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Assessment of Various Critical Incident Management and Support Protocols for Railway Employees After a Serious Incident

Cécile Bardon
Brian L. Mishara
Angelo Soares

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SUMMARY

The Canadian **railway industry** must regularly deal with **critical incidents** (CI) involving **collisions** with people or vehicles. Such incidents may result in serious injuries or even fatalities, in addition to causing **mental health problems** for the locomotive engineers and conductors involved. Every year, approximately one hundred people in Canada, including some 20 in Québec, lose their lives in collisions with trains. In addition to fatal events, an unknown number of incidents also occur in which people are injured or property is damaged. Most locomotive engineers and train conductors will be exposed to this type of event at least once in their careers. When a critical incident of this nature occurs, they are witnesses, victims, participants and often first responders, all at the same time.

A significant proportion of locomotive engineers and train conductors soon return to satisfactory personal and occupational functioning levels and have very few psychological, social or functional after-effects. However, the recovery time after a CI can be quite long, and employees require support during this period. In addition, between 4% and 17% of these employees will experience more serious problems, including depression, acute stress disorder, posttraumatic stress disorder or anxiety.

Several clinical approaches are effective in mitigating posttraumatic symptoms, and a great deal of the research has focused on them. In contrast, needs are less well known and there are fewer resources for those who do not suffer posttraumatic stress, but who struggle with major undiagnosed adverse effects.

Some studies have examined the critical incident management and support protocols (CIMSPs) implemented by employers, and they often recommend the adoption of practices to reduce the potential impact of critical incidents on employees and to shorten their recovery period. However, although these protocols are based on studies of CI after-effects and employees' needs, they have not yet undergone empirical evaluation. Assessments of this kind are necessary to determine the key elements of these protocols that have a positive impact on employee recovery and to promote recommendations based on scientific findings.

The aim of this project was to assess the CIMSPs that have been implemented in the Canadian rail industry and their impact on the recovery of employees who have been involved in critical incidents and to propose key practices to reduce the adverse effects.

Seventy-four locomotive engineers and train conductors who had experienced a CI were recruited to take part in the study. They were interviewed four times over a six-month period. As well, nine managers of train operations (MTOs) who met the same inclusion criteria were interviewed twice over a three-month period. A mixed-method approach was used to analyse the data collected, combining statistical and qualitative analyses to fully understand the relationships between critical incidents, CIMSPs and post-CI recovery. The perceptions, needs and recommendations of MTOs who are responsible for applying protocols and providing support are also presented.

The results indicate that existing CIMSPs are implemented partially or unevenly, depending on employer, province and CI type. In CIs without fatalities, for instance, management and support protocols are not completely followed, even when employee health is affected.

CIs affect employees in a wide variety of ways. The research team was able to establish five distinct recovery trajectories: no adverse effects, adverse effects that disappear within the month following the CI, adverse effects that gradually decline and disappear within the three months following the CI, adverse effects that reach a plateau between one and three months afterwards and then disappear, and adverse effects that are still present after six months.

Overall, among two thirds of employees, the adverse effects of a CI dissipate more or less rapidly in the month following the CI, 20% still feel significant effects after three months (course of the plateau and effects that persist after six months), while that proportion falls to 13% after six months. These effects are not negligible and affect employees' cognition (concentration, rumination, distraction), energy (fatigue, trouble sleeping) and emotions (guilt, grief). They may also interfere with employees' ability to perform their jobs effectively.

Differences in the application of CIMSPs provide opportunities for assessing their role in the post-CI recovery process. The study results show that management protocols can have an effect on the recovery process. The following factors tend to foster an acceleration of the process: the presence of a manager on site; a manager taking charge at the scene of the CI; the various stakeholders showing respect and empathy toward those affected; no pressure on employees to continue working or to return to work before they are ready; demobilization (automatically removing employees from the scene of the CI and taking them home) and granting them recovery leave; a proactive offer of support by the employee assistance program (EAP); a clear procedure for return to work and assessment of the employee's readiness to resume occupational duties; deferred offer of support if needed; follow-up after return to work and a positive work environment.

The study shows that CI management and the support provided by employers are key factors in promoting employee recovery. These are attitudes and actions that employers can act on and that can be applied fairly easily, without entailing prohibitive costs for companies. Employers have less control over other factors, such as social support or the complexity of the CI. Railway companies have protocols that already include most of the actions deemed to be effective. Following those protocols assiduously is a first step toward improving current practices and mitigating the adverse effects of CIs.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

CI: Critical incident

CIMSP: Critical incident management and support protocol

CNESST: Commission des normes, de l'équité, de la santé et de la sécurité du travail

CoA: Class I rail company A

CoB: Class I rail company B

CoC: Class I rail company C

EAP: Employee assistance program

OCC: Operations Control Centre

PTSD: Posttraumatic stress disorder

TC: Transport Canada

TCRC: Teamsters Canada Rail Conference

TSB: Transportation Safety Board of Canada

1. INTRODUCTION

The goal of this project, in partnership with actors in the Canadian rail industry, and in particular, those in Québec, is to evaluate practices to prevent trauma and to support locomotive engineers and train conductors[1] who have been involved in serious accidents and suicides in the course of their work. The project will assess the effect of critical incidents (CI), the application of CI management and support (CIMSP) and the effects of these protocols on post-CI recovery in the context of a prospective longitudinal design. The project also aims to understand the needs of managers who must manage CIs. Finally, the study proposes a set of recommendations to improve CI management and support.

The Effects of CIs: Diagnosed Mental Disorders

After a CI, a minority of engineers and conductors will develop posttraumatic stress disorder (PTSD), depression, or an anxiety disorder: between 4 and 17% according to the samples studied (Bardon and Mishara, 2015b; Cothereau, 2004; Farmer, Tranah, O'Donnell and Catalan, 1992; Limosin *et al.*, 2006; Margiotta, 2000; Tranah and Farmer, 1994). There are many studies on the beneficial effects of treatment in reducing PTSD symptoms, some of which specifically deal with engineers and conductors (Antony, 2010; Cothereau, 2004; Högberg *et al.*, 2007; Högberg *et al.*, 2008; Mehnert, Nanninga, Fauth and Schäfer, 2012; Pagani *et al.*, 2007; Rombom, 2006; Williams, Miller, Watson and Hunt, 1994).

The Effects of CIs: Undiagnosed Difficulties

However, the majority of employees will experience other undiagnosed negative effects and will never benefit from the abovementioned treatment, which is not intended for them. In fact, many (40%) suffer from long-term traumatic reactions of lower intensity (Bardon and Mishara, 2015b; Briem, de Lima and Siotis, 2007). Research shows that preventive actions, support activities before and immediately after CIs, which are in place well before the provision of psychotherapeutic treatment, can improve well-being and help prevent PTSD and other lower-intensity negative effects (Bardon, 2014). The aim of this research project is to verify the impact of these preventive practices, offered by the various actors in the railway industry.

In Canada as a whole, 1129 people lost their lives in train collisions between 1999 and 2007 (Mishara and Bardon, 2017). This includes the deaths of 184 people in Québec. The annual average of rail deaths in Québec is 20.4. At least 40 rail employees are involved in accidents in Québec every year. On average, over their careers, engineers or conductors will be faced with four critical incidents (CI) involving a death, with the numbers of deaths varying from 1 to more than 15. Because of the potential of these CIs to have negative effects on employees, the management of activities and labour relations is very important in the long term.

Over and above fatal incidents, employees face an unknown number of incidents with more or less serious injuries (collisions with people or vehicles) and minor incidents (without injuries, or near misses, when a collision is barely avoided), which also have an impact on the stress experienced and the development of psychological difficulties.

[1] To simplify the text, locomotive engineers will be referred to simply as engineers and train conductors as conductors.

From the perspective of operations management, taking charge of CIs presents significant challenges for local managers, for claim services and for workplace health care. The actions taken by the various actors also play an important role in terms of the development of traumatic reactions and the process of recovery and return to work (Bardon, 2014). In Québec, specifically, the same holds true for the province's workers compensation board, the Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST), which administers claims for employment injuries, the process of medical consolidation, and the rehabilitation and return to work of victims.

It is extremely important to develop trauma prevention and support practices based on the most recent evidence, to equip industry partners and to better respond to the needs of employees working in positions classified as safety critical. To that end, knowledge related to the provision of adequate treatment for those who have developed PTSD is available. However, there is little empirical research on the impact of practices before and immediately after the incident.

There is therefore a great need to define suitable actions to reduce the consequences and length of recovery time of engineers and conductors.

This prospective longitudinal study, which followed engineers and conductors involved in CIs over six months, enabled an assessment of the effects of CIs and of the power of established protocols to reduce these effects. After a brief description of existing data, the report presents the study's objectives, the methodology used, an evaluation of the implementation of protocols, an analysis of the effects of CIs on the participants (over six months), an evaluation of the effects of the protocols in their path to recovery, a study of MTOs' needs, and a discussion of the results in terms of the research objectives and hypotheses. To conclude, the report presents recommendations to improve CI management practices and support to employees, based on the results of this research and the knowledge available about trauma prevention.

2. STATE OF KNOWLEDGE

This section describes scientific knowledge related to the issue of the effects of CIs on rail employees, their prevention and treatment.

2.1 Impacts of Critical Incidents on Train Crews (Engineers and Conductors)

Some studies have specifically focused on the effects of CIs on employees, especially in Great Britain, the Scandinavian countries, France, the United States, and recently in Canada. The effect of CIs (particularly when there are fatalities) can be categorized in three ways:

- An intense short-term reaction, which subsides in the months after the incident, such as a state of acute stress. While this diagnosis is rare in railroad employees, most workers involved in a CI showed signs of intense stress in the days and weeks following it (Bardon, 2014; Cothereau, 2004; Holland and Bultz, 2007; H. R. Kim *et al.*, 2012; S.E. Kim *et al.*, 2014; Limosin *et al.*, 2006; Malt *et al.*, 1993).

- An intense long-term reaction, such as posttraumatic stress disorder (PTSD) or depression. The proportion of rail workers suffering from PTSD varies according to studies in different countries, going from 4% to 16% (Bardon, 2014; Cothereau, 2004; Farmer *et al.*, 1992; Limosin *et al.*, 2006; Margiotta, 2000; Theorell, Leymann, Jodko and Konarski, 1992). Long-term disorders, such as phobias, have also been observed (Bardon and Mishara, 2015b; Clarner, Graessel, Scholz, Niedermeier, Uter and Drexler, 2015; Cothereau, 2004; Farmer *et al.*, 1992; Theorell, Leymann, Jodko, Konarski and Norbeck, 1994).

- A stress reaction of lower intensity over the long-term. These effects are not intense enough to be the subject of a diagnosis (Briem *et al.*, 2007; Limosin *et al.*, 2006), but they have significant consequences for those who suffer from them. Up to 40% of rail workers were still experiencing the negative effects of a CI three months after the event (Cothereau, 2004; Limosin *et al.*, 2006; Tranah, O'Donnell, Farmer and Catalan, 1995), including sleep disorders, fatigue, hypervigilance, irritability or intrusive memories.

Overall, most employees recover from their experience, but at a different pace. It is important to establish the factors that foster or limit this recovery in order to suggest adequate support strategies. Various studies have identified some of the risk and protective factors that play an important role in the probability, degree and speed of recovery. They are situated on different levels, over which employers and employees may have more or less control.

2.2 Factors Increasing the Risk of Significant Negative Effects After a Railway CI

The Incident's Characteristics

Studies carried out through interviews with rail workers have revealed that some characteristics of CIs may increase the risk of traumatic reactions. They include the presence of hazardous products, if the incident occurred at the terminal where the people worked, or if the person was alone with the victim at night, while waiting for help (Holland and Bultz, 2007). Bardon (2014) found that having to touch the body of a victim to check for vital signs was one of the most difficult things for employees to do. The feeling of being obligated to do so has potential long-term consequences. The powerlessness and vulnerability of the victim (young age, physical or psychological limitations), and seeing a victim's eyes and face just before the collision play a significant role in the development of traumatic reactions. Incidents in which there was not a fatality, or near misses, add to the tension and stress, and can trigger a delayed traumatic reaction. When employees are unable to find meaning around an event, they tend to ruminate and are more likely to feel anger at the system (Bardon, 2014). The same study identified the following risk factors: being in an isolated location, seeing the victim before and during the incident, knowing personal details about the person who died, thinking that the death could have been avoided, or being involved in a suicide instead of an accident (Bardon, 2014).

Personal Experiences

There is a cumulative effect when employees are confronted with more than one critical incident and the impact of these incidents adds up (Austin and Drummond, 1986; Briem *et al.*, 2007; Karlehagen *et al.*, 1993; Margiotta, 2000; Vatshelle and Moen, 1997). These effects are often difficult to ascertain. They can be perceived by the presence of posttraumatic stress disorder and acute stress (Karlehagen *et al.*, 1993; Malt *et al.*, 1993; Theorell *et al.*, 1994). However, they are mainly apparent when there are long-term changes in mood, changes in perception of work or life in general, intrusive memories (flashbacks), generalized nervousness, increased fatigue after a day of work, and a longer recovery time after a minor incident. Employees may lose their will to work and just hope to hang on until they retire. Those questioned during a previous study (Bardon, 2014) experienced between 1 and 22 major incidents, i.e., an average of 4.5. Fifteen of the 40 participants indicated that the more often they had experienced incidents involving fatalities, the more difficult it was to get back to normal functioning.

Events in their personal lives: significant events in the employee's life, occurring over the same period as the CI, can add to the difficulty in recovering. Whether it is grief or a separation, these events and their emotional charge become intertwined with the rail incident and the memories associated with it, and the emotional charge of the two events may merge. The presence of personal events must be considered carefully when an offer of support is made after a CI (Abbott *et al.*, 2003; Limosin *et al.*, 2006).

Factors Associated with the Work Context

Having to work on the same rail lines after a traumatic event can have a long-term impact (increased stress, hypervigilance), especially when the victim's loved ones make the place a commemorative site, such as by erecting a cross or a monument as a memorial (Bardon, 2014).

Furthermore, some factors related to the employer's management of the incident appear to have a greater negative impact on recovery (Bardon, 2014; Cothereau, 2004). Employees have a tendency to generalize their negative perception of how incidents are managed by linking them to their entire relationship with their employer; they tend to remember incidents longer when they have been mismanaged. The elements of incident management perceived as being detrimental, according to the studies by Bardon (2014) and Cothereau (2004), are the absence of a local manager at the site of a fatality; a lack of empathy and support by the local manager; being treated with suspicion by the police or the manager during questioning; having to wait for a long time before being evacuated; being ordered to move the train after the incident or to help protect or move the victim's body, having to remain close to the victim's body and not being accompanied by a representative of the employer when returning home after the CI.

2.3 Protective Factors That Can Reduce the Negative Effects of Rail CIs

The protective factors identified appear to be less numerous than the risk factors in studies focused on the impact of CIs.

- Information concerning the victim: information that emphasizes the victim's responsibility in the event (presence of alcohol, dangerous behaviour, clear intention to die, for example) reduces feelings of powerlessness and guilt among engineers and conductors (Bardon, 2014).

- Personal characteristics: having good social support, being resilient, using adequate adaptation strategies, receiving the help that is available, and even a sense of humour can facilitate recovery (Abbott *et al.*, 2003).

- Prior training: some employees are themselves peer helpers in the context of programs implemented in their workplaces. They have received training about traumatic reactions and tend to be more cognizant of what they are undergoing when a CI occurs (Bardon, 2014). These employees appear to have fewer difficulties after an incident than other co-workers.

- Factors associated with the workplace: good management of the CI and the employer's support play an important role in reducing the negative impact of events (Abbott *et al.*, 2003; Bardon and Mishara, 2015a; Cothereau, 2004). These good practices include a compassionate attitude, an offer of support, non-technical advice centred on the well-being of the person, a transparent CI management and support protocol (CIMSP); the rigorous application of the CIMSP; no pressure to return to work when the person does not feel ready.

2.4 Prevention or Intervention Strategies to Reduce the Negative Impacts of Rail CIs on Employees—CIMSPs

Among the various strategies to prevent trauma in rail workers, two levels of intervention were defined in the literature. The first concerns CI management and support protocols (CIMSP,

already established, or as recommended) and the activities realized by the employer. There has been very little examination of these activities. The second concerns professional therapeutic and clinical interventions offered to employees after the incident. These have been the subject of more evaluative studies. This research deals with CIMSPs that are implemented before therapeutic interventions; it does not specifically deal with the issue of the efficacy of clinical therapies, but considers the role of the clinical service delivery (by employers and in the community) on the recovery process. CI management and support activities and their current level of empirical validation are described in Table 1.

