation and agreement between measurements (Bobak et al., 2018; Koo & Li, 2016). There are different types of ICCs, and it is recommended that future research complete intrarater, and test-retest ICC to gain confidence in the measure (e.g., high ICC indicates reliability; Koo & Li, 2016). Intrarater reliability refers to the variation of data measures by one rater across different trials (Koo & Li, 2016). Test-retest reliability testing (questionnaire consistency) is important for self-report measures (Koo & Li, 2016), and could be performed with different paramedic organizations across Ontario and Canada. For example, paramedic groups should complete the contextualized measure at two different times under the same conditions to correlate the scores and assess for the test-retest reliability. A suggested timeframe for the second administration of the measure would be within two weeks. Two weeks is a frequently suggested timeframe based on the available literature

where two weeks may minimize the effect of possible confounding variables such as learning effects (Dutil et al., 2017; Streiner et al., 2015).

The CII, which was the existing inventory used as the initial template for the inventory contextualized to Northwestern Ontario paramedics had six subscales. Therefore, a factor analysis is suggested for future research to establish the factor structure of the questionnaire as a way for loading items into possible subscales (UCLA, 2021). Two types of factor analyses are indicated: confirmatory and exploratory. A confirmatory factor analysis verifies the factor structure of the observed variables (UCLA, 2021). An exploratory factor analysis explores the underlying structures of the factors to ensure that the items in a measure collect responses on the measure of interest and should be considered as a follow-up analysis after the confirmatory factor analysis (UCLA, 2021). This will reduce potential redundancy of items.

Content validity testing should continually assess the extent to which the new checklist inventory corresponds to theoretical constructs and measures appropriate / relevant CIs. In the study by Monnier et al. (2002), content validity of the CII was verified as the participants reported that the items in their checklist were potential incidents that may be called to respond to. Therefore, content validity of the Northwestern Ontario contextualized measure could be completed by verifying the new items reflect paramedicine across Ontario, as the sample from Northwestern Ontario already assessed the perceived occupational relevance of the listed 32 items. As further cognitive interviews are completed, the content validity of the contextualized measure will continue to be established. Other researchers developing CI measurement tools have assessed discriminant and convergent validity (Monnier et al., 2002; Weiss et al., 2010). Discriminant validity refers to the process of assessing whether constructs that are not supposed to be related are indeed not related (Weiss et al., 2010). In the study by Weiss et al. (2010),

education level and social support were used to assess discriminant validity as those factors were not expected to have a meaningful relationship on exposure to CI. Similarly, future research with the new Northwestern Ontario CI inventory could assess relationships between education and social support to establish discriminant validity. Convergent validity refers to the strength of the relationship between the measure and other variables of the same construct (Monnier et al., 2002). Therefore, to assess convergent validity, future research could assess whether the contextualized measure is related to mental health conditions that are known to be related to exposure to CIs (e.g., depression; Monnier et al., 2002; Petrie et al., 2018; Regehr et al., 2002).

Sex and Gender

It is important to consider a gender analysis when developing measurements and establishing strategies to support mental health, as females have reported greater vulnerability to the effects of trauma (Carleton et al., 2018a; Frissa et al., 2016; Hertler et al., 2020). Furthermore, sex and gender can impact the course and perception of illness trajectories and treatments (Hertler et al., 2020). For paramedics, a gender profile has been reported showing that there are more male paramedics than female. A Canadian paramedic health and wellness project assessed the impact of their job responsibilities on quality of life by gathering data from paramedics across the country (Fischer & MacPhee, 2017). In the first phase, 2,557 surveys were completed and identified that 36% of respondents were female and the remaining 64% identified as male (Fischer & MacPhee, 2017). In the project by Fischer and MacPhee (2017), the qualitative component (38% female; 62% male) on mental health was not analyzed by gender. The gender distribution in the project was representative of female paramedics in Canada where women represent 25% of paramedics across Canada (Professional Paramedic Association of Ottawa, 2014).

Women in the general population typically score higher on psychological symptomology after trauma and it would be valuable to assess if the results were the same for female paramedics who are more regularly exposed to trauma for informing early intervention strategies (Hunt & Evans, 2004). In another first responder occupational group, firefighters, results indicated differences between genders in describing traumatic events where females were shorter when describing traumatic experiences while males retold experiences more vividly (Jacobsson et al., 2014). This implies differences in the ways that events are perceived, described, dealt with, and internalized. Female first responders in a Canadian study were also more likely to screen positive than men for a mental disorder (Carleton et al., 2018a). Similarly, a study with South African EMS personnel reported that female participants were more likely to have higher rates of anxiety and depression compared to their male counterparts; however, more research was indicated due to the limited sample size (Ward et al., 2006). Overall, since PROMs reflect the subjective views of respondents, it is important that sex and gender are considered and that a balanced spectrum is used when developing and validating these measures (Hertler et al., 2020). At this point, the participant demographics and limited sample size in this study prevented a gender analysis (males=4, females=1) but should be considered moving forward.

Chapter Five: Proposed Knowledge Translation Strategy

Knowledge translation is the process of bridging the gap between research and the application of knowledge by ensuring that end-users are aware of research findings (knowledge) to improve health outcomes and healthcare systems (Graham et al., 2006). This thesis used an integrated knowledge translation approach, which refers to the stakeholder or potential research knowledge user engaging in the entire research process, thereby creating research results contextualized to them (Graham et al., 2006). Specifically, the primary knowledge user (SNEMS) was viewed as an equal member of the research team, via the Peer Support and Wellness Coordinator, and also participated in aspects of the research project including the design and implementation of this thesis. Additionally, after the contextualized measurement tool has been validated and assessed for reliability, it is anticipated that SNEMS will be involved in the dissemination of the measurement tool.

This thesis was informed by the Knowledge-to-Action Framework (refer to Appendix I). The Knowledge-to-Action Framework identifies a complex and dynamic process of transferring knowledge into usable information via two concepts: knowledge creation and action (Graham et al., 2006). Knowledge creation is represented in the funnel where knowledge begins as individual studies (knowledge inquiry), is synthesized across multiple studies (knowledge synthesis), and created into tools or products (Graham et al., 2006). Therefore, as knowledge moves through the funnel, it becomes more refined and usable by stakeholders where it then enters the action cycle (Graham et al., 2006). The action cycle represents the process of implementing knowledge into action (Graham et al., 2006). It is a dynamic process that can be influenced by other steps in the cycle as well as the knowledge creation funnel (Graham et al., 2006). Therefore, this framework was used to inform the thesis as it indicates that successful

knowledge implementation requires collaboration with the knowledge user and allows for flexibility through the dynamic phases (Graham et al., 2006). Based on this, the current thesis is exiting the funnel via the contextualization of a measurement tool for CIE specific for Northwestern Ontario paramedics and entering the action cycle. It involved the identification of a problem through collaboration with SNEMS as a necessary knowledge user. The new measure was adapted to a local context and needs to undergo further evaluation to ensure that it can be appropriately integrated into practice and will assist in generating early interventions to promote mental health among SNEMS paramedics.

The goal of this thesis was to contextualize a measurement tool for Northwestern Ontario paramedic's exposure to CIs, which could assist in informing future research and strategies to support mental health. After the inventory has been appraised for reliability and validity, the results will be disseminated to the target audience: SNEMS paramedics, researchers, clinicians, and health and safety personnel within SNEMS. Oral presentations with an infographic and lay summaries developed by the research team are suggested to present thesis results to the paramedics and health and safety personnel within the paramedic organization. Additionally, peer review publications should be developed and made available for researchers and clinicians. Results will also be presented at a thesis defence and available via a manuscript written for publication in peer-reviewed journals. Sharing the findings will allow individuals to understand how to administer the measure and encourage respondents to complete it as accurately as possible to garner applicable outcomes.

Chapter Six: Conclusion

With the current focus and national attention on research exploring first responder's mental health (Government of Canada, 2019), a standardized process for assessing CIs is indicated. Paramedics play a crucial role in our society as first responders, where they have made personal sacrifices to serve the community during the ever-changing COVID-19 pandemic. The results from this thesis suggest that the contextualized inventory using combined facets from both the CII by Monnier et al. (2002) and the EMS Critical Incident Inventory by Donnelly and Bennett (2014) contains a comprehensive list of relevant CIs for paramedics in Northwestern Ontario. This contextualized measurement tool for Northwestern Ontario paramedics needs to be assessed for reliability and validity before it can be integrated into practice. Additionally, the conversations with paramedics in Northwestern Ontario suggested that one measure could be applicable for paramedics across Ontario, proposing that further iterations could ensure that the items are clearly worded, well defined, and cover appropriate incidents for Ontario paramedics (Rodrigues et al., 2017). Overall, paramedics routinely face human suffering as part of their occupational demands, where exposure is reported as a contributing factor in the development of adverse mental health conditions. Researchers should ensure that adequate inventories are available to measure CIs for this population. Future research could then inform strategies for early interventions to support these individuals as they continuously care for our communities.

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Appendix A

Participant Demographics Form
This information will be asked using Google Forms

1. Please provide your age in years. _____
2. Please provide your date of birth: _____
3. What was your sex at birth?
    a. Male
    b. Female
4. Please indicate your gender.
    a. Female
    b. Male
    c. Prefer not to say
    d. I don't identify with any of the genders listed
    e. I identify as _____
5. Please indicate your number of years of service as a paramedic with Superior North EMS.
    a. Less than 1 year
    b. 1-5 years
    c. 6-10 years
    d. Greater than 10 years
6. Please indicate your years of service as a paramedic prior to Superior North EMS
    a. Less than 1 year
    b. 1-5 years
    c. 6-10 years
    d. Greater than 10 years
7. What is your Job Title / Rank? _____
8. Indicate your current area of service.
    a. City of Thunder Bay
    b. District of Thunder Bay
9. Please indicate if diagnosed with, or seeking treatment for, depression, anxiety, or PTSI within the previous 6 months.
    a. Yes
    b. No

Appendix B

Semi-structured Interview Guide

Purpose of the interview: to investigate the representativeness of the EMS Critical Incident Stress Inventory and the Critical Incident Inventory for Northwestern Ontario paramedics

Welcome

- "Thank you for agreeing to participate in a discussion about the current EMS Critical Incident Stress Inventory and the Critical Incident Inventory and the use of these inventories for paramedics in Northwestern Ontario. My name is Alysha and I am a student researcher at Lakehead University. Your views are highly valued and your identity will not be disclosed to anyone outside the research team. As indicated in the consent form you completed online, our discussion today will be audio-recorded, so please try to speak clearly. In regards to the consent form, did anyone have any questions (*review here*)? Next, I will outline how today will work. To begin, I will ask you some questions about critical incident exposure in Northwestern Ontario and hope that it will stimulate a discussion amongst you. I will not be contributing to the discussion as you are the experts in this area; rather I am here to facilitate the session".

Background of Topic

- "Today's discussion has come out regarding the increasing research and attention on supporting the mental health of our first responders. Research with paramedics has indicated that, as a profession, you are more likely to experience exposure to critical incidents. A critical incident is a term that refers to an overwhelming difficult event that may impact an individual's ability to cope. It has also been linked to decreased quality of life levels. Recognizing the unique factors associated with being in a Northern and more isolated location, more research is needed with your population. Therefore, the results from this discussion will be used to modify the EMS Critical Incident Stress Inventory and Critical Incident Inventory to reflect your experiences as a Northwestern Ontario paramedic. The modified tool will then be used to quantify critical incident exposure in Northwestern Ontario as well as used to assess how critical incident exposure manifests itself".

Guidelines

- "For today's discussion, there are no wrong answers, only differing points of view. Please feel free to share your point of view even if it differs from what someone else has said. Since we are recording this discussion, please try to have only one person speak at a time so that we can capture all the helpful things said. Throughout this discussion, we will be on a first name basis to control for confidentiality. In the written report, we won't use any names so you can be assured of complete confidentiality. Finally, you do not have to agree with others but you need to listen respectfully to them. If you have any questions, please do not hesitate to ask throughout our session today. If you are comfortable, you can ask verbally over Zoom or there is the option to type a question to the whole group, or just to me. I know it may be a little bit more difficult over Zoom, but let's try talking as if we were in the same room. Why don't we begin by learning more about each person here? Tell us your name, current job position, and years of experience. Would anyone like to go first?"