Table 1. Synthesis of CI management and support activities and validation level in the railway context, drawn from previous studies

Activity	Implementation	Evaluation
Training and information (Margiotta, 2000; Neary-Owens, 2001; Teneul, 2009)	No Requested by employees.	No
On-site incident management (Abbott *et al.*, 2003; Margiotta, 2000) - Compassion - Cared for by the local manager	Does not exist as such in CIMSPs (anecdotal). Requested by employees.	This appears to reduce the traumatic effects of incidents. There is no empirical evaluation.
Demobilization—being evacuated from the incident site and returned home (Abbott *et al.*, 2003; Burrows, 2005; Cothereau, 2004)	Widely implemented. Obligatory or optional according to the worksite.	This appears to help recovery. There is no empirical evaluation. Insufficient on its own to prevent PTSD.
Leave of absence (Abbott *et al.*, 2003; Margiotta, 2000)	Widely implemented. Mandatory or optional according to the workplace. Variable duration of leaves, between 24 hours and 72 hours.	This appears to support recovery. There is no empirical evaluation and there is no consensus on the optimal duration of the leave.
Return to work policy - Planned (Burrows, 2005) - Work capacity assessment (Briem *et al.*, 2007)	Anecdotal Requested by employees.	No
Peer support (Briem *et al.*, 2007; Burrows, 2005; Margiotta, 2000)	Implemented in several companies.	This appears to help recovery.
Debriefing (Abbott *et al.*, 2003; Cothereau, 2004)—Individual or collective, carried out by clinician after a CI.	Implemented in several companies.	This appears to help recovery.

Canadian rail companies have developed and implemented various CIMSPs that include some of the activities described above. These protocols are described in the table in the appendices (Appendices 1.A and 1.B).

3. RESEARCH OBJECTIVES

As previously stated, the knowledge compiled about the useful components of CIMSPs should be consolidated to enable effective programs to be implemented in the rail industry. The goal of this project is to improve knowledge about the implementation and effects of CIMSPs in Canada's rail industry. It is based on the following four complementary objectives:

Objective 1: To analyze the extent to which the various components of CIMSPs have been implemented by Canadian rail companies (by individually analyzing three companies operating under federal jurisdiction: CoA, CoB, CoC) and to determine the factors favourable to the proper application of CIMSPs and the obstacles to them;

- Sub-objective 1.2: Describe the use of CIMSPs by managers of train operations (MTO) and what they require to improve their implementation.

- Sub-objective 1.3: Evaluate the degree and type of satisfaction of employees with respect to how CIMSPs are applied during the CIs in which they were involved.

Objective 2: Describe the effects of CIs on rail employees and the MTOs overseeing them;

Objective 3: Evaluate the effectiveness of CIMSP components in preventing and limiting the negative effects of CIs on employees over time, and compare the effects of various practices to identify the key components of the CIMSPs to implement;

Hypotheses related to objective 3—evaluation of the effect of CIMSPs:

- Hypothesis 1: The quality of labour relations and the interaction between employees and managers influences the incidence and duration of traumatic symptoms, the ability to work, the time required for and the degree of recovery.

- Hypothesis 2: How well the CIMSP is applied has an influence on negative effects, post-CI.

- Hypothesis 3: The negative effects of CIs can be reduced by positive and proactive measures by MTOs and the employer.

- Hypothesis 4: The access to and use of clinical and specialized support and care resources provided by the employer facilitate the recovery process.

- Hypothesis 5: The long-term recovery of employees who used specialized clinical resources (psychologist, social worker, psychiatrist, therapist specialized in trauma treatment) is better than those who did not use them. This hypothesis does not deal with the effectiveness of various therapeutic approaches to reduce trauma, but on the general relationship between the use of clinical services and the recovery process.

Objective 4: Suggest recommendations to improve CI management practices and the support provided to employees in order to accelerate the recovery process for engineers and conductors.

4. METHODOLOGY

The methodology was developed with the project partners in order to take into account the characteristics of engineers, conductors and MTOs. The project was then examined and approved by the Comité d'éthique de la recherche (CER) (research ethics committee) of the Université du Québec à Montréal (UQAM).

A prospective longitudinal design was chosen for this study to assess the implementation of the various components of CIMSPs (before and after incidents) and their medium-term effects on the health, well-being and ability of employees to return to work. This type of design makes it possible to analyze the recovery process over time and to differentiate between the negative short- and medium-term effects. This design also enabled a better understanding of the issues and constraints of the industry in terms of CIs and their management, as well as the entire relational aspect during contacts among employees, managers and executives, which must be taken into account to effectively implement CIMSPs.

4.1 Participants

Two types of participants were included to respond to the study's objectives: (1) engineers and conductors from three class I rail companies (CoA, CoB, CoC); (2) CoA MTOs. This sample made it possible to analyze the experiences and needs of engineers and conductors, as well as those of the managers responsible for managing CIs.

Engineers and Conductors

Two subgroups of conductors and engineers were included in the sample; they were recruited in the days following their involvement in a CI.

- Group 1: CoA engineers. The trains are operated by two engineers whose roles are interchangeable.

- Group 2: Engineers and conductors of class I companies (CoC, CoB). Trains transporting merchandise are operated by an engineer, whose role is to safely operate the locomotive according to the train order, and a conductor, whose role is to supervise the train and the route.

The two subgroups were recruited differently, but their subsequent participation was similar and they were analyzed together.

CoA Managers of Train Operations (MTOs)

The CoA group of MTOs was recruited after a CI. The inclusion of this group enabled the study of the factors that facilitate and impede the application of CIMSPs, in addition to their needs in the context of CI management. These MTOs are those who arrived at the site of CIs involving a train and a CoA crew. Their role is to manage the incident scene, to communicate with emergency and investigative services, to ensure a quick return of normal traffic, and to support the engineers involved.

4.1.1 Participant Recruitment Procedure

The recruitment plan consisted of two parts:

- The recruitment of CoA engineers and MTOs. The engineers and MTOs involved in CIs were identified by the operation control centre staff (OCC) of CoA and referred directly to the research team within three days after the CI;

- The recruitment of engineers and conductors of other class I companies. Information concerning these CIs was sent to the research team by the Transportation Safety Board of Canada (TSB), and the employees were identified and contacted with the assistance of local union representatives (TCRC).

These two recruitment methods were applied simultaneously throughout Canada.

The recruitment protocol and the responses to ethical and confidentiality issues related to participation were developed and discussed with the project partners (CoA and the TCRC) to ensure that they would adhere to it, feel confident and be able to promote the project in their environments.

Information describing the project and participation was disseminated several times during the project in order to ensure that the various partners and potential participants would be notified of its progress.

- The project was presented at provincial union meetings at the outset of the project, and then at the national meeting, at the midpoint of the study. The project and the role of union representatives were presented; the research team answered questions and distributed material to support communication with the union membership.

- Before starting, a letter was sent on behalf of the TCRC and the research team informing the engineers and conductors about the project and the recruitment process.

- Those responsible for the CoA operation control centres were encountered to get their input in defining the modalities of communication and information about CIs and the employees involved.

- The CoA operation administration sent out a letter to its engineers and MTOs to explain the project and the recruitment process.

- Throughout the recruitment process, the research team carried out regular follow-up with the TCRC to ensure the project's continuity and support from local representatives. Communication and information methods were adjusted as the project progressed.

As this was a prospective and longitudinal study, major challenges were associated with participant recruitment and attrition. The following process was used to maximize recruitment and retention of participants without pressuring the employees. It was applied for all rail incidents that occurred during the period of the study.

- Information acquired from the TSB or the OCC on the occurrence of a rail CI (24–48 hours after the incident). The process in each situation is described in Table 2.

Table 2. Access to information process for recruitment

CoA Process	CoB and CoC Process
○ The OCC provides the research team with the name and telephone number of the MTO in charge of the CI. ○ The team contacts the MTO, reminds him/her of the project's objective and asks if he/she wants to participate. ○ The MTO provides the research team with the names and telephone numbers of the engineers involved. He/she informs them that they will be contacted in the coming days and that they can decide whether or not they wish to participate.	- The research team identifies the locality where the CI, occurred using information from the TSB and contacts the TCRC provincial representative. - The representative contacts the crew concerned, asks for their authorization to transmit their contact information (telephone number and email address) to the research team and informs the research team.

- The research team contacts the engineers and conductors, explains the project and asks them to participate.

- If they accept, an appointment is made for a first telephone interview and the employee receives by email a consent form, detailed information about the project and the planned timetable for subsequent interviews.

- For interviews two, three and four, the research team contacts the employee to make an appointment. Contacts for follow-up are carried out by email or telephone, depending on the most efficient method to reach each participant. A maximum of four calls are made to reach the participant for the follow-up. The fourth call is a message indicating that the person will no longer be bothered or re-contacted, but that the person can return the call, if so desired.

Throughout the project, the recruitment process and follow-up was adapted to the constraints and working conditions of participants (uncertain schedules, fatigue, unanticipated situations).

Most of the interviews were carried out by telephone. Only a few were done face-to-face, when the employees were available in Montréal.

4.1.2 Sample Size

The number of participants necessary to detect the effect of the various variables included in the hypotheses was estimated on the basis of an average effect size (0.30). Based on previous work (Bardon, 2014) about the impact of serious incidents on rail employees, the correlation between dependent variables is estimated at 0.280 on average. At the time the research design was being drawn up, the main type of analysis planned was a MANOVA including three dependent variables (the effect of CIs on site, in the medium-term, and mental health diagnosis) with repeated measurements and the comparison of two groups (CoA versus other companies). The sample size to perform this type of analysis was calculated with the statistic software, GPower 3.1,[2] available on the Internet and based on the work of Cohen and Cohen (1983).

[2] Site: http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/

Estimates were produced for a desired effect size of 0.30, α: .05 and a power of 0.95. A global sample of 54 participants was calculated as being sufficient. However, if possible, we wanted to recruit up to 90 participants in this study in order to address the problem of attrition inherent in this type of longitudinal design.

4.2 Variables Measured and Tools

This section describes the various variables and tools used for the study. They are presented according to the objectives to which they were intended to respond. The project was carried out using semistructured interviews and standardized tools to gather information about each variable of the study.

4.2.1 Objective 1: Implementation of CI Management and Employee Support Protocols (CIMSP)

The extent of implementation was determined through a descriptive analysis of the various components of the CIMSP established by employers and formalized in the documents available (appendices 1.A and 1.B). A list of expected and undesirable actions and attitudes was drawn up from these documents. During each interview, the participating engineers and conductors responded to a general question ("What happened with respect to CI management [during the period of time covered by the interview]?"). Then their responses were completed from items in the list that were not addressed ("was the [action or attitude] present during the management of the CI?"). This approach enabled the spontaneous narrative of participants to be gathered and for the various actions and attitudes appearing in the written protocols of the employers to be systematically verified. Moreover, to respond to Objective 3, questions were asked about the employees' satisfaction level with how the CI in which they were involved was managed by various bodies (employer, MTOs, first responders) at each stage of participation (interviews 1 to 4).

The information gathered was compiled into a series of variables to reflect the implementation of CIMSPs:

- Individual actions and attitudes, as cited in the companies' CIMSPs;
- The number of desirable actions or attitudes in the CIMSPs noted as being present during each CI;
- The number of actions or attitudes deemed as undesirable in the CIMSPs present at each CI;
- Satisfaction with the CI management protocol and the support provided by the employer.

At the same time, the CoA MTOs were asked about their use of the company's CIMSP and the barriers and facilitating factors that affect this use in the scope of their interventions during a CI (Objective 1.2). These data were qualitatively coded and categorized.

In order to respond to the second part of Objective 1, concerning the factors influencing the implementation of CIMSPs, different factors were identified from a previous study (Bardon, 2014) and associated with the structure of the Canadian rail network. These elements were covered in systematic open questions included in the interviews at different measurement periods:

- Labour relations (general stress level at work);
- CI characteristics and the circumstances surrounding them (complexity of the CI);
- Employee characteristics (seniority, past experience with CIs).

4.2.2 Objective 2: Describe the Effects of CIs on Rail Employees and the MTOs Overseeing Them

Objective 2 concerns the description of the effects experienced by employees and MTOs after a CI and how they changed over time. It is essential to describe these effects to assess how CIMSPs can affect them. To achieve this objective, information was gathered during the different measurement periods. The participating engineers and conductors were asked an open question ("How did you feel about the CI [during the period of time covered by the interview]?"). Next, the answer was completed using a list of potential negative effects taken from the literature on traumatic reactions among train conductors and the population in general ("was the [effect] present in relation to the CI?"). This approach enabled the spontaneous narrative of participants to be gathered and for the various potential negative effects for each participant to be systematically verified.

The variables created with this information and included in the analyses are as follows: the immediate effects and reactions (in the hours following the CI, on site and until the return home) the effects experienced in the week following the CI, the recovery trajectory over the six months covered by the study, the diagnosis of a mental health problem, the perceived effects and traces of the CI after six months:

- Immediate effects, at the site of the CI and in the following hours. These are emotional, cognitive, and physiological reactions experienced by the individual between the moment that he or she becomes aware that a collision is going to occur and when she or he leaves the scene.
- The effects experienced in the week following the CI. These are emotional and cognitive effects related to sleeping, concentration and fatigue, which could last a few hours or may continue up to the time of the first interview.
- The recovery trajectory. It is described using data gathered by measurements repeated in periods 1, 2, 3 and 4 of the negative effects experienced.
- The diagnosis of a mental health problem made by a physician and self-reported by the participant, as understood by the participant.
- The nonclinical long-term effects (six months after the CI). The participants were questioned during the fourth interview about CI effects that continued after six months and about perceptions that they may have of what changed for them.

- The delay in returning to work after the CI. This delay is independent of the recovery trajectory because employees may return to work while they are still experiencing certain negative effects associated with the CI.

These data were coded into the database and underwent statistical descriptive, factorial and linear growth model to determine the types of negative effects described by the participants.

4.2.3 Objective 3: Evaluate the Effectiveness of CIMSPs

In order to respond to Objective 3 (evaluation of the effects of CIMSPs), the data produced in the context of objectives 1 and 2 were used. Furthermore, additional data were gathered on the variables identified in the literature about trauma among train engineers and conductors and the general public that could affect the development of traumatic reactions and attenuate the effect of CIMSPs. These variables are as follows:

- Adaptation mechanisms (Brief cope, Carver, 1997);

- Social support, use of clinical services, previous experience, the complexity of the CI and the actions of other stakeholders at the site of the CI (emergency services, coroner, others). These topics were discussed through open and closed questions in the interview.

Two standardized instruments were used to explore the role of the workplace in the application and effects of CIMSPs:

- Areas of Worklife Scale (AWLS) (Maslach and Leiter, 1997). This instrument was designed to measure the work environment of the respondents. It is divided into six subscales (workload, control, reward, community, fairness and values). In the scope of this study, only the total score, whose internal consistency shows a Cronbach alpha of 0.91, was used.

- Survey of Perceived Organizational Support (SPOS) (Eisenberger, Huntington, Hutchison and Sowa, 1986). This instrument was developed to measure the perception of employees in terms of how much their company values their contribution and cares about their well-being. The scale is composed of 36 items. Cronbach's alpha internal consistency score is 0.97.

4.2.4 Objective 4: Recommendations Concerning CIMSPs

These recommendations are based on the findings from this research and previous research on rail CIs, and on best practices in preventing the negative effects of potentially traumatizing events among the general public and in the workplace. The first draft of these recommendations was submitted to and discussed with the representatives of the project's partners (VIA Rail and the TCRC), then finalized before being included in the report.

4.3 Research Protocol Structure

This study used a prospective and longitudinal protocol, with two or four measurement periods and with two types of participants included in different processes. This process is described as follows:

- The engineers and conductors were interviewed four times: in the week after the CI, and then one, three and six months after it. The measurement periods were chosen by considering the results of previous studies with train conductors and research about potentially traumatizing events, as well as the diagnostic criteria for mental health problems potentially associated with them.

- One week after the CI: This first interview could not be done too soon after the CI, to provide time for the participant to rest, to inform him about the project and to contact him.

- One month after the CI: It was known that most of the employees return to work in the days following the CI (Bardon, 2014, Cothereau, 2004) and it would be possible to talk about returning to work for most of the participants during that second interview. The *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) states that acute stress manifests itself during the first month, but to receive a diagnosis of posttraumatic stress disorder (PTSD), the symptoms must last for over a month (APA, 2013).

- Three months after the CI: Safety is critical in terms of railway workers' jobs and they should not work on a train if they have certain mental health problems or take certain medication. The medical rules handbook stipulates that the person must be free of anxiety or depression symptoms for three months before returning to work (RAC, 2010). The third interview was therefore planned around this time marker.

- Six months after the CI: With respect to the medical rules handbook (RAC, 2010), an employee must have no posttraumatic stress symptoms for six months before returning to work. Prolonged absences over six months appear to be rare (Cothereau, 2004, Limosin *et al.*, 2006, Margiotta, 2000), and the fourth measurement period made it possible to carry out a final follow up with those who had not yet returned to work and to identify the potential presence of delayed trauma among certain participants. It was also important not to leave too much time before the final interview to maximize the chance that the participants would complete the study.

The MTOs were interviewed twice: in the week following the CI, and three months afterward. The three-month period was chosen according to the time in which actions are generally completed in the management of CIs.