Questions

GENERAL INFORMATION:

Role as a Paramedic

1. "Tell me about your job as a paramedic at Superior North EMS?"
    a. Probe: "District versus City of Thunder Bay".
    b. "What are the levels of paramedics who serve Thunder Bay? (Primary Care Paramedic, Advanced Care Paramedic, and Critical Care Paramedic)

Northwestern Ontario:

2. "Think about your experience as a paramedic in Northwestern Ontario. What makes your job different than paramedics who serve more urban communities?"
    a. Probe: "Are there any obstacles that influence your work performance (impact of the work on their mental health) being in Northwestern Ontario? If so, explain".
    b. Probe: "In your experience, are there events more prone to occur in this area? Explain".
    c. In what way do you feel that that COVID-19 has impacted your experience as a paramedic?
        i. "Do you think that this experience is influenced by the regions in which paramedics work? (i.e., is working paramedic work different during COVID-19 in Northwestern Ontario vs. another region)?"

Critical Incident Exposure:

3. "Is a critical incident a term you have heard before today?"
    a. Probe: "If so, where have you heard it?"
    b. Probe: "What do you consider a critical incident?"
    c. Probe: "How would you describe the frequency of exposure to critical incidents (over one shift, career)?"
    d. Probe: "Are there events in your career that have had a lasting impact on you?"
    e. Probe: "What has had more impact on you, **one or two serious critical incidents or the ongoing exposures**? Or do you think they affect you differently?
4. "Do you feel that there are critical incidents unique to paramedics in Northwestern Ontario?"
    a. Probe: "If you are comfortable, can you share what you mean?"

APPLICIBILITY OF EXISTING MEASURES:

"For the following, we will review the EMS Critical Incident Stress Inventory to assess its' applicability for you as SNEMS employees. If possible, have the inventory available and I will also display it over Zoom©".

EMS Critical Incident Stress Inventory:

5. "What are your general thoughts about this inventory?"
    a. Probe: "Was it easy to use/self-explanatory?"
    b. Probe: "What aspects of this tool did you like?"
6. "In your opinion, do the listed events reflect your experience as a paramedic in Northwestern Ontario?"
    a. Probe: "If given the opportunity, which items would you remove to make it more applicable to you? Which would you add?"

Critical Incident Inventory: "Let's transition to the second inventory, the Critical Incident Inventory. Again, feel free to have this inventory available during this part of our discussion and I will share it over Zoom©".

7. "What is your opinion of this tool? Are there potential reasons why people would not want to use it?"
    a. Probe: "If we compared it to the first tool (the EMS Critical Incident Stress Inventory), would you say that it is easier to use? Explain what you mean".
    b. Probe: "What aspects of this tool did you like better/worse if we compared it to the EMS Critical Incident Stress Inventory, if any? Explain".
8. "In your opinion, do the listed events in these inventories capture your experience as a paramedic in Northwestern Ontario?"
    a. Probe: "Reflecting on your experiences as paramedic with Superior North EMS, are there ***any*** events missing from ***either tool*** that you think need to be included in the inventory? If so, can you elaborate on them?"
    b. Probe: "What items should be removed?"
9. "Having had the opportunity to look at two tools used to assess critical incident exposure, what changes should be made so that your experiences in Northwestern Ontario are better depicted?"
    a. Probe: "If given the opportunity, how would you design the ideal tool/method of measuring exposure to critical incidents?"
    b. Probe: "What would type of tool would you like to see as a way to measure your exposure to critical incidents?"
    c. Probe: "Are there aspects of either tool that you preferred?"
        i. Probe: "For example, would you recommend a timeline associated with the inventory? The EMS Critical Incident Stress Inventory asks you to indicate if you've experienced the following event in the line of duty whereas the Critical Incident Inventory asks if you to indicate the number of times each event has occurred in the past 2 months".
        ii. Probe: "Response options as "yes or no" or "frequency of events"
        iii. Probe: "Is one tool easier to use than the other?"

CONCLUSION

- "Thank you for sharing and participating in this discussion. Of all the things we discussed, what to you is the most important?"
- "The reoccurring themes that I am hearing from you are _____. Is this an adequate summary?"
- "Would you like to clarify or comment on anything else you think is important?"
- "Once again thank you for taking the time to participate and I will follow-up with an e-mail that contains that modified tool for your review".

Appendix C

New Critical Incident Inventory for Northwestern Ontario Paramedics

Date: ____/____/_____ dd/mm/yyyy ID Code: _____

Critical Incident Inventory – NWO Paramedic

Instructions: To the best of your knowledge, identify approximately the number of times you experienced each event (below) in the provided timelines during your experience as a paramedic. Subsequently, provide a rating regarding how the combined frequency of exposure to each event is currently having an impact on your life. When it asks about PSP (Public Safety Personnel), it is referring to colleagues you know or work with when protecting the public.

	Timeline of Events					**Impact on my Life**			
	Never	**Past 2 Months**	**2 - 6 Months**	**6 Months - 2 Years**	**2 + Years**	**None**	**A little**	**Moderate**	**A Lot**
1. Serious line of duty injury to self.									
2. Threat of serious line of duty injury or threat of death to self, also known as a "near miss" (that did not result in actual serious injury).									
3. Line of duty death of a PSP.									
4. Serious line of duty injury to PSP (that did not result in death).									
5. Threat of serious line of duty injury or threat of death to PSP, also known as a "near miss" (that did not result in actual serious injury or death).									
6. Was assaulted by a patient.									
7. Suicide or attempted suicide by PSP.									
8. Encountered the body of someone who died by suicide.									

9. Responded to incident involving three or more deaths.									
10. Responded to incident involving one or two deaths.									
11. Responded to incident involving multiple serious injuries (three or more victims sustained serious injuries).									
12. Incident requiring police intervention while on duty.									
13. Verbal or physical threat by the public while on duty, including critical (negative) media attention.									
14. Incident involving serious injury or death to children.									
15. Incident involving severe threat to children (that did not result in actual serious injury or death to children).									
16. Responded to a victim who was sexually assaulted.									
17. Responded to a patient who is unstable and unpredictable due to psychiatric or drug / alcohol-related issues.									
18. Respond to a drug overdose									
19. Victim(s) known to you (family, friends, or others known to the crew).									
20. Prolonged patient care with extensive effort and a negative trajectory / outcome.									
21. Close contact with burned or mutilated victim.									