4.4 Analyses

A design based on a multiphasic mixed methodology (Teddlie and Tashakkori, 2006) guided the research. To that end, a general discussion and recommendations simultaneously integrated and interpreted the quantitative and qualitative results during the data analysis phase.

Information Gathered from Engineers and Conductors

All the data gathered during the interviews with engineers and conductors corresponding to the variables included in the analysis plans were categorized and coded in a database, then analyzed using SPSS 24 statistical software. The data concerning the recommendations to improve practices were entered in the form of verbatim reports and then analyzed qualitatively. The data was coded from audio recordings of the interviews by a team of trained research assistants and the project coordinator performed spot checks of the rating quality.

The quantitative phase of the analyses, based on the decision tree proposed by Tabachnick and Fidell (2007), guided the choice of statistical analyses according to the types of variables (continuous or categorical) and the information required (differences in groups or relationships between the variables) (Tabachnick and Fidell, 2007). If the independent variable (IV) and the dependent variable (DV) were categorical, nonparametric tests were carried out to see whether a relationship existed between them. When the IV and the DV were continuous, multiple regressions or Pearson correlation tests were performed to determine whether the IV could predict and/or was associated with the DV. In the case in which the IV was categorical and the DV was continuous, ANOVA or Student tests (t tests) were performed to establish the differences between the groups represented by the IV according to their mean from the DV (in this case, the eta squared value was used to calculate the effect size observed and the percentage of variance explained by the IVs is indicated (Lakens, 2013)). Given the range in the number of variables, principal component analyses were performed for certain hypotheses to reduce this number. The factors that they produced made it possible to examine the presence of association and/or the predictive capacity of IV aggregation on a DV in multiple regressions. In addition, the analyses of the individual trajectories that made it possible to use the categorical and continuous IVs with a continuous DV were used to explore the evolution of the negative effects of CIs and to determine their predictors. For all of these analyses, the null hypothesis rejection criterion was set at $p < 0.05$. When the analyses involved repetitive tests on the same DV, with the exception of the analyses of factors influencing the presence of negative effects in the days following the CI, Bonferroni corrections were applied to maintain the null hypothesis rejection level at 0.05 for all of the research. Otherwise, and unless otherwise specified, the quantitative results dealt with the entire sample, regardless of employer type in order to maintain sufficient statistical power.

To overcome the limits of the quantitative analysis of factors that could influence recovery of participants after a CI, a qualitative analysis was performed using interview transcripts. This analysis should enable the risk factors to be established by highlighting the “extreme” participants, those who experienced the greatest and the fewest negative effects from a CI. The purpose of this analysis is therefore to determine the factors occurring at the time of the CI or in the subsequent hours that may help to understand the level of adverse effects described by the participants. The analysis focused on two topics: (1) the participants’ stories, i.e., how they described what happened, their emotions, their silences, the meaning that they gave to the events, the tone of the interview; (2) the circumstances of the CI and the factors surrounding their experience.

Selection of extreme participants

The analysis was performed on a subsample of 10 participants. The selection criteria were as follows:

- The characteristics of the CI: (1) the participant was on the locomotive when the victim was struck (AND) (2) the victims were seriously injured or killed; (AND/OR) (3) the participant feared for his/her safety or his life; (AND) (4) the CI occurred on the open tracks or at a level crossing (not in a rail yard).

- The intensity of the negative effects associated with the CI: The five participants who experienced the greatest number of negative effects and the five participants who experienced the fewest negative effects were included. The general effects previously described in the quantitative analysis were used, and those with between 8 and 17 negative effects without a clear short-term reduction model in the first time period were

included in the severely affected group of participants. The group that was not very affected included those who had described between 0 and 6 negative effects in the first period (one week), effects that had disappeared by the second time period (one month).

Method

The data were gathered from the stories of participants and the responses to questions about the circumstances surrounding the CI and its management in the first interview (one week after the CI). The verbatim of the stories of each participant was transcribed. A qualitative multiple cases analysis (Stake, 2013) was carried out with the N'Vivo 11 software, in order to understand the phenomenon that occurred for the entire group.

First, in order to understand each case in depth, the methods used by Miles and Huberman (2003) were used to identify the themes, then a single case analysis was carried out to better understand each participant's trajectory (Stake, 2013). One of the single case analyses was performed by two different analysts to test its validity and to ensure that the themes were satisfactory and that the excerpts selected for this case were valid for each of the themes. Each participant's experience was fully taken into account through the development of five synthesis statements per participant. During the multiple case study phase, this ensured that the 10 different experiences could be memorized more effectively by the analysts. Then, each case was compared to the other cases, the themes were reconstructed by merging them into a smaller number of themes representing the various cases, in order to better understand the phenomenon.

Finally, the results from the two methods were combined into a summarized schema to support the correlational statistical data with qualitative causal inferences (Teddlie and Tashakkori, 2006).

Information Gathered with the CoA MTOs

Thematic analyses of content were carried out to analyze the effects of CIs on the MTOs, in addition to their involvement and needs related to CI management. A thematic analysis of content was also performed to identify the recommendations made by the MTOs during their two interviews. The details concerning the methodology that guided the various analyses are provided in Section 5, and results are presented when applicable.

5. FINDINGS

5.1 Description of the Sample

The study sample is constituted of 74 engineers and conductors and 9 CoA MTOs. The subsection below describes the participants.

5.1.1 Engineers and Conductors

During the study, 306 engineers and conductors were identified as being involved in CIs from Transportation Safety Board (TSB) event reports.

The exclusion criteria for the study are as follows: the employee was already a participant at the time of the CI (N=2), and the employee was not involved in a critical incident (CI) associated with collisions with people or vehicles (N=43). A total of 261 people were thus eligible among the 306 identified (85.3%). Among those eligible, 186 (71.2%) did not participate, for the reasons described in Table 3. In 125 cases, the individual's contact information was not obtained (47.9%). The participation rate was calculated from the number of people eligible and whose contact information had been provided to the research team. In all, 135 engineers and conductors were contacted and 74 participated (54.8%).

Table 3. Indicators of causes of nonparticipation of engineers and conductors in the research project

Reason for nonparticipation	Number	Percentage
The employee did not respond to our calls (after four tries and a final message indicating that the employee could contact us if he/she wished)	34	18.3
Absence of employee's contact information	125	67.2
The employee stated verbally or by email his/her refusal to participate (the most frequent reasons for refusal were lack of time, the employee felt that there was nothing more to say because everything was going well, the employee no longer wanted to talk about the event)	27	14.5
Total number of nonparticipants	186	100.0

Table 4 describes the differences and similarities between the group of participants and that of nonparticipants, with respect to variables for which information was available to the researchers (province of origin, employer, type of job, type of CI).

Table 4. Comparison between employees who participated and those who did not

Variable	Statistical test
Province	$\chi 2$ (N = 74.7) = 8.229, p: .313
Employer	$\chi 2$ (N = 74.3) = 7.117, p: .212
Type of employment 60.3% of conductors and 36.6% of engineers participated	$\chi 2$ (N = 74.2) = 90.259, p < .001
Type of critical incident (CI) 17.3% of employees involved in an accident and 59.7% of employees involved in a suicide participated	$\chi 2$ (N = 74.3) = 54.082, p < .001

In terms of all of the employees involved, conductors and employees involved in suicides were over-represented in the sample. Table 5 presents the participants. The participation rates were comparable by province and by employer.

Table 5. Sample characteristics

Variable	Data		Variable	Data	
Province	Alberta	6 (8.1%)	Type of critical incident	Fatal accident with pedestrian	7 (9.2%)
	British Columbia	12 (16.2%)		Non-fatal accident with pedestrian	9 (11.8%)
	Manitoba	9 (12.2%)		Suicide	21 (27.6%)
	New Brunswick	4 (5.4%)		Attempted suicide	3 (3.9%)
	Ontario	28 (37.8%)		Fatal accident with vehicle	2 (2.6%)
	Québec	7 (9.5%)		Nonfatal accident with vehicle	26 (34.2%)
	Saskatchewan	8 (10.8%)		Murder-suicide	2 (2.6%)
				Attempted suicide with vehicle	2 (2.6%)
				Suicide with vehicle	2 (2.6%)
Employer	CoB	29 (40.0%)	Age	Average age: 41.8 years (SD: 11.451)	
	CoC	26 (34.7%)			
	CoD (grouped with CoB for whom it is a subcontractor)	2 (2.7%)			
	CoA	17 (22.7%)			
Job title	Conductor	35 (47.3%)	Gender	All but one of the participants were men	
	Engineer	37 (50.0%)			
	Engineer in training	2 (2.7%)			
Seniority in the rail industry	Average seniority: 16.84 years (SD: 13.232)				

Because of its longitudinal character, not all of the participants in the first interview finished the study. Table 6 describes the participation rate in each measurement period. The overall attrition rate in the project is 17.6%, which corresponds to the percentage of those who participated in the first interview, but who did not continue until the end of the project. The causes of attrition

were lack of time, a too busy schedule, which made it difficult to reach some participants, and the perception that they had already said everything they had to say. Given the difficulties in identifying and reaching the participants, the measurement time frames could not always be respected. The main difficulty came from irregular working hours, which made contacting subjects and making appointments difficult.

Table 6. Participation and dropout rates throughout the project's four measurement periods

Participants	**Interview 1** (1 week after the incident: 7–10 days) N (%)	**Interview 2** (1 month after the incident: 30–35 days) N (%)	**Interview 3** (3 months after the incident: 90–100 days) N (%)	**Interview 4** (6 months after the incident: 180–200 days) N (%)
Did the interview	74 (100%)	67 (90.5%)	63 (85.1%)	61 (82.4%)
Filled out the online questionnaire (% of participants in each measurement period)	62 (83.8%)	54 (80.5%)	49 (77.8%)	47 (77.0%)
CoA	17	15	13	13
CoB	31	30	27	26
CoC	26	22	23	22
"Return to work" interviews	47	20	0	1
Time (days) between the incident and the interview	16.6 (12.056)	53.4 (20.974)	108.5 (20.909)	198.5 (57.908)

5.1.2 The CoA MTOs

The MTO sample is made up of nine people, recruited after CIs involving a CoA train. It includes eight men and one woman, with a mean age of 53 (between 46 and 61). Participants' mean numbers of years of seniority in the rail industry were 31 years, in various positions (mechanic, equipment and transportation, management, engineer, MTO).

Recruitment was carried out at the same time as that for engineers and conductors. During that period the names of 16 MTOs were transmitted to the research team, and among them, 10 people were recruited. One of the participants was not included in the analysis because he worked in mechanical supervision and his activities were not linked to those of engineers. Among the six MTOs who were not included, four could not be reached, one did not go to the CI site and one refused to participate. Only seven of the nine participants took part in interviews 1 and 2. The two people who did not participate in interview 2 cited changes to their positions or lack of time. The CIs that prompted their inclusion in the study entailed a death (N=5) or injuries (N=4). They were accidents (N=4) or suicides (N=5), of which two were complex because they were accompanied by attempted homicides. Most occurred at crossings (N=6), only one occurred on the tracks and two occurred at the station. These MTOs must manage numerous CIs in the scope of their jobs, and four of the seven individuals who participated in interview 2 experienced another CI in the three months following the first CI. The analysis of this study did not associate MTOs and engineers/conductors who were involved in the same CI, because the chances of recruiting engineers and MTOs of the same CI were low.

5.2 Results of the Evaluation of the Implementation of CIMSPs (Objective 1)

This subsection of results deals with the levels of implementation of CIMSPs. The data from interviews 1 and 2 with engineers and conductors were obtained through detailed questions about all of the elements included in the descriptions of the CIMSPs of each railway company.

5.2.1 Implementation Level of CIMSPs

Table 7 lists all the different actions that the participants remember of the implementation at the site of the incident at the time it occurred and in the days that followed (based on the employers' CIMSPs). Some actions are specific to the CIMSPs of certain companies and are indicated as such in Table 7. Some actions are undesirable, in that the CIMSPs recommend that they should not occur in the scope of the company's CIMSP. These are also indicated as such in Table 7. The elements of the CIMSPs are presented in their probable order of appearance during a CI.

Overall, the actions and attitudes identified during CIs were very uneven. An MTO was present in most of the cases (84%) and demobilization (being taken away from the location of the CI) was the action most often taken (78% of cases). However, it was not universally applied, even though it should be systematic, according to employers' protocols. Trained peer helpers met with the employees in 39% of the cases and EAP professionals met with employees in 31% of the cases when they returned to the terminal. The employees underwent clinical debriefing in 39% of the cases. It is important to note that the participants sometimes found it difficult to distinguish between the peer intervention, the EAP intervention and the debriefing procedure. A small proportion of employees (17%) took time off for two days or less, 50% took between three and five days, and 32% took more than five days. A formal assessment of ability to return to work was only performed in 24% of the cases.

Undesirable actions occurred during CI management operations. In particular, 30% of the CoB and CoC employees felt pressured to continue working or to move the train at the scene of the CI and 26% of all the participants experienced pressure to return to work rapidly after the CI. The average number of undesirable elements during the management of the incident (blaming the employee, applying pressure to move the train, encouraging them to continue to work) was m=1.307 (SD: 0.299), with no differences among the employers.

Table 7. Level of presence of various actions and attitudes described in the CIMSP during the CIs studied (data from interviews 1 and 2)

Participants	Total (N=74)	CoA (N=17)	CoB (N=31)	CoC (N=26)
Employee's prior familiarity with the CIMSP	21 (28%)	9 (53%)	7 (22%)	5 (19%)
Actions of the MTO on site				
- Presence of an MTO on site	62 (84%)	15 (88%)	22 (71%)	25 (96%)
- How soon an executive arrived (average in minutes)		107 min	92 min	68 min
- The MTO asked the employee about his well-being	61 (82%)	17 (100%)	22 (71%)	22 (85%)
- The MTO took charge of the situation and took care of all aspects of CI management	45 (61%)	14 (82%)	14 (45%)	17 (65%)
- The MTO acted as the reference point for all involved (to ensure that the employee would not be questioned by several people, for example)	35 (47%)	9 (53%)	13 (42%)	13 (50%)
- The MTO explained the CIMSP and the next steps	30 (40%)	10 (59%)	11 (35%)	9 (35%)
- The MTO asked questions about the symptoms (CoC)				3 (11%)
- The MTO asked the employee to continue working (undesirable: CoB)			9 (29%)	
- Pressure on the employee to move the train (undesirable: CoB-CoC)			6 (19%)	9 (35%)
- The MTO treated the employee as a victim of the incident	23 (31%)	9 (53%)	10 (32%)	4 (15%)
- The MTO blamed the employee for the CI (undesirable)	3 (4%)		3 (9%)	
- The MTO had a supportive attitude toward the employee				
- Treated the employee with empathy	54 (73%)	14 (82%)	20 (64%)	20 (77%)
- Treated the employee with respect	43 (58%)	13 (76%)	17 (55%)	13 (50%)
Demobilization	58 (78%)	16 (94%)	22 (71%)	20 (77%)
- The employee was asked if he wanted to be replaced	18 (24%)	3 (18%)	7 (22%)	8 (31%)
- Delay before the worker could leave the site (average in minutes)		167.33 min.	146.30 min.	130.75 min.
Peer helper				
- Employee was met by a peer helper at the terminal	29 (39%)	10 (59%)	15 (48%)	4 (15%)
- Employee was accompanied home by a peer (CoB)			7 (22%)	
Clinical consultation at the terminal (EAP)	23 (31%)	6 (36%)	11 (35%)	6 (23%)
Consultation with the executive at the terminal (CoB – CoC)			2 (6%)	5 (19%)
- Asked about needs			12 (39%)	9 (35%)
- Manager let the person talk about the incident freely				12 (46%)

Participants	**Total (N=74)**	**CoA (N=17)**	**CoB (N=31)**	**CoC (N=26)**
- Provided information about possible reactions and services available			10 (32%)	13 (50%)
- Provided an information leaflet about the CIMSP			2 (6%)	
- Provided information about the EAP	39 (53%)	10 (59%)	21 (68%)	8 (31%)
Post-incident recovery leave (includes all the days taken off, both those provided by the employer and personal days)				
- Average duration of post-CI leave (average in days)	8.43	6.41	6.14	12.54
- Took 1 or 2 days of leave	13 (17%)	1 (6%)	6 (18%)	6 (23%)
- Took 3 days of leave	28 (38%)	5 (29%)	14 (45%)	9 (35%)
- Took 4 or 5 days (additional leave)	9 (12%)	7 (41%)	1 (3%)	1 (4%)
Clinical follow-up with EAP				
- Debriefing (individual or group counselling session with a clinician)	29 (39%)	7 (41%)	13 (42%)	9 (35%)
- Follow-up carried out the same day as the incident	13 (17%)	5 (29%)	7 (22%)	1 (4%)
- Appointment made by the employer with the EAP	20 (27%)	4 (23%)	10 (32%)	6 (23%)
Follow up with the manager during leave				
- To discuss the well-being of the employee only	16 (21%)	9 (53%)	3 (9%)	4 (15%)
- To discuss the return to work only (undesirable)	5 (7%)	1 (6%)	3 (9%)	1 (4%)
Pressure by the manager or the company to return to work (employee's perception: undesirable)	19 (26%)	3 (18%)	8 (26%)	8 (31%)
A formal assessment of capacity to return to work was carried out	18 (24%)	3 (18%)	5 (16%)	10 (38%)
The employer offered a flexible return to work	9 (12%)	3 (18%)	3 (9%)	3 (11%)
Follow-up carried out with the manager after the return to work	15 (20%)	6 (36%)	5 (16%)	4 (15%)

5.2.2 Factors that Could Influence the Implementation of CIMSPs

The factors potentially associated with variations in the application of the CIMSP were examined in order to establish the potential determinants of implementation and to suggest avenues of improvement. Two approaches were used: the first consisted of using the number of actions accomplished in the scope of management of the CI on site and in the following days as implementation criteria. The dependent variables used for this analysis were as follows:

- the number of CIMSP actions for each CI (M: 5.388, SD: 2.235);
- the number of undesirable actions during management of the incident for each CI (M: 1.307, SD: 0.299).

The second consisted of verifying the factors that could influence the presence each individual CIMSP action. The dependent variables used for this analysis were each CIMSP action, both desirable and undesirable.

5.2.2.1 Environmental Factors that Could Influence the Application of Individual Actions and Attitudes identified in CIMSPs

The first series of factors influencing the application of CIMSPs concerns the environmental context in which the CI occurred. The following variables were tested: the distance of the CI from the terminal, the population density, the characteristics of the site (crossing, open tracks, rail yard, station platform), the province in which the CI occurred, whether it was in a rural or urban area, weather conditions. Only the factors for which significant variation was observed are described (tables 8 and 9).

Table 8. Variables related to the environment and the CI context that influence the number of CIMSP actions[3]

Variable	Type of influence	Statistical test
Region (eastern or western Canada)	The CIs in the eastern provinces (ON, QC, NB) had fewer undesirable management actions (M: 0.539, SD: 0.682) than those in the western provinces (MN, SK, AB, BC, M: 1.086, SD: 0.887)	($F(1, 72) = 8.951$, p: .004), eta^2: .111 Variance explained: 11.10% (mean effect size). The average difference corresponded to 0.547 with a confidence interval of 95% from 0.182 to 0.917
The combined notation of eta squared and the percentage of variance is used for ease of reading (Lakens, 2013) Abbreviations: AB: Alberta, BC: British Columbia, MN: Manitoba, NB: New Brunswick, ON: Ontario, QC: Québec, SK: Saskatchewan		

Table 9. Variables related to the environment and the CI context that influence the application of individual actions and attitudes prescribed in the CIMSP[4]

Variable	CIMSP element influenced	Statistical test
Region (eastern and western Canada)	The employees most often pressured to continue working were in the west	χ^2 (N = 64, 1) = 8.632, p: .003
	The MTO asked employees to move the train more often in the west	χ^2 (N = 64, 1s) 14.716, p < .001

The primary factor in the environmental context influencing the implementation of CIMSPs is the geographical region or province (eastern or western Canada). Other environmental factors did not reach a statistical signification threshold with an alpha of .05, indicating that the differences by province are attributable to the level of urbanization and the distances involved when the CI occurred. CIs in western Canada occur more often in rural areas and are further from terminals than in eastern Canada.

5.2.2.2 Factors Associated with CI Characteristics That May Influence the Application of Individual Actions and Attitudes Prescribed in CIMSPs

This second series of variables concerns the CI characteristics that could increase the complexity of the situation and affect the level of use of CIMSPs. These variables are the CI type (accident or suicide), fatalities or injuries, number of victims, the involvement of vehicles or vulnerable people. Here, we only describe the elements for which a significant variation was observed (tables 10 and 11).

[3] In total, the variable of the number of CIMSP actions was introduced in nine repeated analyses, thus requiring a Bonferroni correction of 0.006. For a result to be deemed statistically significant at α = 0.05, the analysis threshold had to reach 0.006.

[4] In total, the variables related to the environment and the CI context involved ten repeated analyses, thus requiring a Bonferroni correction of 0.005. For a result to be deemed statistically significant at α = 0.05, the analysis threshold had to reach 0.005.

Table 10. Variables related to the CI characteristics that influence the number of CIMSP actions

Variable	Type of influence	Statistical test
CI involving death	More actions in the CIMSP were applied in CIs involving a death or deaths (M: 5.882, SD: 1.996) than one without death (M: 4.875, SD: 2.344)	$F(1, 72) = 3.882$, $p = .050$), eta^2: .0512 Variance explained: 5.12% (small effect size).
Accident	There were more undesirable actions by management in accidents (M: 1.361, SD: 0.322) than in suicides (M: 1.228, SD: 0.245)	$F(1, 72) = 4.063$, $p = .048$), eta^2: .0485 Variance explained: 4.85% (small effect size).
The combined notation of eta squared and variance percentage is used for ease of reading (Lakens, 2013)		

Table 11. Factors related to the characteristics of CI that may influence the implementation of individual actions and attitudes prescribed in CIMSPs[5]

Variable	CIMSP element	Statistical test
CI involving or not involving death	The employees involved in CIs not involving a death or deaths were pressured more to move the train	χ^2 (N = 64, 1) = 17.287, $p < .001$
	The employees involved in CIs not involving a death were pressured more to continue working	χ^2 (N = 64, 1) = 11.822, p: .001
CI is a suicide or an accident	The employees were pressured more often to move the train when they were involved in an accidental CI.	χ^2 (N = 64, 1) = 7.365, p: 007
	The employees were pressured more often to continue working when they were involved in an accidental CI.	χ^2 (N = 64, 1) = 9.044, p: .002
Involvement of a vehicle	The MTO asked employees to move the train when the CI involved a vehicle.	χ^2 (N = 63, 1) = 9.144, p: .002

The analyses show that the CI's characteristics affect the amount of pressure put on employees to move the train or to continue working. The CIMSPs are applied more exhaustively (i.e., more desirable actions were carried out) when the CIs were deaths or suicides than when they were accidents involving vehicles.

5.2.2.3 Factors Associated with the Perception of the Workplace That Could Influence the Application of Individual Actions and Attitudes Prescribed in CIMSPs

Quality of Labour Relations

The occupational context can play a role in the application level of CIMSPs. The "Areas of Worklife Scale" (AWLS) standardized questionnaire explores the quality of labour relations in six

[5] In total, the variables of the CI's characteristics involved ten repeated analyses, thus requiring a Bonferroni correction of 0.005. For a result to be deemed statistically significant at $\alpha = 0.05$, the analysis threshold had to reach 0.005.

areas (workload, control, reward, community, fairness, values). The relationships between these areas and the implementation level of CIMSPs were explored. The questionnaire was filled out online after the first interview by 40 participants. We have therefore only included here the associations that were sufficiently robust to counter the small sample effect.

When employees have the perception that their workload is too heavy in general, they feel more pressure to work at the site of the CI ($r(40) = -.352$, $p = .026$). When employees have the perception that they do not have enough control over how to do their work in general, they feel more pressure to work at the site of the CI ($r(74) = -.295$, $p = .064$).

Factors Related to the Perception of Organizational Support

The "Survey of Perceived Organizational Support" (SPOS) standardized questionnaire was used to understand the perceptions of organizational support and the role that perception can have on the implementation level of CIMSPs.

In general, those who felt that organizational support was good did not feel pressured to move the train ($r(49) = .329$, $p = .024$), or to continue working ($r(49) = -.442$, $p = .002$) and the employer did not do anything to hurt them during the CI and in the following days ($r(49) = -.359$, $p = .015$). Instead, they wanted to continue working more often ($r(49) = .383$, $p = .007$); they felt that they were more often treated with empathy ($r(49) = .267$, $p = .070$) and they felt supported during the CI more often ($r(49) = .506$, $p = .001$).

5.2.3 Employees' Satisfaction with CIMSPs

This section of findings explores the level and the type of satisfaction experienced by employees with respect to the CIMSP that was applied during the CI. The employees' degree of satisfaction with the CIMSP was assessed during the first and second measurement periods and upon return to work through open questions, for which the responses were coded in an SPSS table, and closed questions, for which the response was given on a Likert scale. The themes discussed in these questions focused on the employees' perceptions about various aspects of the CI's management: perceived pressure, perceived support, appreciation of the attitude of the various professionals and managers, expectations with respect to the employer, attribution of responsibility. Satisfaction could be related to the effects of CIMSPs, but it is not synonymous with their effectiveness. Employees may be satisfied with the actions taken, without it being possible to observe the positive effect of CIMSPs on their post-CI recovery trajectory, for example. The elements of satisfaction or dissatisfaction are described in Table 12.

Overall, employees felt that the manner in which the CI had been managed did not increase or decrease their stress level (31%–29%). A small number of employees (13%) would have liked to continue working; they wanted to "get back in the saddle" right away, without being demobilized. One third (31%) found that the time it took to leave the site was acceptable, independently of the duration. This emphasizes the necessity of communicating sufficiently with employees about the causes of delays. In fact, the level of satisfaction with respect to delays did not seem to be related to the length of time before being demobilized, but to the perception of whether or not the delay was justified, given the circumstances of the CI and its management. Half the participants thought that the protocols had been adequately respected, no matter their degree of familiarity with them. The perception that the protocol had been properly followed may be related as much to people's expectations (previous experiences, expectations regarding care, etc.) as it is to the knowledge of the CIMSPs promoted by the employer. Information and

communication can play important roles in employee expectations and satisfaction. Most employees felt that they were treated with empathy (79%) and respect (73%) by their MTOs.

Indicators of dissatisfaction are mainly related to the pressure felt at the site of the CI (42%) and to move the train (20%). Giving into pressure (23%) can increase the feeling of not having control over what is going on. This loss of control is associated with a greater risk of posttraumatic stress (Brillon, 2010). Half (50%) of the participants associated the difficulties they experienced with how the CI was managed or with their relationship with their employer after the CI (45%).

Table 12. Indicators of employee satisfaction or dissatisfaction with the CIMSP, gathered during interviews 1 and 2 and upon returning to work

Item	Total	CoA	CoB	CoC
Asked during the first interview	(N=74)	(N=17)	(N=31)	(N=26)
On-site, at the time of the CI, the participant				
- felt pressured to act at the scene of the CI	16 (22%)	3 (19%)	7 (23%)	6 (23%)
- Pressure came from the employer	10 (13%)	3 (19%)	5 (16%)	2 (8%)
- refused to perform the tasks that were requested at the time of the CI	7 (10%)	1 (4%)	1 (19%)	5 (6%)
- The way the incident was managed				
- increased feelings of stress	19 (26%)	1 (6%)	9 (29%)	9 (35%)
- changed nothing with respect to stress	23 (31%)	4 (23%)	13 (42%)	6 (23%)
- lowered stress levels	22 (29%)	11 (65%)	5 (16%)	6 (23%)
- Felt pressured to move the train	15 (20%)	0	6 (19%)	9 (35%)
- Felt pressure from the employer	31 (42%)	3 (18%)	12 (39%)	16 (61%)
- Resisted it	11 (15%)	0	4 (13%)	7 (27%)
- Gave into it	17 (23%)	3 (18%)	8 (26%)	6 (23%)
- Wanted to continue working after the CI	10 (13%)	3 (18%)	5 (16%)	2 (8%)
- Found that the delay before leaving the site was acceptable	23 (31%)	6 (35%)	9 (29%)	8 (31%)
In the first hours after the CI, the participant				
- thought that the CIMSP was followed correctly	36 (49%)	12 (70%)	12 (39%)	12 (46%)
- felt supported by his/her MTO	45 (61%)	14 (82%)	14 (45%)	17 (65%)
Discrepancy between what the person would have liked to have seen happen during CI management, and what the person expected from the employer				
- absolutely no expectations with respect to the employer (negative perception)	5 (7%)	0	2 (6%)	3 (11%)
- Expectations not met	34 (46%)	7 (41%)	19 (61%)	8 (31%)
- Expectations met and no other wishes	8 (11%)	4 (23%)	3 (10%)	1 (4%)
- No expectations in particular (positive or neutral perception)	22 (30%)	6 (35%)	5 (16%)	11 (42%)
Asked during the second interview—the participant	(N=67)	(N=15)	(N=30)	(N=22)
- felt that the difficulties experienced after the CI were, at least in part, due to the way the CI was managed	34 (50%)	7 (47%)	19 (63%)	8 (36%)
- felt that the difficulties experienced after the CI were, at least in part, due to labour relations and the company	31 (45%)	5 (33%)	17 (57%)	9 (41%)
- The debriefing session that the employee attended helped him/her (% of	19 (28%)	4 (27%)	8 (27%)	7 (32%)

Item	Total	CoA	CoB	CoC
those for whom information was provided)				
- In retrospect, the person felt pressured to perform tasks during the CI	20 (29%)	4 (27%)	8 (27%)	8 (36%)
- Had the feeling of being treated with empathy by the manager	54 (79%)	13 (87%)	17 (57%)	13 (59%)
- Had the feeling of being treated with respect by the MTO	54 (73%)	14 (93%)	20 (67%)	20 (91%)
- Vexatious or upsetting things were said or done during the management of the incident (emergency responders or employer)	25 (37%)	5 (33%)	11 (37%)	9 (41%)
- Perception that the CIMSP was respected in the weeks that followed the CI	39 (52%)	11 (73%)	13 (43%)	15 (68%)
- Felt supported by his/her work environment	29 (42%)	11 (73%)	10 (33%)	8 (36%)
Asked during the return to work interview (1)—the participant:	(N=69)	(N=17)	(N=28)	(N=24)
- Felt ready for a normal return to work	59 (85%)	14 (82%)	23 (82%)	22 (92%)
- Felt that he/she had taken enough leave to recover after the CI	40 (58%)	12 (71%)	14 (50%)	14 (58%)
- Felt ready to return when he/she returned to work	58 (84%)	16 (94%)	24 (86%)	18 (75%)
- Felt a high level of stress during his/her first trip after the return to work	22 (32%)	7 (41%)	8 (30%)	7 (29%)
- Felt pressure exerted by the employer to return to work	19 (27%)	3 (18%)	8 (28%)	8 (33%)

(1) The return to work interview was carried out at the 1st, 2nd, 3rd, or 4th measurement periods, according to the dates that employees returned during the study. Therefore, the number of people who did this part of the interview does not correspond to the number of participants at each stage of data gathering. Furthermore, some people did not do the return to work interview (had not returned at the time of period 4, dropped out before returning to work).

5.2.4 Factors that May Contribute to Employees' Satisfaction with the CIMSP

Principal component analysis (PCA) was performed to identify the potential types of satisfaction elicited by the participants. The objective of the analysis was to sum up information relevant to the participants' satisfaction into "factors" in order to reduce the number of variables, thus avoiding the inflation of type I errors, and not to predict individual satisfaction scores based on those factors. It was therefore possible to tolerate some discrepancies in the statistical assumptions (Tabachnick and Fidell, 2007). The analysis was made with 14 satisfaction variables. Preliminary analyses were performed in order to determine the factorability of the sample with the KMO index (ratio of the sum of the correlations of squared variables to the sum of the correlations of squared variables plus their partial squared correlation) and Bartlett's sphericity test. The KMO reached 0.681, which means that the variables have common variants and respect the recommendations of Tabachnick and Fidell (2007), which require a KMO index above 0.60. Bartlett's test consists of determining whether the correlation matrix of the variables is significantly statistically different from the identity matrix, which would imply no relationship between them. In this case, Bartlett's sphericity test was statistically significant (χ^2 : 150.300, ddl : 91, $p < .001$), suggesting that there are factors to extract. In terms of statistical assumptions to examine, the first pertains to extreme scores. Given the dichotomy of several satisfaction variables, only those in which at least 20% of the sample endorsed one of the categories were included in the analysis. That way, the factors extracted from the PCA represent a common variance of a significant part of the sample and not just a few participants (extreme scores). The second assumption concerns the sufficient number of participants. Although the total number of the sample (N = 74) appears low, Tabachnick and Fidell (2007) noted that a PCA performed with 50 to 100 participants could produce reliable results when the number of factors extracted is small and the load of most of the variables over them was above 0.80. Given that the dichotomy of most of the variables artificially reduces their variance, a variable loading criterion on their factor of 0.65 was accepted. Because the results suggest the presence of 4 factors, with 7 variables out of 14 having a load of at least 0.65 on a factor, the sample size was deemed sufficient for this analysis.

Factor 1, "Employer's responsibility" explains 17.133% of the variance and includes the items of CI management responsibility and the employer's responsibility in the difficulties experienced, and the feeling of not being supported by the workplace. Factor 2, "Limited protocol and support" explains 14.352% of the variance and includes the items of perceptions that the CIMSP was not correctly applied. Factor 3, "Tension at the CI site" explains 14.217% of the variance and includes items associated with the pressure to perform tasks, delays, the adoption of hurtful behaviours and empathy. Factor 4, "Significant pressure," explains 13.487% of the variance and includes the items of pressure to move the train, manage the scene and get back to work.