22. Removing and/or transporting dead body or bodies.									
23. Prolonged time caring for a patient that required extrication or was trapped in a potentially life-threatening situation.									
24. Use of deadly force by police at an incident.									
25. Direct exposure to extremely hazardous materials.									
26. Direct exposure to blood and body fluids.									
27. Direct exposure to a potentially life-threatening virus (e.g., COVID-19, SARS, AIDS).									
28. Repeated exposure with same patient (multiple times a shift or week) and a poor patient outcome (e.g., frequent flyer).									
29. Made a mistake that led to serious injury or death of a patient.									
30. Made a death notification and / or interacted with deceased's family.									
31. Critical equipment failure or lack of equipment in any of the above situations.									
32. Other: _____									

Appendix D

Critical Incident Inventory (CII)

Instructions: Indicate the number of times each event has occurred in the **past 2 months**.

Questions	One time	Two Times	Three or more times	None
1. Serious line of duty injury to self.				
2. Threat of serious line of duty injury or threat of death to self (that did not result in actual serious injury).				
3. Line of duty death of a fellow emergency worker.				
4. Serious line of duty injury to fellow emergency worker (that did not result in death).				
5. Threat of serious line of duty injury or threat of death to fellow emergency worker (that did not result in actual serious injury or death).				
6. Suicide or attempted suicide by fellow emergency worker.				
7. Responded to incident involving three or more deaths.				
8. Responded to incident involving one or two deaths.				
9. Responded to incident involving multiple serious injuries (three or more victims sustained serious injuries).				
10. Incident requiring police protection while on duty.				
11. Verbal or physical threat by public while on duty (that did not result in police protection).				
12. Incident involving serious injury or death to children.				
13. Incident involving severe threat to children (that did not result in actual serious injury or death to children)				
14. Victim(s) known to you.				
15. Failed mission after extensive effort.				
16. Critical (negative) media interest.				
17. Close contact with burned or mutilated victim.				
18. Removing dead body or bodies.				
19. Incident necessitating search or rescue involving serious risk to yourself.				
20. Prolonged extrication of trapped victim with life-threatening injuries.				
21. Use of deadly force by police at an incident.				
22. Direct exposure to extremely hazardous materials.				
23. Direct exposure to blood and body fluids.				
24. Critical equipment failure or lack of equipment in any of the above situations.				

Note. This represents the CII by Monnier et al. (2002). It was used as the initial template when contextualizing the measurement tool for Northwestern Ontario paramedics. Participants

reviewed each line item and a decision to keep, adapt, or remove the item was made based on their feedback with supporting scientific evidence. Line items in green represent those that were kept. Line items in orange represent items where the language was adapted and used in the contextualized measure, and red represents the item that was removed. Adapted from “The impact of resource loss and critical incidents on psychological functioning in fire-emergency workers: A pilot study.” by J. Monnier et al., 2002. *International Journal of Stress Management, 9*(1), 11-29. https://doi.org/10.1023/A:1013062900308

Appendix E

Evaluation of the Critical Incident Inventory by Monnier et al. (2002)

Key Elements	Supporting Quotations
Overall Impression of the CII	"…I like the wording on [the CII] better" (Participant 01, *district paramedic*) **"**[The events on the CII] all happened, so I think they're definitely relevant" (Participant 05, *city paramedic*) "Suicide attempt by fellow emergency worker, like, that one [was a] little bit… [I felt a little] something just because I […] immediately thought of like my coworkers [who] had to go to that call. I didn't have to go to that call but yeah like I just…I immediately thought of […] the paramedics [who] had to go to those calls. So, I don't know if that's considered a trigger or not… like […] it wasn't overwhelming for me, but it was like a little pang, it was like- oh it's there" (Participant 05, *city paramedic*)
Period Prevalence of the CII	"[When talking about period prevalence] I don't think the memory, like…ah. You know, serious line of duty injury or death like to a co-worker. They're going to know dates for those kind of things. And it's the little ones that are like-happen all the time, like that's where you get to that memory issues, like, oh, when was last time I was threatened by someone?-Oh yesterday, and the day before, and the week before… So, those ones […] blur, but I don't think you're generally like. Um. Bigger like more critical incidents, I think you generally know the date" (Participant 01, *district paramedic*) [Participant providing suggestion for period prevalence] "did this occur like. Instead of the one, two, or three times. Like, I don't know if you're wanting frequencies. Or if that would be a better, like in the past two months…in the past, you know, two months to six months, in the past six months to two years, kind of thing. To see like that might give you a better, better data as far as frequency right? Does that make sense? … did you experience this in the last two months? [Did] you experienced this in the last…whatever, six months or a year? Did you experience this last two years- […] So, I'm saying, like at the top […] it says […] has happened last two months, and then it, and then it has frequency, right? One time, two times, three times, none. You could change that to like past two months, past six months to a year, past […] one to two years, and then, ever […]. And then you will be able to look at it and you would have a better [indication] of like oh, paramedic say this has happened sometime in their career, or you get a little bit of

	perspective of like these types of incidents occur. That seems like every two years as a paramedic in Superior North EMS you, you're going to experience this type of incident. And then you'd have those like oh you experiencing these every two months and you'll see some commonalities I think of like. Okay, so these are the things that happen regularly here's sort of those incidents, we were talking about their little more outside the box that happen like they do happen, but there may be in that like 1-to-3-year range. And these are things that are going to maybe happen once in your career" (Participant 01, *district paramedic*) *"*Well that's a good point, not too many people remember much past two months so two months is probably a reasonable timeline" (Participant 03, *city paramedic*) "I would think longer just because […] we might not get as many calls and the acuity of calls might be [lower]. […] Northwestern Ontario [may] be better suited to like six months, maybe a year" (Participant 04, *district paramedic*) "If say it was like the past year, I would have a real tough time narrowing down how many incidents that I've been to, so I think having a shorter timeframe to think of for myself personally, is beneficial. And if it's only two months that I have to think about then, yeah. I think like that measurement [...] options are decent" (Participant 05, *city paramedic*)
Language - Serious Line of Duty Injury to Self	"I think number one [on the CII is] super pertinent. Um. Maybe a distinction between physical and mental injury to self because, like I…I don't know how you distinguish like or define the mental-physical would be pretty straightforward or if there's a like that, if that were the source of that injury is actually from if it's from lifting technique or actual assault from a patient" (Participant 04, *district paramedic*) "Serious line of duty injury to self - just the question itself is like for the past two months. Like I don't think it would be possible to come back […] from a serious injury and have like multiple attempts of that like I've had three serious injuries over the last two months it's like well, what are you doing out there" (Participant 05, *city paramedic*)
Language - Emergency Worker Term	*"*I think any emergency worker can be changed to paramedic or you can just change it to colleague…. I guess, depends what you want, because we do have staff that are not paramedics, right? […] I know two years ago […] we did have our crews respond to [a]

	suicide of a colleague. She wasn't a paramedic, but she worked for us for, I don't know, 25 plus years or something. So, […] that would kind of fall under colleague, but not under paramedic" (Participant 01, *district paramedic*) "Yeah. Emergency worker is a good term because here we work very closely with the fire department and the police department, so if one of the firefighters got hit on scene at one of our accidents […] that would have just as much impact" (Participant 02, *district paramedic*) *"*Oh yeah absolutely. I would interpret that as anyone I work with in an emergency setting whether that's a police officer, firefighter or a first responder or someone along those lines" (Participant 03, *city paramedic*) "[If you're] called standby for a fire and [a] firefighter falls through and dies. That would be […] a stressor because it's a […] slightly different context, from like general civilian population, as opposed to a fellow emergency worker doing what you do. […] The term of [emergency worker] is fine" (Participant 04, *district paramedic*)
Language - Failed Mission After Extensive Effort	"We don't refer to calls as missions. […] Maybe like a prolonged. […] contact with the patient that passed away-[…] [That] […] would apply more […] in the rural settings. […] You do the initial call to someone's home, you transport them to the little hospital, they're treated there, for you know, a couple hours and then you pick them up again and transfer them […] to the regional, so, you're experienced [interacting with that] person might be, you know…you're in their home, seeing their loved ones reactions, then you're with them for that, you know, hour, two hour transport time. And then, […] whether they pass away in your care or after the fact, that gets kind of that [cough] you're having a little bit more involved [care] with them" (Participant 01, *district paramedic*) *"*The only […] [item on the CII] that sounds weird is […] a failed mission after extensive effort and that's mostly because most paramedics don't see calls in a mission sense. The term itself mission is kind of an odd one for us" (Participant 03, *city paramedic*) "Failed mission after extensive effort… […] The wording with that doesn't resonate really with paramedicine specifically. Like failed mission. Because […] the mission of, at least for paramedics, is to get the individual to definitive care with the best outcome…so that's like I, as opposed to something like saving a building […]

	The tricky thing with paramedicine, too, is we don't always know, in fact we very rarely know, the end patient outcome" (Participant 04, *district paramedic*) "Failed mission after extensive effort. Nothing-I've never referred to anything that I've done as a mission, so I guess that one doesn't [resonate with me]. […] [I've] never been on a mission as a paramedic in my own mind. […] [To modify it] a failed resuscitation [would be a way to word it. […] I just told you that that I've never been on a mission before, but I have three or more times checked off. [laughs] I think, I think, I definitely correlated it with like failed resuscitations" (Participant 05, *city paramedic*)
Language - Critical (Negative) Media Interest	"We don't get negative media attention here. We just don't have […] the paper or anything like that, but I guess it's, not to say it couldn't […] happen, but we've never ever had that here, since I've been here" (Participant 02, *district paramedic*) "Critical negative media interest. […] Like we as paramedics we don't deal with media […] I don't think that one would apply quite as readily either […] I don't feel medics would internalize media…thing unless-unless they were like really fucked up" (Participant 04, *district paramedic*)
Language - Search and Rescue	*"*No. I'd say [search and rescue is] not appropriate or not applicable" (Participant 01, *district paramedic*) "In the district yes, [search and rescue is applicable]. […] because I've hopped on trains, I've hopped in like a boat, like we've done like stuff that's. That could be that could be risky for sure. We've-I've done some stupid things, yeah" (Participant 02, *district paramedic*) "Typically, we wouldn't be involved in something like [search and rescue], but that's not to say that we don't get ourselves involved in things like that. Typically, we're supposed to wait for the fire department to do things but I myself have found myself jumping in the water, and same with other paramedics, and if we have to sometimes we'll pull people out of vehicles or get them out of a kind of a hazardous space to be able to do our work, so it's not out of the realm of possibility" (Participant 03, *city paramedic*) "Involving serious risk like pretty…pretty much whatever we do, does involve serious risk because we don't know what we're getting into…. But I mean if there's something like super extraneous with…but we don't really search and rescue, either. Like we'd be

	standby, basically let police and or fire do that" (Participant 04, *district paramedic*)
Language - Prolonged Extrication of Trapped Victim	"Time with a patient that required extrication or was trapped… Which is pretty bad. Yeah. So. Yeah. But […] we're not necessarily doing the extrication, but it'd be the prolonged care […] of a trapped patient or someone requiring extrication" (Participant 01, *district paramedic*) "That's actually-unfortunately, that's kind of common…takes sometimes two hours to get people out of the vehicles and when it's 40 below it's really shitty" (Participant 02, *district paramedic*) "Potentially if someone is stuck in a vehicle and the fire department is trying to extricate them if we can safely get access to a patient while fire departments carries on with the extrication, whether that be removing the vent hood or whatever they need to do then we'll by all means go into the vehicle and try to treat the patient when the extrication happens around us" (Participant 03, *city paramedic*) "Prolonged extrication of trapped individual with life threatening injuries, I think […] that can be relevant. […] because, like yeah you're on scene. We definitely have the like it would be a bad scene for sure, but we can definitely treat people as the fire department would be like obviously the fire department specializes in extrication for us, we don't typically do extrication unless it's very straightforward. But. That being said, if somebody was trapped, I would have to be treating them during the prolonged- like I can think of, I remember it's not, again not me personally, but. Another paramedic told a story […] of prolonged extrications have occurred so that's definitely relevant, then you have to be treating, treating those patients" (Participant 05, *city paramedic*)

Note. This table presents feedback obtained from participants regarding the CII by Monnier et al. (2002). They provided opinions based on the structure of the inventory, the period prevalence, and language used to describe events. Their feedback was used to inform the contextualized Northwestern Ontario measurement tool.