The factors of satisfaction (the employer's responsibility; limited protocol and support; tension at the CI site; significant pressure) were used as dependent variables to determine employees' degree of satisfaction. Independent variables that could affect satisfaction are the level of implementation of CIMSPs (numbers of actions applied and actions taken individually), and the environmental variables related to the complexity of the CI. The results of the analyses of these variables will be discussed in the following subsections.

5.2.4.1 Satisfaction Related to the Implementation Level of CIMSPs

The variables used to analyze the effect of implementation of CIMSPs on satisfaction level are the number of actions applied and actions taken individually.

CIMSP Actions Applied

Correlation tests between the number of actions of the protocol corresponding to independent variables and the four satisfaction factors that constitute the dependent variables were performed. Table 13 summarizes the results of that analysis.

Table 13. Number of desirable and undesirable actions and their relationship to employees' satisfaction with the CIMSP6

Number of actions	Employer's responsibility	Limited protocol and support	Tension at the CI site	Significant pressure
Desirable	R: -.279, p: .016, R^2: .077	R: .447, p < .001, R^2: .199	NS	NS
Undesirable	R: .231, p: .048, R^2: .053	NS	NS	R: .738, p < .001 R^2: .544
NS: not significant				

The number of CIMSP actions used is therefore related to a higher level of satisfaction among employees following a CI.

Actions Taken Individually in CIMSPs

ANOVAs were performed to identify the actions taken individually in CIMSPs that have an effect on the satisfaction factors and the results are summarized in Table 14. As expected, the satisfaction factor "Limited protocol and support" is more sensitive to the effects of the various actions taken individually in the protocol, because it reflects employees' perception that the protocol was not adequately applied. Actions taken individually that have a positive influence on this satisfaction factor are especially related to positive interactions between the MTO and the employee (presence on the site, taking charge, empathetic attitude, personal follow-up).

[6] In total, the variables related to the number of desirable and undesirable actions of CIMSPs involved nine repeated analyses, thus requiring a Bonferroni correction of 0.006. For a result to be deemed statistically significant at $\alpha = 0.05$, the analysis threshold had to reach 0.006.

Table 14. Actions taken individually from CIMSPs that had an influence on satisfaction in terms of CI[7] management

Actions taken individually	Limited protocol and support
The MTO asked the employee how he/she was feeling	t(1.69) = 3.893, p < .001, eta^2: .1801 Those who were asked how they were feeling thought that the CIMSP was better applied Variance explained: 18.01% (high effect size). Post-hoc test with Bonferroni correction, mean difference corresponds to -1.193 with a confidence interval of 95% from -1.804 to -0.582.
The MTO took charge of the situation	t(1,65) = 4.724, p < .001, eta^2: .2560 When the MTO took charge of the situation, the employees felt that the CIMSP was better applied. Variance explained: 25.60% (high effect size). Post-hoc test with Bonferroni correction, mean difference corresponds to -1.027 with a confidence interval of 95% from -1.515 to -0.538.
The MTO acted as point person	t(2,52) = -4.395, p < 0,001, eta^2: .2710 When the MTO acted as the point person, the employees felt that the CIMSP was better applied. Variance explained: 27.10% (high effect size). Post-hoc test with Bonferroni correction, mean difference corresponds to -1.038 with a confidence interval of 95% from -1.512 to -0.564.

5.2.4.2 Satisfaction Related to the Environmental Context and the Characteristics (Complexity) of the CI

A series of ANOVA tests was carried out to verify the associations between the variables describing the environmental context of the CI, and characterizing its complexity with satisfaction and with the protocol and support. In that analysis, the dependent variables are the satisfaction factors.

The satisfaction factors affected by the context of the CI are the perception of significant pressure and the employer's responsibility with respect to negative effects experienced. The most important variables are related to the distance from the terminal, the province (west or east) its location on the network and the level of stress perceived at work (see Table 15).

[7] In total, the variables resulting from factors of satisfaction involved eighteen repeated analyses, thus requiring a Bonferroni correction of 0.003. For a result to be deemed statistically significant at α = 0.05, the analysis threshold had to reach 0.003.

Table 15. Influence of variables associated with the environmental context and the characteristics of CI on the satisfaction factors[8]

Variable	Employer's responsibility	Significant pressure
Eastern or western provinces		t (2, 72) = 3.541, p = .001, eta^2: .148 Variance explained: 14.8% (high effect size. Post-hoc test with Bonferroni correction mean difference corresponds to 0.7661 with a confidence interval of 95% from .3349 to 1.1975. When the CI occurred in a western province, the employees felt **more** pressure.
Location in the network		F (4, 69) = 4.427, p = .003, eta^2: .204 Variance explained: 14.8% (high effect size. Post-hoc test with Bonferroni correction mean difference corresponds to 0.7661 with a confidence interval of 95% from .3349 to 1.1975. When the CI occurred on the rails or in the yard, the employees felt **less** pressure
Distance from the terminal	F (3, 70) = 8.847, p = .001, eta^2: .2575 When the CI occurred between 51 and 100 km from the terminal, the employees felt that the employer was more responsible for their difficulties. Variance explained: 25.75% (high effect size. Post-hoc test with Bonferroni correction: difference of the mean between the distance of 0 to 50 km and 51 to 100 km corresponds to -1.0331 with a confidence interval of 95% from -2.0391 to -0.0270; difference of the mean between the distance from 51 to 100 km and 101 km and more corresponds to -1.2092 with a confidence interval of 95% from -2.3445 to -0.0747.	
General level of stress at work		t (2, 72) = 4.462, p < .001, eta^2: .2492 The lower the general level of stress, the **less** employees felt pressure. Variance explained: 24.92% (high effect size. Post-hoc test with

[8] In total, the variables resulting from factors of satisfaction involved eighteen repeated analyses, thus requiring a Bonferroni correction of 0.003. For a result to be deemed statistically significant at α = 0.05, the analysis threshold has to reach 0.003.

Variable	Employer's responsibility	Significant pressure
		Bonferroni correction mean difference corresponds to 1.1906 with a confidence interval of 95% from .6569 to 1.7243.
A combined notation of eta squared and % of variance is used for ease of reading (Lakens, 2013)		

5.2.4.3 Satisfaction Related to Working Relations

An analysis of the association between the perception of work and degree of satisfaction of employees, using the "Areas of Worklife Scale" (AWLS) was realized by using Pearson correlation tests. When employees have the impression that, in general, their work is appreciated by their employer, they want to continue working after the CI more often (r (33) = .46, p .050), they feel that they are treated more empathetically by the MTO (r (39) = .33, p .050), they feel less stress when they return to work (r (35) = .39, p = .050). When employees feel that they are generally treated fairly by their employer, they feel less pressure to move the train at the time of the CI (P: -.375, p: .029). When employees feel that they are working in a supportive, cooperative group that they trust, they feel less pressure to move the train during the CI (r (34) = .34, p = .050) and they more often have the impression that the CIMSP was correctly applied one month later CI (r (38) = .33, p = .050). When employees feel that their workload is adequate, they have less of an impression, one month after the CI, that they were pressured to do things they did not feel comfortable about doing during the CI (r (32) = .39, p = .050). When employees feel that their company is generally in tune with their values (overall measurement of the scale), they feel less pressured to move the train after the CI (r (34) = .40, p = .050), and they indicate that they want to continue working after CI (r (33) = .41, p = .050).

5.3 Results of the Effects of Critical Incidents on Engineers and Conductors (Objective 2)

To better understand the effects of CIs on the recovery of employees and MTOs, it is important to precisely describe the various effects experienced by the participants after an incident. The findings from analyses of the effects as they occurred over time (between the time of the CI and up to six months after it) are presented in the following subsections.

5.3.1 Effects During the CI (Onsite and in the Following Hours)

The participants were asked about what they felt at the site of the CI (open questions and checklist). Only one participant indicated not having experienced any negative effect during the CI. All the others reported at least one; the responses varied between 1 and 14 effects experienced while on site. Table 16 describes the effects experienced by engineers and conductors during the CI and in the minutes and hours following the CI.

Table 16. Effects during the CI (at the site of and in the hours following the CI)

Effect	Number (%) N=74	CoA N=17	CoC N=26	CoB N=31
Physical injury	2 (2.7%)	1 (5.9%)	0	1 (3.2%)
Fear for your life or your safety	13 (17.6%)	3 (17,6%)	5 (19.2%)	5 (16.1%)
Shock	54 (73.0%)	11 (64.7%)	18 (69.2%)	25 (80.6%)
Horror and fatigue	33 (44.6%)	8 (47.1%)	14 (53.8%)	11 (35.5%)
Feeling of total disbelief	45 (60.8%)	9 (52.9%)	16 (61.5%)	20 (64.5%)
Powerless to prevent the incident from happening	56 (75.7%)	12 (70.6%)	18 (69.2%)	26 (83.9%)
Powerless to manage the incident	20 (27.0%)	3 (17.6%)	8 (30.8%)	9 (29.0%)
Physiological reaction: perspiration	20 (27.0%)	4 (20.0%)	10 (50.0%)	6 (30.0%)
Physiological reaction: heartbeat	46 (62.2%)	9 (19.6%)	18(39.1%)	19(41.3%)
Physiological reaction: trembling	33 (44.6%)	5 (29.4%)	13 (50.0%)	15 (48.4%)
Physiological reaction: narrowing of the visual field (tunnel vision)	9 (12.2%)	3 (17.6%)	2 (7.7%)	4 (12.9%)
Physiological reactions: feeling of detachment from what is happening (floating/feeling of unreality)	21 (28.4%)	7 (41.2%)	7 (26.9%)	7 (22.6%)
Physiological reaction: other (headache, psychomotor agitation, nausea, muscular tension, hypervigilance, loss of appetite, etc.)	20 (27.0%)	1 (5.9%)	10 (38.5%)	9 (29.0%)
Intense fatigue	37 (50.0%)	9 (52.9%)	13 (50.0%)	15 (48.4%)
Anger	33 (44.6%)	6 (35.3%)	12 (46.2%)	15 (48.4%)
Feeling of being unable to deal with the situation	6 (8.1%)	1 (8.1%)	3 (11.5%)	2 (6.5%)

Principal component analysis was performed, respecting the same statistical conditions as those described in subsection 5.2.3, “Employees’ Satisfaction.” The analysis was performed with eight variables of the effect of CIs. The KMO reached 0.679, which means that the variables had shared variance. The Bartlett sphericity test was statistically significant (χ^2: 62.9000, ddl: 28, $p < .001$) because the results suggest the presence of three factors, of which four variables out of eight had a load of at least 0.65 over one factor, therefore the sample size was deemed sufficient.

Factor 1, which we call “horror and fatigue” explains 21.674% of the variance and includes the feeling of horror when confronted with the situation, breaking out in a sweat, a pounding heart and intense fatigue on the site of the CI. The second factor, “shock” explains 18.805% of the variance and includes trembling uncontrollably and the feeling of being in a state of shock at the site of the CI. The third factor, referred to as “intense fear” explains 15.894% of the variance and includes being afraid for one’s life or safety and a feeling of detachment, experiencing moments of unreality at the site of the CI. This indicates that some of the people who are involved in the CI may feel combinations of the effects described above. These combinations can trace the profiles of the immediate effects, post-CI, assisting in the assessment of short-term needs.

5.3.2 Effects in the Days Following the CI

At the first interview (one week post-CI), the participants were asked about the effects they experienced between when they returned to the terminal and when the interview took place. Here again, the investigation into these effects began with an open question ("what effects did/does the CI have on you?"), followed by a systematic and complementary exploration of a list of items from the literature on trauma and the results of the previous study on the effects of CIs (the items explored are described in Table 17).

Only nine (12%) participants stated that they felt no effects in the days following the CI. All the others experienced at least 1 and up to 15 effects related to the CI. Table 17 provides a compilation of the participants' responses to the open question and the additional investigation.

Table 17. Effects in the days following the CI (period 1)

Effect (item)	N (%) (N=74)	CoA N=17	CoC N=26	CoB N=31
Physical pain	11 (149%)	2 (11.8%)	4 (15.4%)	5 (16.1%)
Sleeping problems: getting to sleep	28 (37.8%)	6 (35.3%)	11 (42.3%)	11 (35.5%)
Sleeping problems: staying asleep	34 (45.9%)	9 (52.9%)	12 (46.2%)	13 (41.9%)
Sleeping problems: waking up	19 (25.7%	2 (11.8%)	10 (38.5%)	7 (22.6%)
Sleeping problems: nightmares	13 (17.6%)	4 (23.5%)	4 (15.4%)	5 (16.1%)
Flashbacks of the incident	42 (56.8%)	11 (64.7%)	15 (57.7%)	16 (51.6%)
Anger	31 (41.9%)	8 (47.1%)	9 (34.6%)	14 (45.2%)
Irritability (feeling nervous)	33 (44.6%)	7 (41.2%)	12 (46.2%)	14 (45.2%)
Exhaustion	36 (48.6%)	8 (47.1%)	14 (53.8%)	14 (45.2%)
Grief	30 (40.5%)	6 (35.3%)	14 (53.8%)	10 (32.3%)
Feelings of guilt or self-blame	11 (14.9%)	2 (11.8%)	3 (11.5%)	6 (19.4%)
Isolation	16 (21.6%)	2 (11.8%)	7 (26.9%)	7 (22.6%)
Numbness, unusual feelings	32 (43.2%)	8 (47.1%)	12 (46.2%)	12 (38.7%)
Thoughts affected: ruminating, reliving the event	30 (40.5%)	6 (35.3%)	9 (34.6%)	15 (48.4%)
Train of thought affected: being distracted, absent-minded	15 (20.3%)	5 (29.4%)	4 (15.4%)	6 (19.4%)
Thought processes affected: having difficulty concentrating	18 (24.3%)	4 (23.5%)	5 (19.2%)	9 (29.0%)
Thought process affected: feeling that it is difficult to function normally in various areas of life	15 (20.3%)	3 (17.6%)	5 (19.2%)	7 (22.6%)

Principal component analysis was performed, respecting the same statistical conditions as those described in subsection 5.2.3 “Employees’ Satisfaction.” The analysis was performed with eight variables summarizing the effects observed and described in Table 17, not including the variables for which the incidence was significant enough for them to be included. The KMO reached 0.792 and Bartlett’s sphericity test was statistically significant (χ^2: 92.023, ddl: 28, $p < .001$). Because the results suggested the presence of three factors, of which four variables out of eight had a load of at least 0.65 over one factor, the sample size was deemed sufficient.

The three factors explain 60.634% of the variance of items of effects in the days following the CI, which is considered as good. Factor 1, referred to as “pervasive cognitive disturbance” explains 26.282% of the variance and includes the presence of flashbacks of the CI (images, sounds, odours, proprioception), a feeling of anger or irritability (toward the victim, the management of the CI, the employer or in general), feeling emotionally or cognitively numb and feeling that one’s thoughts have been affected (rumination, distraction, feeling that it is difficult to function normally). The second factor, referred to as “exhaustion” explains 19.251% of the variance and includes sleeping problems (getting to sleep, staying asleep, waking up and nightmares) and persistent fatigue or exhaustion from which it is difficult to recuperate. The third factor, referred to as “pervasive emotional disturbance” explains 15.100% of the variance and includes feelings of grief and guilt about the CI. The variable “grief” has a similar weight to factors 1 and 3. The decision was made to attribute it to factor 3 because it had a stronger clinical meaning. In fact, during previous observations (Bardon, 2014), it appeared that some employees often feel grief and guilt simultaneously.

These three factors describe a good part of what engineers and conductors experience in the days following the CI. They can be useful elements in post-CI observation and clinical follow-up.

5.3.3 Effects in the Days, Weeks and Months Following the CI

The way that the effects changed over time was evaluated through repeated measurements of the items used at interview 1 by asking the same questions to participants during interviews 2, 3 et 4. Table 18 describes the effects as reported by the engineers and conductors. Some could have disappeared, while others could appear in the same person over time.