Appendix F

EMS Critical Incident Stress Inventory

Please indicate if you've experienced the following event: [yes/no] In the line of duty, I was …	If this happened, how much stress has it caused you in the last six months? No stress at all — Moderate stress — A lot of stress
1. Seriously injured	1 2 3 4 5 6 7 N/A
2. Present when a fellow EMT/Paramedic was seriously injured (suggested rephrase: present when a fellow EMT/Paramedic or other first responder was seriously injured)	1 2 3 4 5 6 7 N/A
3. Present when a fellow EMT/Paramedic was killed. (Suggested rephrase: present when a fellow EMT/Paramedic or other first responder was killed)	1 2 3 4 5 6 7 N/A
4. Seriously beaten	1 2 3 4 5 6 7 N/A
5. Taken hostage	1 2 3 4 5 6 7 N/A
6. Received serious threats towards loved ones as retaliation for your work in EMS	1 2 3 4 5 6 7 N/A
7. Threatened with a gun or other weapon	1 2 3 4 5 6 7 N/A
8. Trapped in a potentially life-threatening situation	1 2 3 4 5 6 7 N/A
9. Exposed to serious risk of AIDS or other life-threatening disease	1 2 3 4 5 6 7 N/A
10. Exposed to a life-threatening toxic substance	1 2 3 4 5 6 7 N/A
11. Was assaulted by a patient	1 2 3 4 5 6 7 N/A
12. Made a mistake that led to the serious injury or death of a patient	1 2 3 4 5 6 7 N/A
13. Was in a serious car accident (Suggested rephrase: was in a serious accident with an ambulance or other emergency response vehicle)	1 2 3 4 5 6 7 N/A
14. Saw someone dying	1 2 3 4 5 6 7 N/A
15. Encountered the body of someone recently dead	1 2 3 4 5 6 7 N/A
16. Encountered a decaying corpse	1 2 3 4 5 6 7 N/A
17. Encountered a mutilated body or human remains	1 2 3 4 5 6 7 N/A
18. Made a death notification	1 2 3 4 5 6 7 N/A
19. Encountered a child who had been sexually assaulted	1 2 3 4 5 6 7 N/A
20. Encountered an adult who had been sexually assaulted	1 2 3 4 5 6 7 N/A
21. Encountered a SIDS death	1 2 3 4 5 6 7 N/A

22. Encountered a child who had been badly beaten	1 2 3 4 5 6 7 N/A
23. Encountered an adult who had been badly beaten	1 2 3 4 5 6 7 N/A
24. Encountered a child that had been accidently severely injured	1 2 3 4 5 6 7 N/A
25. Encountered a child that had been accidentally killed	1 2 3 4 5 6 7 N/A
26. Encountered a child that had been murdered	1 2 3 4 5 6 7 N/A
27. Encountered a child who was severely neglected or in dire need of medical attention because of neglect	1 2 3 4 5 6 7 N/A
28. Encountered an elderly person who was severely abused or neglected or in dire need of medical attention because of abuse or neglect	1 2 3 4 5 6 7 N/A
29. Saw animals that had been severely neglected, intentionally injured, or killed	1 2 3 4 5 6 7 N/A
30. Had to respond to a large-scale disaster	1 2 3 4 5 6 7 N/A
31. Had your life endangered in a large-scale disaster	1 2 3 4 5 6 7 N/A
32. Responded to an aggressive crowd or riot	1 2 3 4 5 6 7 N/A
33. Responded to a scene involving family, friends, or others known to the crew	1 2 3 4 5 6 7 N/A
34. Responded to a mass casualty incident	1 2 3 4 5 6 7 N/A
35. Encountered a patient that was severely burned	1 2 3 4 5 6 7 N/A
36. Encountered a suicide victim (Suggested rephrase: Encountered the body of someone who died by suicide)	1 2 3 4 5 6 7 N/A
37. Encountered a drowning victim	1 2 3 4 5 6 7 N/A

Note. This is the EMS Critical Incident Stress Inventory by Donnelly and Bennett (2014). Line items were reviewed by participants during interviews and used to inform the contextualized measurement tool for Northwestern Ontario paramedics. Line items in green represent those that were added to the inventory, orange represents those where the language was adapted and used in the contextualized measure, red represents the items that were removed, and blue represents the items the were replicated in the CII. Furthermore, the questionnaire structure (e.g., period prevalence and rating scale) were discussed and used to inform the contextualized measure. Adapted from "Development of a critical incident stress inventory for the emergency medical services." by E. A. Donnelly & M. Bennett, 2014, *Traumatology, 20*(1). https://www.uwindsor.ca/people/donnelly/sites/uwindsor.ca.people.donnelly/files/the_ems_critical_incident_stress_inventory.pdf

Appendix G

Evaluation of the EMS Critical Incident Stress Inventory by Donnelly and Bennett (2014)

Period Prevalence of the EMS Critical Incident Stress Inventory	**“**The six months for [the EMS Critical Incident Stress Inventory was good] because we don't have a ton of, like, calls. I think, six months was […] fair […] for people in the district, it may be different for people in the city. But, yeah. [In the district], we don't have the [highest] call volume. We're only doing […] 600-700 calls every year. So […] six months […] is good if you wanted to catch […] stuff” (Participant 02, *district paramedic*) **“**Six months is also [a] really reasonable timeline, especially when you consider most of these incidents are pretty severe incidents, they tend to stick in your memory. So, I…I feel like that's relevant or a good time. […] You're more likely to get more people […] actually experiencing these situations” (Participant 03, *city paramedic*)
EMS Critical Incident Stress Inventory and the Rating Scale	*“*[The rating scale addresses] gets back […] self awareness. You know, some people might just be like, I have a stressful, stressful, stressful, stressful…I’d be like [um-yeah] it was fine. Without really being aware of where they're at” (Participant 01, *district paramedic*) “I liked having the yes or no, and the […] stress [rating] level because it actually made…made me think about well does this actually […] affect me day-to-day or not […]. Just to see like there was some things that really don't have an impact, even though, like on paper, they sound like oh wow but it's like, yeah. But it actually doesn't bother me at all” (Participant 02, *district paramedic*) “As I said with the questions before, every incident provides [a] different amount of stress for different people. So this kind of gauge [stress rating scale] […] gives you the [personal reactions] (Participant 03, *city paramedic*) “I think this [rating scale] would be appropriate, because, like different people respond to incidents differently, and I think this reflects that a little bit better than the [CII]. Um. Rather than like how many times you've come across it how you've responded to it –[…] if the two of them were kind of amalgamated” (Participant 04, *district paramedic*) “The one through seven like I don't know. […] I scratched it out so many different times like I don't even know how I feel about it, like, I was like yeah four, ah- it was a seven I don't know” (Participant 05, *city paramedic*)

EMS Critical Incident Stress Inventory - Language	"[The items are] a little blunt. I don't know. [laughs] Little harsh" (Participant 01, *district paramedic*) "I thought [the language] was pretty direct" (Participant 02, *district paramedic*) "That's interesting um. I just went for a walk last night with my police officer friend and she's off with the with PTSD and I wouldn't ask her […] some of this stuff yeah…. She, unfortunately she works in child sex crimes. So I wouldn't ask […] stuff about that, like the other stuff I would ask, but just because I know that that's […] kind of the cumulative stuff that's, that's got her taking a break right now. Um... Yeah. But for us it's not the bulk of our work so. Yeah I think that would be. [*talking to* self] If I was off with PTSD... I would think that those questions would be the same as asking motor vehicle-motor vehicle questions I think yeah. Yeah, I think it would be fine" (Participant 02, *district paramedic*) "I like that there were like suggested rephrases […] of the questions […] Just broadened it up a little bit […] Gave me a little bit more to think about" (Participant 05, *city paramedic*)
Present when a Fellow EMT was Killed	"Can we change-that was one thing? Um… um...present. (pause). So, we just say, for the death at, the death of a paramedic" (Participant 01, d*istrict paramedic*) "You can take EMT's out. We don't have the EMTs in Ontario" (Participant 01, *district paramedic*) "Fellow EMT killed, yeah. Ah. So. I guess it's not often […], but if it if that was expanded to other first responder, whether it be police or fire like that that might be more applicable […] I don't [think] […] we as medics, […] we're not often the target of assaults [but] like it can certainly happen" (Participant 04, *district paramedic*)
Taken Hostage	"I would not expect to see […] taken hostage" (Participant 03, *city paramedic*) "Taken hostage, never had that happen. I'm not sure if that would be applicable specifically for medics" (Participant 04, *district paramedic*) "Relevant in the way that like it's very infrequent that it would happen […] some of them like being taken hostage like. I don't know if that's ever going to happen, it could-it's possible. But like if that happens, I'll be like 'dang that's a bad day'. Um I would be surprised if that ever happens in my career, specifically for me like even within the entire service" (Participant 05, *city paramedic*)

Language Around Children	"In my mind…[it] doesn't matter, what type of [incident involving children], unless you're actually wanting to […] get […] deep into differentiating between different types of abuse or is like a child that's been abused or neglected has that affected you like, I think that it's enough to […] group those together" (Participant 01, *district paramedic*) *"*There's that section with a large concentration-large focus on children […] being in bad situations […] or the sexually assaulted one. […] I don't know if it would be of any benefit to have different titles within [the questionnaire]" (Participant 04, *district paramedic*)

Note. This table presents feedback related to the EMS Critical Incident Stress Inventory (Donnelly & Bennett, 2014) provided by the participants. It outlines opinions provided by participants related to the period prevalence, rating scale, and language presented in the EMS Critical Incident Stress Inventory by Donnelly and Bennett (2014).

Appendix H

Additional Items for a Northwestern Ontario Contextualized Critical Incident Inventory

Coronavirus	"I don't know if you want to get into COVID at all, but you could have a, you know, direct exposure to COVID [item]" (Participant 01, *district paramedic*) "Like it's just another whatever, whatever, whatever days and those do drone on, and then, like, when you throw the [COVID-19] pandemic in there. […] People shifting in…we have a lot of […] young parents and that kind of thing too…with kids in school, so the added stress of all the changes, you know? Innovators that may run small businesses on the side or work elsewhere, and like there's just a lot of extra stress going on in everyone's lives so. Now you're kind of carrying that on your days off and then coming in to face higher levels of stress here […]. It's been a unique year for paramedics for sure..." (Participant 01, *district paramedic*) "[COVID-19] changed the feeling of going to work- of going to calls. The feeling your coworkers, how everyone, the stress levels are pretty high and just going to a call is a lot more work. Having to put on full PPE and the question is always are you-is your belly pain COVID? Is it not COVID? We're dealing with the same issues we had before COVID, but now the question is always is this COVID? Is my PPE going to work? Is this enough? Am I going to bring this back to my family and then, but we still have to carry on doing the same calls that we do so it's definitely one hundred percent changed the work environment" (Participant 03, *city paramedic*)
Making a Death Notification	"Dealing with family […] surrounding […] a patient's death because that...it gets pretty crappy sometimes and that's not something we [are] really trained very well in so it's kind of hit or miss [which] paramedic that family gets when, when crap-when bad things happen as to how well it's going to be handled. And […] some of the paramedics have a really hard time with that for sure because sometimes you're all [the families] got for 45 minutes till the police show up so…. Yeah, because, like five or six years ago they gave us the ability to stop resuscitating so we're allowed to […] stop CPR and then tell the family that they're now dead kind of thing which some families don't do well with" (Participant 02, *district paramedic*)