Table 18. Effects in the days, weeks and months following the CI (repeated measurements)

Effect	Interview 1 (N=74)	Interview 2 (N=67)	Interview 3 (N=63)	Interview 4 (N=61)
Physical pain	11 (14.9%)	1 (1.5%)	7 (11.1%)	1 (1.6%)
Sleeping problems: getting to sleep	28 (37.8%)	9 (13.4%)	5 (7.9%)	6 (9.8%)
Sleeping problems: staying asleep	34 (45.9%)	11 (16.4%)	9 (14.3%)	6 (9.8%)
Sleeping problems: waking up	19 (25.7%	2 (3.0%)	7 (11.1%)	2 (3.3%)
Sleeping problems: nightmares	13 (17.6%)	3 (4.5%)	5 (7.9%)	4 (6.6%)
Flashbacks of the incident: images	37 (50%)	30 (45%)	18 (28.6%)	11 (18.0%)
Flashbacks of the incident: sounds	8 (10.8%)	8 (12.0%)	3 (4.7%)	2 (3.3%)
Flashbacks of the incident:	1 (1.3%)	0	0	1 (1.6%)
Flashbacks of the incident: other (movements,	2 (2.6%)	0	0	0
Anger	31 (41.9%)	14 (20.1%)	8 (12.7%)	9 (14.7%)
Irritability (feeling nervous)	33 (44.6%)	11 (16.4%)	17 (27.0%)	10 (16.4%)
Exhaustion	36 (48. 6%)	10 (14.9%)	13 (20.6%)	5 (8.2%)
Grief	30 (40.5%)	6 (8.9%)	4 (6.3%)	3 (4.9%)
Feelings of guilt or self-blame	11 (14.9%)	1 (1.5%)	5 (7.9%)	1 (1.6%)
Isolating oneself from others	16 (21,6%)	7 (10.4%)	7 (11.1%)	3 (4.9%)
Emotionally numb, affected, not like normal	32 (43.2%)	8 (11.9%)	8 (12.7%)	2 (3.3%)
Thought processes affected: ruminating, thinking a lot about the event	30 (40.5%)	12 (17.9%)	13 (20.6%)	12 (19.7%)
Thought processes affected: being distracted,	15 (20.3%)	7 (10.4%)	10 (15.9%)	4 (6.6%)
Thought processes affected: having difficulty concentrating	18 (24.3%)	8 (11.9%)	6 (9.5%)	3 (4.9%)
Thought processes affected: feeling that it is difficult to function normally in various areas of life	15 (20.3%)	7 (10.4%)	7 (11.1%)	2 (3.3%)

5.4 Recovery Trajectories

Linear growth model analyses were performed to describe the evolution of the effects of the critical incident over four measurement periods. This type of analysis has a number of advantages. In particular, it can deal with samples that have missing data and where the assumption of independence of the sampling error cannot be inferred, as was the case in this research.

Preliminary Analyses

Before the principal analyses were performed, a review of the variables measured in the study was undertaken using the SPSS software program. The respect of statistical assumptions was verified and, despite some discrepancies, it was deemed reasonable to conduct exploratory analyses, while interpreting the results cautiously.

Data Preparation

In the context of these analyses, the independent variable corresponds to the effect of the passing of time, while the dependent variable refers to the trajectory of the number of effects associated with the CI. The database was reorganized in order to analyze individual trajectories. This reorganization meant that each observation had to correspond to a measurement period. That made it possible to differentiate the effects between the participants (inter-individuals) from those resulting from the trajectory of a single individual (intra-individual).

Principal Analyses

Following the example of Singer and Willett (2003), several models were tested. The first represents an unconditional model (model 1), in which the test serves to determine whether the number of effects experienced on average by the participants differs. The second corresponds to an unconditional linear growth curve model (model 2), which constitutes the baseline to which the other models are compared. On one hand, the unconditional linear growth curve model examines whether the participants differ from each other in the number of reactions to CIs they experienced at the last measurement period, and on the other, whether the level of change in the number of reactions differs from one measurement period to the other, which, essentially, represents the effect of time (Shek and Ma, 2011). These construction phases resulted in a linear growth model that best represented the participants.

Unconditional Model

The goal of the first model was to ensure the relevance of carrying out linear growth model analyses. To that end, the intra-class correlation coefficient is calculated from it. That indicator represents the portion of the variance attributable to effects among the participants (inter-individuals), i.e., the proportion of effects from the CI resulting from factors such as the degree to which the CIMSP was implemented, the nature of the CI, or the adaptation strategies used by the participants. For the unconditional model, the intra-class correlation corresponded to $4.24/(4.24 + 8.82) = 0.33$, which suggests that almost 33% of the total variation of the effect variance related to the CI is attributable to differences among individuals, independently of intra-individual evolution.

The Unconditional Linear Growth Curve Model

The unconditional linear growth curve model examines the individual variation of growth rates. In other words, it verifies whether the evolution of effects associated with the CI changes from one participant to another, or if it remains the same. To replace it, subsequent models must present a statistically significant improvement in its adjustment in terms of the parameters of the population from which the sample is taken. In other words, to be accepted, the models that follow it must produce more accurate estimations of the engineers and conductors group than the unconditional growth model. The results connected to the fixed parameter of this model indicate that the initial average of the number of effects associated with the CI for the sample corresponded to 5.96. The statistically significant fixed variation coefficient associated with the passage of time (β = -1.32, SE = 0.14, p = .010) indicates that, on average, the number of effects associated with the CI decreased at a rhythm of -1.32 per measurement period. In addition, the results taken from the random parameters of this model show that the correlation between the intercept and the growth curve (β = -1.28, SE = 0.80, p = .060) suggest that the participants with a high level of effects associated with the CI at the outset had a slower recovery rate than those with fewer effects related to the CI at the time of the first interview. In other words, it takes longer for those who were the most seriously affected after the CI to feel better than those who were less affected.

The Second and Third Degree Trajectories Model

Until now, all the models required linear growth in the trajectory of effects related to the CI. This means that they had fewer effects related to the CI proportional to each measurement period. The second and third models that were tested show whether the recovery trajectory of participants was always the same at every measurement period or if there are variations. The results indicate that the third-degree model adjusts better statistically and more significantly than the unconditional growth model ($\chi 2$ (ddl = 8-6=2) = 1471.27 – 1419.19 = 52.08 observed, compared to the expected 14.06). Note that the coefficient of fixed effects of the third-degree factor is also statistically significant (β = -0.84, SE = 0.17, p = .010). The adoption of this growth model means that, overall, the number of the effects associated with the CI experienced by the participants drops rapidly at first, then reaches a plateau, and then drops again at the last measurement period. It is important to note, however, that some participants had few effects at each measurement period, while others experienced several throughout the study period.

The analyses of the trajectories indicate that the one that best represents the sample corresponds to a third-degree growth model. Despite this, the hypothesis that other recovery trajectories can exist among the participants emerged during the data collection, when very different ones were described by the participants. To explore this hypothesis, a visual examination of the number of effects reported by each participant for each measurement period was carried out to identify the types of trajectories that differed from the third-degree model. This inductive procedure, while inspired by the linear growth model previously described, led to the determination of five trajectories. The **first** represents the participants who had practically no effects related to the CI over all measurement periods. The **second** concerns those who had effects only at the first two measurement periods. The **third** describes the trajectory of participants who recovered between period 1 and period 2 but stagnated until period 4, when their situation improved again. The **fourth** illustrates the evolution of effects related to the CI in participants who recovered slowly between period 1 and period 2, and whose recovery accelerated in the subsequent periods. The **final** trajectory, which included 10 participants, represents those who experienced at least four effects associated with the CI throughout every measurement period.

Figure 1 illustrates the five trajectories established by the analysis and which made it possible to understand the progression of employees between the CI and the end of the project (six months).

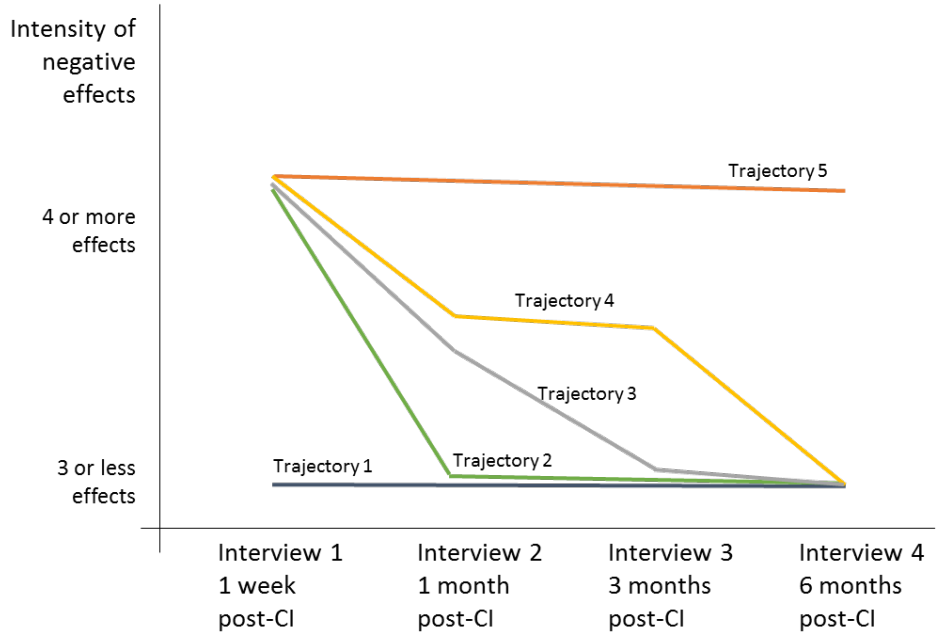

Figure 1. Visual illustration of post-CI recovery trajectories over six months

Table 19 identifies the participants who are included in each of the trajectories defined by the analysis, according to employer type.

Table 19. Types of recovery trajectory according to employers

Trajectory	Total N=74	CoA N=17	CoC N=26	CoB N=31
Trajectory 1: no negative effects	25 (33.8%)	6 (35.3%)	10 (38.5%)	9 (35.5%)
Trajectory 2: negative effects disappear in period 2	24 (32.4%)	5 (29.4%)	8 (30.8%)	11 (35.5%)
Trajectory 3: negative effects disappear in period 3	8 (10.8%)	3 (17.6%)	2 (7.7%)	3 (9.7%)
Trajectory 4: plateau between periods 2 and 3	7 (9.5%)	2 (11.8%)	4 (15.4%)	1 (3.2%)
Trajectory 5: effects continue until period 4	10 (13.5%)	1 (5.9%)	2 (7.7%)	7 (22.6%)

5.5 Diagnoses Associated with the CI

In the sample, seven (9.4%) people indicated that they had received a diagnosis from a physician following the CI (six in period 1 and one in period 2). Three CoA employees (17.6%) and four CoB employees (12.9%) received a diagnosis. These diagnoses often seemed to be poorly understood by the engineers and conductors, who sometimes had difficulties in indicating the type of diagnosis that had been made by the physician or even if the physician had made a diagnosis. The diagnoses were for depression, anxiety, adaptation disorders, acute stress syndrome and posttraumatic stress disorder.

5.6 Delay Before Returning to Work After the CI and Assessment of Capacity to Return to Work

The length of time it takes to return to work after the CI is an indicator of employees' recovery, but cannot be included in the trajectories. This is because an employee may return to work while still experiencing negative effects from the CI, if those effects do not prevent the person from doing his or her job. A decision was therefore made to provide a distinct variable for the trajectories. The delay before returning to work was measured in numbers of unworked days. The participants were asked about how long it took before they returned to work (Table 20) and their level of satisfaction and comfort with that delay (Table 21).

Table 20. Average time in days before returning to work, by employer type

Employer	N	Mean	Standard deviation
CoB	28	6.14	8.36
CoC	24	12.54	42.452
CoA	17	6.41	3.692
Total	69	8.43	25.460

In some cases, employees had several days off, which were part of their regular work schedule (weekends or planned days off), in addition to leave granted because of the CI. It is important to note that during the interviews employees did not always distinguish between these different types of time off. An analysis in terms of leave provided by the employer or planned in the regular work schedule was therefore not carried out.

Table 21. Satisfaction and comfort in terms of time taken off before returning to work

Satisfaction and comfort	Total N=74	CoA N=17	CoC N=26	CoB N=31
The employee feels that he/she had enough time off before returning to work	40 (54.1%)	12 (70.6%)	14 (63.6%)	14 (51.9%)
The employee would have liked to have more time off	20 (27.0%)	4 (23.7%)	6 (27.3%)	10 (37.0%)
The employee would have liked to have less time off	6 (8.1%)	1 (5.9%)	2 (9.1%)	3 (11.1%)
The employee felt ready to return to work	58 (78.4%)	16 (94.1%)	18 (85.7%)	24 (92.3%)
The employee took time off more than once (went back to work and then took more leave)	2 (2.7%)	0	1 (4.3%)	1 (3.8%)

The CIMSPs include a step to assess the capacity of employees to return to work after a CI. In most cases, no assessment was carried out (N=37, 58.7%). When there was an assessment, it was carried out by a physician (N=12, 19.0%) or an EAP professional (N=3, 4.8%).

5.7 Non-Clinical and Longer-term Effects of Single and Multiple CIs: Qualitative Analyses of the Perceptions of Engineers and Conductors

At the last interview (six months after the CI), the participants were asked to describe their memories and their experiences of the CI. These long-term, nonclinical effects (i.e., not associated with psychological disorders or significant negative effects), are interesting because they provide insight into how people may experience another CI in the future. A thematic analysis of content made it possible to determine the different types of "residual" effects expressed by the participants.

The results of this analysis show that most participants did not identify specific long-term signs of the CI. However, some had the impression that the experience changed their perception of their jobs. They have increased concerns about safety. Their awareness of the danger of trains is sharper. They realize the importance of controlling the train's speed and of using the horn, and they are more alert, vigilant or nervous when they see people or vehicles near the tracks. Others mentioned a change, negative in most cases, with respect to their perception of work and their employer, which results from how the CI was managed and how they were treated by the MTOs or the company, with a lack of respect for the human aspect of the situation. Some stressed the terrible and inevitable nature of that aspect of their job, as well as the immense fatigue that accompanies it (especially for those who operate freight trains).

5.8 Findings About the Effectiveness of CIMSPs (Objective 3)

This subsection aims to analyze the links between the variables of negative effects experienced after CIs by the employees, and the CIMSPs applied during these incidents. It aims to respond to Objective 3 of the study (assessment of the effects of CIMSPs on the recovery of employees post-CI) and to identify elements to help in the discussion of research hypotheses associated with that objective (see section 3) in the context of the discussion (section 7).

The independent variables used in these analyses are as follows:

- The immediate effects of the CI (experienced on the site of the CI). The CIMSP was not yet in place at the time the CI occurred, and therefore could have no influence on these effects so closely linked to the CI. However, as has been shown in trauma research, some of the effects experienced during a potentially traumatic event are indicators of the development of future traumatic reactions (Brillon, 2010). These immediate effects were therefore observed in relationship with the recovery trajectories, in the context of the study.

- The actions of the CIMSP applied during the CI.

- The satisfaction factors regarding the CIMSP.

5.8.1 Factors Influencing the Presence of Negative Effects in the Days Following the CI (Measurement Period 1)

The number of negative reactions at the site of the CI is strongly correlated with the number of negative effects experienced in the following days ($r(74) = .49$, $p = .010$). The presence of negative reactions on the site is thus an indicator of the risk of experiencing negative effects in the days following the CI.

Multiple regression analyses were performed to identify the factors that could affect the presence of the various types of effects among participants. These analyses used factors of the effects of CIs at period 1 as dependent variables. The relationship among these factors and various variables related to the CI, its management and the environment in which it occurred were explored using a series of multiple regressions. The conservative application of post-hoc Bonneferroni corrections make these analyses vulnerable to an increase in a type II error. That error consists of showing that there is no statistically significant effect when there is one. In the context of this analysis, that correction makes the results unlikely statistically and clinically, because no factor reaches the statistically significant criteria of .05 with Bonneferroni correction. Table 22 thus presents the variables associated with post-CI effect factors without Bonneferroni correction. These results, which should be carefully considered statistically, have significant clinical importance.

Table 22. Factors that could affect the development of three types of post-CI effects (period 1)

Pervasive cognitive disturbance (factor 1)	Exhaustion (factor 2)	Pervasive emotional disturbance (factor 3)
Stronger “intense fear” reaction (factor 1 of immediate reactions) (β = 0.16, SE = 0.04, p = .010)	Stronger “intense fear” reaction (factor 1 of immediate reactions) (β = 0.35, SE = 0.11, p = .010)	
Greater complexity of the CI (β = 0.30, SE = 0.11, p = .010)	The employee perceives the “responsibility" factor in the management of the CI as being more present (β = 0.25, SE = 0.11, p = .050)	The employer does not take charge of the CI (β = 0.25, SE = 0.25, p = .050)
The employee feels pressured to perform tasks during the CI (β = 0.49, SE = 0.11, p = .010)		The employer does not care about the well-being of the crew onsite (β = 0.3, SE = 0.31, p = .010)
There is a large contrast between the expectations of the employee in terms of support and what actually occurs (β = 0.36, SE = 0.09, p = .010)	The employee was not relieved of responsibilities at the scene of the CI (β = 0.24, SE = 0.27, p = .050)	The employer does not ask questions about the effects of the CI onsite (β = 0.27, SE = 0.54, p = .050)
	The labour relations factor (stress and employer) is high (β = 0.30, SE = 0.13, p = .050)	The employee does not perceive the management of the CI as “support” (β = 0.26, SE = 0.11, p = .050)
	The labour relations factor (gratification and co-workers) is high (β = 0.33, SE = 0.13, p = .050)	
	Greater assignment of the responsibility for the CI to the employer (β = 0.65, SE = 0.15, p = .010)	
	The employee identifies with the victim (β = 0.40, SE =	

Pervasive cognitive disturbance (factor 1)	Exhaustion (factor 2)	Pervasive emotional disturbance (factor 3)
	0.16, p = .050)	
	The employee does not feel supported by the employer (β = 0.31, SE = 0.23, p = .010)	
The variables were recoded to harmonize the direction of linear relationships among the variables.		

These analyses show that some factors associated with CI management and the support offered or perceived at the site of the CI are significant risk factors in the development of various types of negative effects among employees. These effects are not significant enough to justify a diagnosis, but could have a major impact on the quality of life of employees, their level of attention at work and on their fear of making mistakes (because of a lack of attention, fatigue, the presence of intrusive memories, etc.).

5.9 Factors Influencing the Recovery Trajectories: the Effect of CIMSPs

This subsection includes the findings from statistical analyses of the influence of the factors associated with CIMSP on the five recovery trajectories identified in subsection 5.4, and qualitative analyses, based on multiple case studies of the 10 participants who were the most and the least affected by CI. Finally, the combined results of these two analyses are presented in section 5.9.3 and in Figure 2, which summarize the effect of CIMSPs on the recovery of employees by taking into account environmental factors that could also influence this recovery, in accordance with the multiphasic mixed method used (Teddlie and Tashakkori, 2006) and described in subsection 4.4 “Analyses.”

5.9.1 The Results of Statistical Analyses for Factors Associated with Post-CI Recovery Trajectories: The Effect of CIMSPs on Post-CI Recovery

Subsection 5.3.3 presents the models of the participants’ recovery trajectories. The model used required a third-degree relationship, but had no variable that could help predict the evolution of negative effects. This subsection deals with the statistically significant variables that would enable the participants’ recovery to be predicted. Because of the small sample size and the non-respect of the normal distribution of dependent variables, the models with predictors were evaluated with linear growth model analyses of CI-related effects. A model incorporating different predictors was used to examine whether the following elements influenced the trajectory of CI-related effects experienced by the participants: the nature of the CI; the number of CIMSP items implemented; the intensity of recourse to the family network, co-workers or religious groups, assessment of general health; the complexity of the circumstances surrounding the occurrence of the CI, proximity with the victim; the presence of the police on the site of the CI; the presence of emergency services and the railroad police; the factors involved in assigning responsibility for the CI, and the types of CI management.

The Linear Growth Model with Predictors

The results of the complete model with all of the predictors produced a better solution than the unconditional growth model (χ^2 (ddl = 26-6=20) = 1471.27 – 870.00 = 601.27 observed in terms of the expected 31.40). Despite this, several predictors included in this model did not reach the statistical significance threshold. Therefore, a more conservative model that incorporates only significantly statistical predictors was tested. It produced a better solution than the unconditional growth model (χ^2 (ddl = 15-6 = 9) = 1471.27 – 821.77 = 649 observed in terms of the expected 16.92). The fixed effects estimates (Table 23) represent regression coefficients that affect the growth model of CI effects. These coefficients designate elements that influence the course of participants' recovery or deterioration. In addition to the direct effects of the above-mentioned predictors, an interaction term was created with the CIMSP implementation groups and the effect of the passage of time. This means that the recovery trajectories of participants in which many elements of the CIMSP were implemented are more rapid than those who reported fewer CIMSP items being implemented (for the high implementation level group: β = -1.99, SE = 0.26, p .010; for the lower implementation level group: β = - 0.94, SE = 0.33, p = .010). These coefficients show that the number of CI-related effects fell by almost two for participants in the high-level implementation group, while the number of effects only fell by one for those in the lower-level implementation group.

The other fixed effect coefficients have not interacted with time; it is therefore the principle effect. There is a positive and statistically significant linear relationship between the CI complexity factor (β = 0.66, SE = 0.34, p = .0.02), the participant's degree of proximity with the CI victim (β = 0.83, SE = 0.28, p = .010), the type of management used for the support resource (β = 1.11, SE = 0.24, p = .010), the perception that the difficulties experienced by the participant were in part caused by the employer (β = 1.00, SE = 0.29, p = .001), and the circumstances surrounding the CI (β = 0.77, SE = 0.30, p = 014) with the number of negative effects reported. In other words, the higher the participant scored on these predictors, the more he/she would present with a recovery trajectory involving a high number of effects associated with the CI. Table 23 sums up the statistics associated with fixed effects, in addition to indicating their standard error, their degrees of freedom and the Wald test, which is similar to a standardized coefficient because it is a parameter ratio with its standard error. However, Tabachnick and Fidel (2007) point out that the Wald test must be the interpreted cautiously when the sample size is small, as in this analysis, because the estimate of the standard error may be imprecise in the scope of the growth analysis (Table 23).

Table 23. Estimate of fixed effects in the final model of the analysis of factors influencing the recovery trajectories

Parameter	Estimate	Standard error	ddl	Wald	Sig.
Constant	5.30	1.33	62.50	3.98	<.001
Group with a low level of implementation	-2.99	.95	42.43	-3.16	.010
Time	-1.99	.26	45.00	-7.54	<.001
Group with a low level of implementation * Time	1.053	.33	45.00	3.15	.010
Complexity of the CI	.66	.34	45.00	1.97	.010
Proximity with the victim (saw, touched, etc.)	.82	.28	45.00	2,95	.010
Use of resources offered by the employer after the CI	1.12	.24	45.00	4.68	<.001
Perception that the employer is at least in part responsible for the negative effects experienced after the CI	1.00	.29	45.00	3.40	.020
Perception that the circumstances of the CI are responsible for the negative effects experienced	.78	.30	45.00	2.56	.010
a. Dependent variable: Recovery trajectories					

5.9.2 Qualitative Analyses of Narratives About the CI in Measurement Period 1

As described in the “Analysis” section (section 4.4.), the five most affected participants and the five least affected participants were the subject of a more detailed qualitative analysis. Through the analysis and attentive re-reading of the accounts of each participant and the contexts surrounding them, the two themes were explored and developed into 15 concepts for the participants’ accounts. Theme 1 included participants’ accounts, i.e., the way they described what occurred, their emotions, silences, the meaning they gave to the event, and the tone of the interview. The concepts included generalization, use of humour, silences, emotions expressed, and 19 others, which were used to analyze the circumstances of the CI and the external factors surrounding the participants’ experiences (theme 2), including the complexity of the situation, the participants’ level of engagement in the management of the CI, co-workers, the MTO, the first responders.

The themes that emerged from the analysis of the preliminary content were developed in detail in the context of the multiple case analysis. These themes are described according to whether they were associated with a post-CI negative effect of low intensity (few effects over a short period of time) or of significant intensity (numerous negative effects over a long period of time).

Theme 1: The sense of belonging to the railway community (in general, with their group of co-workers, the company they work for) and the feeling of being taken care of or of being abandoned.

Employees have a strong sense of belonging towards their co-workers, and have the impression of being part of a team. In general, they like being employees and driving trains and they feel very close to their job and their industry, but these feelings don't always include the employer. The intensity of this sense of belonging to their work environment can influence their well-being on the site of a CI and afterward.

- **A strong sense of belonging to their group of co-workers and to the rail industry, and appropriate support during the management of the CI are associated with few negative effects.**

"[Employer] does have a great program which we all went through, so… you know, we have been trained, if we have incidents, which are really good. […] And eh… you know at the end of the day all our co-workers, we're all supporting each other in situations like this. So… you know." (Case 48[9])

- **Some employees had a strong sense of belonging to their group of co-workers, but significantly distanced themselves from the rail industry and their employer. Thus, they were surprised by the appropriate and empathetic response of their MTOs and had few negative effects.**

- **Some employees had a strong sense of belonging to their group of co-workers, but their expectations regarding support from their MTOs were not met. They had the feeling that the employer had let them down. That feeling was associated with significant negative effects.**

"You know, once our first manager showed up, things got worse we had to basically protect ourselves from him because he told us to just recover the train and proceed. That's what he told us and it was… personally I had to say 3 times 'No I wasn't proceeding any further' but I'm not going any further […] the other manager he showed up about 5 or 10 minutes after the first guy, but in that 5 or 10 minutes, I probably had more stress put on me than anything else, 'cause it was a constant: 'Just continue on!…. Just…go.' I'll sit on the scene, he said I'll wait." (Case 29)

- **Some employees had a strong sense of belonging to their group of co-workers and to the industry, but kept their distances from the employer (managers and MTOs). They were resistant to accepting the support that their MTOs offered, despite their general disappointment in how the CI was managed.**

"I'm not sure that there was any management process or protocol at all (…) But the incident was the incident and people showed up, and people left and there was no… I'm not sure there was any management at all. […]" **If you were to say yes or no, feel supported by your manager?** (8 sec. hesitation—laughs and says it is not an easy question) "I… I would not s… I f… felt as though I had the support I needed, I guess. I guess I was supported by my manager, I guess." (Case 56)

[9] In this subsection, the case numbers correspond to the coding of participants used for the data analysis. The interview extracts in French include an English translation for the readers' comprehension.

Overall, a strong attachment to the employer or the industry could lead to an increase in negative effects when expectations about support, confidence and loyalty were not met. If employees felt they were being mistreated or that their manager had let them down, the traumatic effects of the CI rose.

Theme 2: The narrative style: distancing oneself from the events or describing the story in detail

When they told their stories, some employees distanced themselves from the other people present (victims, co-workers, MTOs, first responders), or closed down emotionally, using generalizations (everybody does…, when you…, we always feel…). When talking about their actions or emotions, they used the third person singular or plural, or they avoided answering sensitive questions (partial or evasive responses, avoiding some aspects of the CI, of the victim, of their emotions). Others reported the events, the actions or emotions in detail, spoke in the present tense, and appeared to be reliving the CI as they talked about it. The ways they described the CI could be an indicator of the presence and the intensity of negative effects.

- **Some employees told part of the story or described the emotions felt at the scene of the CI in the present tense. Others generalized their actions or emotions in an attempt to normalize their experience or to distance themselves from shocking elements of the CI. The latter group presented with significant negative effects.**

« L'ingénieur s'est approché plus au début. (Défile le reste rapidement) yé…tsé l'monsieur y bouge pas, y respire même pas, ya rien, ya yeux fermés, y manque une jambe, y manque un bras, pis…y shake même pas rien (breathes heavily) […] » (Cas 79).

« Pis ça c'est comprenable parce que r'garde eh… ya personne qu'y aurait voulu être là pendant c'moment-là j'pense. » (Cas 79)

[Translation] *The engineer went over first (recounts the rest of the story rapidly) yeah, you know… the guy wasn't breathing, nothing, his eyes were closed, he was missing a leg, missing an arm, he didn't even shake, nothing (breathes heavily).*

And that, it's understandable, because, look, eh… no one would've wanted to be there then I think.

- **Some employees clearly avoided talking about their emotions and certain aspects of the CI. These people suffered negative effects the most often. Avoidance strategies may be a useful indicator of a potential posttraumatic reaction.**

- **Conversely, one employee avoided talking about the victim, and distanced himself from the CI, but had few negative effects. In parallel with the type of narrative, he received effective support from the MTO. The potential negative effects were perhaps countered by this protective factor.**

Context of the narrative: The employee experienced a complex and disturbing CI, which he described as the "worst nightmare." In his account, he focused on the vehicle that was hit and the damage caused to it. The interviewer had to ask him about the victims.

"But when I walked back there I saw the smashed vehicle. It was completely… rear end or the complete front end was all crumpled up, the whole right side of the vehicle was smashed pretty

good." **Did you see the victims? "**I saw the man that eh…got hit and killed and then, I saw the other two victims. […] Ah the manager…kind of…kind of just put me at ease. Kind of reduced the tension and the stress for me." **How did he do that?** "He just kind of a…. almost like a… acted almost like a father figure kind of…when their kid is needing help. Ok." **Was he reassuring you, was he taking charge?** "Yeah. He was reassuring me and he just a… took charge of the situation too. Ok. Walked us through everything that we were feeling. Ok. Assured us that it wasn't our fault." (Case 44)

In that case, the tendency to use an avoidance strategy indicated that he was not significantly negatively affected by the CI. The employee appeared to have benefited from a significant protective factor and an appropriate intervention from the MTO. Thus, it is important to understand the context and to analyze the presence of other factors before interpreting the narrative style as a direct or sole indicator of the risk of developing significant negative effects.

All in all, the employees who, a few days after the CI, when they talked about it, avoided talking about their emotions, the details and various aspects of the incident and those that they relived when recounting the incident, may be at risk of suffering significant negative effects. These two narrative styles have in common the fact that they reflect discomfort and point to areas of adjustment difficulties and potential symptoms. Someone who goes to great lengths to avoid talking about a major aspect of the CI (for example, a decapitated victim whose head crashed into the cabin) may be using harmful avoidance strategies and could be at risk of having intrusive flashbacks about that specific aspect of the CI. Conversely, someone who describes an event in detail and appears to relive it while talking about it risks fuelling potentially negative thoughts, and may find it difficult to distance himself from the CI and to recover. It is important for clinicians to assess these people to identify narrative styles and to explore the potential risks associated with them. Some forms of avoidance can, however, be beneficial to people dealing with a serious event. For example, not wanting to dwell on the incident, refusing to look at what happened, to look at or touch the body of a victim are all very good self-protection strategies.

Theme 3: Expressing one's emotions when telling the story

- **Some employees were emotional about the CI during the interview. These employees all suffered negative effects following the CI. The emotions appeared to resurface and affect the person during the interview.**

"Walked back and found the body. (exhales sharply) Found a shoe first. (7 seconds of silence) There was no need to check for signs, the vital signs." **No… OK**. "No.. I brought the first aid kit it's sort of unusual to bring this thing back with us." **So it was obvious that she was deceased?** (3 seconds of silence) "It was obvious to me, yes." (Case 56)

- **Some employees did not talk about difficult emotions experienced during the CI. They also appeared to want to excuse themselves for their lack of emotions or distress. These people had few negative effects.**

Overall, what this theme indicates is that if the emotional charge is still present more than a week after the CI and the person is still emotionally affected by that experience, there is a significant risk of long-term negative effects and psychological support (counselling) should be offered.

Theme 4: General attitudes and perceptions about oneself, others and the support offered

Employees have different ways of looking at their role and that of others during a CI (co-workers, victims, first responders, etc.). They express their values regarding the responsibility and expectations in their involvement and that of others (co-workers, first responders, MTOs, managers). The way they see and describe these relationships may be associated with minor or major effects. For example, a more seasoned conductor who is supervising a co-worker being trained could feel responsible for that person's well-being and therefore put additional pressure on himself that could lead to more negative effects from the CI.

- **Some employees lay the responsibility for the CI on the victim, because of the victim's choice or careless or dangerous behaviour. Sometimes they are angry with the victim. In general, these employees have few negative effects.**

- **Some employees, who used humour in their narratives and emphasized the absurd or ironic aspect of the CI and the situation, had few negative effects.**

- **Some employees easily accepted the support offered after the CI. They used the debriefing service and were very receptive to receiving assistance. If the empathetic support corresponded to their needs, they had few negative effects.**

"We got some good advice from our union reps as to… hum… you know who to talk to, who to see, who to… that kind of stuff, … he calls me at home and eh… advised me to take some time off. Go through the debriefing that's offered through a third party kind of thing. Hum… (5 seconds of silence). That information is not readily provided by the company, yeah …It was actually quite nice for a change for them to come and you know speak to you like people and eh… you know offer you assistance, you know huh… I thought it was very kind they say you know: 'What can we get you? Would you like a coffee? Is that something that you would, you would enjoy?' kind of thing. Now that you're sitting here waiting… It was just nice to be actually treated nicely for a change instead of always being kicked with (laughs)." (Case 38)

- **Some employees felt that they had not been affected by the CI and that they did not need support; they knew that assistance was available if they needed it. They felt few negative effects.**

- **In some cases, the support provided and the existing CIMSP did not appear to be adapted to the needs of the employee at the scene of the CI. This was associated with significant negative effects, even if the employee used the debriefing and the counselling suggested.**

Context of the narrative: The employee came into physical contact with the remains of the victim during the collision. He got out of the train to see if the person was dead and to inspect the equipment. In shock, he carried out his tasks slowly. He received a debriefing before anyone suggested that he go to clean his clothing. While he appreciated the support offered, the time it took before being able to clean himself (perhaps associated with a fear of contamination) appears to have had a profound effect in terms of developing significant negative effects.

"Then once we got back to hum… our office there was someone there, a peer person to… discuss it with us and after we did that I … took a shower and threw my clothes away. I mean

stuff had come in and there was debris on my clothes and I didn't want to take that home with me. And they bought me new clothes to wear home." (Case 15)

Context of the narrative: Two MTOs were at the scene of the CI. One of them urged the employee to continue working by moving the train, which runs counter to the CIMSP, and the other tried to protect the employee. Although one of the MTOs acted correctly, the other MTO's intrusion and his inappropriate demands appear to have increased the risk of significant negative effects.