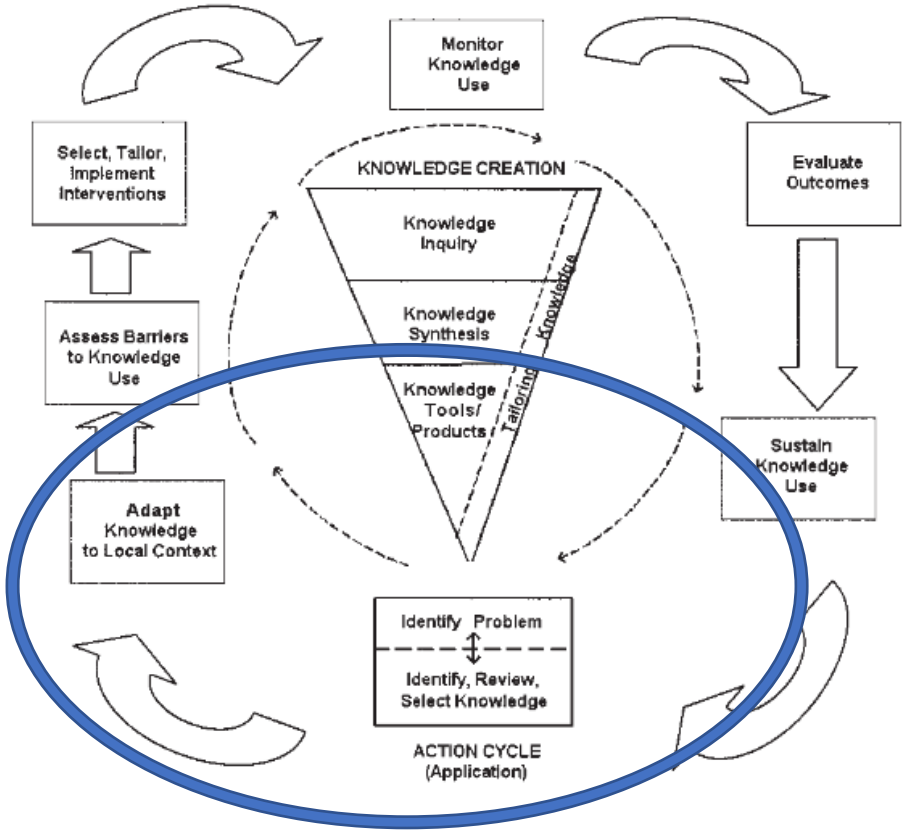
Frequent Flyer	"Frequent flyer, […] like see the same patient, […] the same day, or in the same month or something like that, because I truly deep down, like, I believe that these the big high acuity calls definitely are stressors, absolutely. But, I don't think they're […] definitely not the only thing. […] I think that the […] low acuity, [….] constant grind is one of the things that bothers you the most" (Participant 05, *city paramedic*)
	*"*Crap. This person that, even though they were a pain in our side for the last couple years, now they're gone, right? So you still have a weird…like it's a, it's a different dynamic […] Hit me different than so and so died like kind of sad. You're used to getting sworn at and spit and yelled at […], and now it's like now who's gonna be the next one?" (Participant 01, *district paramedic*)
	"I don't think any other question on here is like seeing the same patient over and over again, right? But like that could be that could be what triggers a lot of people the most. It's like […] I've been to that person two times in the exact same shift, like I've seen them before yeah multiple times in less than 12 hours. […] [For example], one specific lady that we have, she's […] almost always like 'Yeah, I have chest pain.' So, it's the highest priority and you can't get tiered off of that to another emergency. Yet, you know that this individual is going to be perfectly fine the next day so like that's […] a stressor in my mind at times and that's like it's something that's not really on […] any stress questionnaire that I've ever done for my mental well-being on the job, or anything like that" (Participant 05, *city paramedic*)
	"I'd say absolutely. You can definitely be numbed toward something. [….] [For] example, I mentioned the narcotic overdoses. Those used to be a high acuity interesting call, and now we do [a lot]. Everyone says they're kind of a basic. We're kind of used to it now, to the point where they're almost mundane. And that can be the same thing with higher acuity calls. If we're constantly […] [seeing] trauma from a specific place or for a specific group of people, then we can just kind of get used to seeing it. The first few times, you might see it, […] you might be a little shook by it and you might be a little taken aback […]. The second, third, fourth, fifth time […] you don't feel it-you don't notice it as much" (Participant 03, *city paramedic*)
	"If you came across like a burned or mutilated body like three times, […] you actually [might] have a low stress because you've come across that [before and know that] as a medic, you do what you can do. And then the outcome is, however, it goes, as opposed to like you see a kid die once and that's like seven [on the stress rating scale]. Whereas three mutilated bodies might be like one. As an example. So

	anyway, I. I think that reflects that better, as for the questions" (Participant 04, *district paramedic*)
Unstable and Unpredictable Patients	"I would say, probably assaults and substance use and psych calls are the most common that I've seen in [city] recently" (Participant 04, *district paramedic*) "A psychotic episode or an exacerbation of depression that leads to suicidal ideation and or attempts. We have a particular individual who we've dealt with a couple of times, where he feels fine, however, he is a paranoid schizophrenic who doesn't like to take his medication and has been known to hoard protective devices like knives and such to protect him from his perceived threats that no one else seems to be able to sense. Um. So physically he's fine. Ah, however, those can be very delicate situations where ah, should that individual perceive a threat that no one else can sense in another individual for which they live with, for example. Then they'll do bodily harm and we have a whole different situation on our hands so. Um. Yeah. So kind of paranoid schizophrenics, those ones scare me the most… very much so, but also like depression, suicidal ideation we've had a couple of those" (Participant 04, *district paramedic*) We do a lot of alcohol intoxication calls […] substance misuse" (Participant 05, *city paramedic*)
Drug Overdose	"Within the city, we see a pretty high amount of substance abuse. Whether that be alcohol or narcotics, […] Now it's hard to keep track of how many narcotic overdoses" (Participant 03, *city paramedic*) "Yesterday a really bad batch of purple down that we were called for a VSA, but the patient ended up having a pulse, but he di- his outcome is not going to be great and, just as I was leaving the other crew was called to almost an identical call within seven hours" (Participant 04, *district paramedic*)

Note. This provides quotations transcribed from the interviews that outline items identified by participants that need more clarification for inclusion in the Northwestern Ontario contextualized measure. These items were supported by the scientific literature for consideration in future CI measures.

Appendix I

Knowledge-to-Action Framework and Current Thesis



Note. This figure represents the Knowledge-to-Action Framework: knowledge creation is represented as the funnel, and the action cycle revolves around it. The framework suggests that the processes in the action cycle are fluid and can influence each other as well as the knowledge creation phases (Graham et al., 2006). The blue circle illustrates the current stage of the research thesis; it is exiting the funnel as knowledge tools / products while also cycling through the action cycle by identifying a problem and adapting it to a local context. Adapted from "Lost in Knowledge Translation: Time for a Map?" by I. D. Graham, et al., 2006, *Journal of Continuing Education in the Health Profession, 26*(1), p. 19. https://doi.org/10.1002/chp.47