"Well the only guy was that very first manager, he was… He was the whole…. If you took him out of that scene and he never showed up and you just erased him completely from the scene, the scene would have been handled probably in a, maybe not in a great manner but at least it would have been satisfactory." (Case 29)

- **In some cases, employees' perception of the CIMSPs implemented by the employer and the support offered is very negative. They feel that the support was insufficient and inadequate and that those involved were unqualified or that they were in conflict with them. They may also feel that they did not need assistance, based on values such as masculine stereotypes, the difference perceived in terms of the expertise of the person helping, the presence of an employee being trained and the perception of themselves as a model. These people had significant negative effects, unless, at the same time, they also had significant protective factors.**

Overall, the offer of support and the acceptance of this support at the scene of the CI and in the following hours represent important risk or protective factors. The circumstances under which support is offered and the receptivity of the employee at different moments should be considered in the implementation of CIMSPs during a CI. For example, an employee may not be ready to talk or may feel that he doesn't need to talk immediately after the CI, but may need assistance in the days or weeks following the CI.

Theme 5: Degree of the employee's involvement in the management of the CI

Employees may be involved in different ways in the management of the CI once the train has been immobilized. They may have to administer first aid and interact with the victims, guide or help the first responders, provide information to various people, support co-workers in distress, etc. The manner in which the employee becomes involved, either of his own volition, or because of pressure exerted by others, may influence the development of negative effects. Employees who refuse to get involved or to expose themselves to situations in which they feel uneasy have few negative effects. They can use their own authority or apply existing regulations to protect themselves.

- **Some employees feel intense pressure to get involved in the management of the CI and to continue working. This pressure can come from MTOs, the control centre, or, more rarely, from themselves. These individuals have significant negative effects.**

What is your level of satisfaction with incident management, at that moment, just after the incident? "Not very at all. I was actually really disappointed (exhales) being told to continue the trip. And having to just refuse that portion, like 'No my head's not in it. No I'm really not…' that was really… that was actually mishandled from that first manager, very poor. […]" **And did**

you feel pressured to go back to work later on? "Yeah, yes they didn't even want me to really take any time off. Yes I felt pressure, yes." (Case 29)

Overall, the degree of involvement in the management of the CI and the way this involvement plays out, voluntarily or under pressure, has an influence on negative effects. The more employees feel pressure to be in contact with the victim, to assist the first responders, to move the train, etc., the more they are at risk of experiencing significant negative effects. Self-induced pressure is as negative as pressure from others. It is important to be vigilant in situations in which employees feel obligated to do certain things that they feel uneasy about and to let them leave the site as quickly as possible. As well, it is essential that MTOs and other managers protect their employees at the scene of the CI and from its consequences, and that they do not push them to get involved in its management.

Theme 6: Perception of the quality of CI management overall

The first responders set the tone for the management of the CI. The quality of interactions with them and the sense of being treated humanely by them are important for the employees. The MTOs play a key role in employees' perception of well-being. Sometimes the interactions are of poor quality (during and after the CI), there are challenging physical or psychological demands for the employees and the management of the CI is complex, or there is no MTO on the site. These situations lead to a sense of not being supported, of being abandoned during this traumatic situation, and employees then suffer significant negative effects.

- **In some cases, relationships with MTOs were tense, disrespectful of employees, or the MTO was absent. In those cases, employees experienced significant negative effects, even if the interactions with the first responders were good.**

- **In some cases, the interaction with the first responders was invalidating, or the employee was treated like a suspect in the CI. These employees suffered significant negative effects if they did not receive appropriate support afterward and their actions were not acknowledged.**

- **In other cases, the first responders took care of the employees, the interactions with the MTO were good (he/she took charge of the scene, showed empathy and was concerned about their well-being). These employees had few negative effects.**

"The first responders and the police there were very friendly and one of the police was actually really kind to say that you know: 'the person, the victim… is dead, you're my priority, not the victim or anything… you're my number one priority, you know anything you need, you let me know.' I mean… like to hear that was really nice." (Case 48)

The absence of an MTO or his/her lack of empathy are seen by the employee as invalidating; they feel that what they just experienced is not important enough to merit consideration and therefore, their feelings and their pain are not important either.

Theme 7: The complexity of the CI

Some CIs are more complex and potentially more stressful or traumatic than others. The sources of complexity may vary. Sometimes there is more than one victim. There are people with serious injuries, others who must be cut out of their vehicles, and others whose remains are so embedded in the locomotive that it is difficult to remove them. Some CIs involve heavy

vehicles or toxic substances that represent a danger for the employees. Other CIs occur in isolated regions, where it takes the first responders a very long time to arrive. These elements of complexity add to the employees' stressful experience and increase the risk that the negative impacts will be significant.

- **Several complexity factors increase the risk of significant negative effects.**

Context of the narrative: The CI was quite complex. It occurred in an isolated area, the victim was alive, but seriously injured, the employees were afraid that the vehicle would catch fire, and they thought that children may have been ejected from the vehicle. The employee suffered significant negative effects.

"We're as far as you can get in between the two bigger communities there. […] we were pretty well smack dab in the middle of nowhere. And eh…so it was just me and the conductor on the scene for quite a while. […] we were there pretty much by ourselves it seemed like a lifetime… dealing with this…this injured lady (inhales-sniffs). […] But we just sat there, with the door open and just kneeling down on the ground and just talking to her to say 'hey! hang on lady you know we've got help coming, we've made the call there should be people coming.' Cause there was nothing else we could do, it was so… I don't know what you would say, it was…we felt so helpless, so powerless, there was just nothing you could do, she was pinned in that car." (Case 29)

In and of itself, this CI had a high potential to induce significant negative effects. In this case, the MTO had pressured the employees to move the train and to complete the trip. The employee had an accumulation of risk factors and it was therefore impossible to know whether proper management of the CI could have reduced its negative effects.

- **Some employees came into direct contact with the injured or deceased victim, or with human remains. They were sometimes upset by the appearance of the body or what would become of it. These employees suffered significant negative effects. Some of them felt a closeness to the victims, they wanted to take care of them, or they projected something onto them (e.g., the victim resembled someone close to them, they felt that they could understand the person and the gestures he or she was making, etc.), which appears to make them more vulnerable to the negative effects of CIs.**

Context of the narrative: the employee found the remains of the victim's body and saw them close up. He was concerned about what would happen to the body, how would they get it out from under the train?

"I volunteered to do it. I wanted to do it. I wanted them to make a cut on the train. Bulldozed a few cars off of her. And eh… allow them to move her that way, but it was insisted that we could pull the whole train over her. Like with the rest of the train, right. At which point I insisted on doing that." (Case 56)

Generally, the complexity of the CI seems to have an effect on the stress reactions, but the way in which the employees and the other people concerned in the management of the CI react to this complexity appears to be more significant. In the context of this analysis, the clear and precise nature of the CI (accident or suicide) and its complexity on the development of negative reactions could be determined. It was always modulated by the management method and relational factors.

5.9.3 Summary of the Effects of CIMSPs on Post-CI Recovery of Engineers and Conductors

The combination of statistical and qualitative analyses makes it possible to draw a portrait of the role of the various factors studied on the effects of CIs and employees' recovery. This summary is presented in Figure 2. Some elements related to the CI itself and the circumstances in which it occurred (environment, complexity) affect the employees, in addition to how the CIMSP is applied and the employees' level of satisfaction. The attitudes of the employees towards the CI, their responsibility, that of their employer, their adaptation mechanisms and the use that they make of the resources offered by their employer also affect their recovery, as well as their satisfaction with the CIMSP. Furthermore, their relationship with the employer, perception of organizational support and support from the MTO, and the degree to which the CIMSP was implemented significantly affect the various types of effects experienced following the CI. When the protocols are applied with sufficient intensity, in a supportive work context, they will reduce the intensity of the negative effects of the CI and help to shorten the recovery trajectories of employees. These analyses show how the CIMSPs have a remarkable influence on the post-CI recovery of engineers and conductors. The most effectively implemented CIMSPs reduce recovery time and are most often associated with an absence of significant negative effects on the individual.

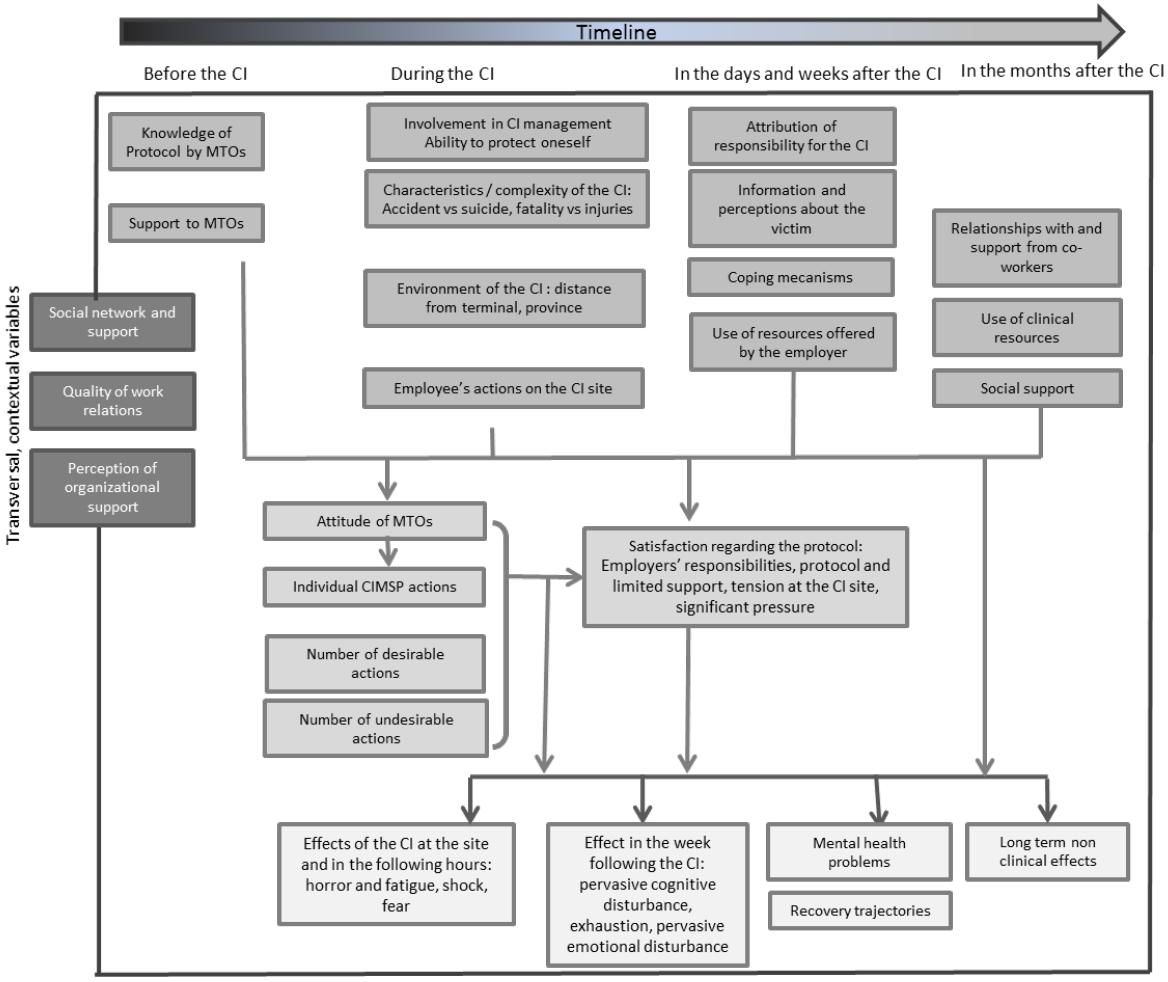

Figure 2. Flowchart of the role of the CI's context and characteristics, CI management, employee satisfaction and individual factors on the negative effects of these CIs

5.9.4 Use of Resources by Employees After a CI

The use of resources by employees in the days, weeks and months after the CI were explored. Among the clinical resources, it is important to distinguish those offered by the employer and which are most often used in the days and weeks following the CI, and those of health professionals (physician, private therapist) most often used in the months following the CI (Table 24).

Table 24. Use of resources by the employees in the six-month period of the study

Resource	Period 1 (N=74)
Seen by a peer helper	29 (39%)
Clinical consultation at the terminal by an EAP counsellor (group or individual debriefing)	23 (31%)
- The day of the CI	13 (56%)
- Directly organized by the employer	20 (87%)
Referral to the EAP	39 (53%)
Consultation with a physician	17 (27%)
Consultation with a psychotherapist	25 (38%)
Submission of a claim to or opening of a file at a workers' compensation board	17 (27%)
	Period 2 (N=67)
Consultation with a physician	12 (18%)
Consultation with a psychotherapist	9 (13%)
Use of EAP services	8 (12%)
Submission of a new claim to or opening of a file at a workers' compensation board	3 (5%)
	Period 3 (N=63)
Consultation with a physician	1 (1.6%)
Consultation with a psychotherapist	3 (5%)
Use of EAP services	3 (5%)
Submission of a new claim to or opening of a file at a workers' compensation board	4 (6%)
	Period 4 (n=61)
Consultation with a physician	6 (10%)
Consultation with a psychotherapist	9 (15%)
Use of EAP services	0
Submission of a new claim to or opening of a file at a workers' compensation board	3 (4%)

It is important to note that the participants are often not able to name the various sources and forms of resources that they have at their disposal and that they have used. For example, 38% of the participants indicated that they had seen a psychotherapist in period 1, but it was difficult to know whether this clinician was associated with the EAP or not. A clinically significant number of people indicated that they had filed claims with their worker's compensation board in periods 2, 3 or 4. This data should therefore be regarded with caution, because the research team noted that several participants were not very familiar with the procedures of their worker's compensation board and the services offered by it.

The professional services used in the months following the CI are related to the recovery trajectories. People with persistent negative effects are those who use professional services the most often. This indicates that those who need assistance appear to use them.

The resources provided by the employer are most often used immediately after the CI, and professional resources are used by those with more long-term negative effects and who require professional care for a longer period of time. The provision of resources by the employer is a factor that is specifically linked to short recovery trajectories. People who know about the existence of services offered by their employer, whether they use them or not, recover more quickly than those who do not know about them. The offer of services by the employer can be seen as an indication that it acknowledges the difficulties experienced. This component is an element that has previously been observed in studies on trauma management in the workplace (Hughes, Kinder and Cooper, 2012).

5.10 Results of Qualitative Analyses of Interviews with the CoA MTOs (Deployment of CIMSPs and the Effects of CIs: Objectives 1.2 and 2)

The thematic analysis of the content of the interviews with CoA MTOs (N=9) had the following themes: use of CIMSPs and degree of familiarity and comfort with them; the general context of CI management; their satisfaction with respect to CIMSPs; the CI and its effects on them in the short- and medium-term; their needs to improve CI management and to reduce its effects on them; their general recommendations for improving CI management. It is important to understand the effects of CIs on MTOs who must apply CIMSPs in order to better respond to their needs and to understand how to support them in the application of these CIMSPs. The CIMSPs must include the needs of MTOs in order to be deployed effectively.

5.10.1 Use of CIMSPs by the MTOs

At the Site of the CI

The time that elapses between the occurrence of the CI, the reception of the call for help and the arrival of the MTO on the site is extremely variable. Sometimes, the MTO is able to arrive almost immediately, but in other cases it could take three hours. The MTOs are generally very willing to go to the site of a CI, even when they are not on call. In our sample, late arrival to the site was due to the distance from the terminal, or sometimes because of the police, who considered the site to be a crime scene and prevented them from getting to the locomotive. Once they were there, the MTOs stayed on the site longer than the engineers (between 30 and 405 minutes; on average 130 minutes).

Generally, the MTOs have very little information about the CI when they get to the site. Most of the MTOs have seen or touched human remains. In the context of their job and because of the multiplicity of the CI that they manage, they are often exposed longer than the engineers to the presence of human remains, because they remain on the site after the engineers leave.

All the MTOs interviewed feel that the CIs could not have been avoided by the engineers and they do not ascribe any responsibility for the incident to them. In some cases, there was no interaction with the crew because of their late arrival on the site, but when the engineers were present, their first concern was to ask them about how they were feeling. Generally, they were very involved in the various aspects of the management of the CI: organization of the meeting with the counsellor, taking the engineers to the terminal, interactions with the first responders,

police, etc. Sometimes, the MTO was the one to move the train while waiting for the arrival of the relief crew.

In Relationship with the Engineers

The MTOs offered support to engineers, organized a meeting with the EAP counsellor or the peer counsellor and arranged their transportation for the return home. They gave them information about the leave to which they were entitled and a number of days off, depending on the seriousness of the situation, leaving open the possibility of prolonging the leave if needed. Only two MTOs were dissatisfied with the aftermath of a CI, one because of a communication mix-up with the EAP, which meant that the follow-up with the engineer did not take place quickly enough, and the other, because the day after one CI, he had to go to the site of another, when there were other co-workers who were available to go, but he would have had to make a request. In his opinion, this replacement should have been automatic.

Days of leave for engineers affected by a CI were granted without problem. For those who did not return to work after five days, there was no systematic follow-up by the MTOs. Some of them reached out to the engineers personally, others were content with the follow-up carried out by the EAP counsellor, or they made no attempt to follow up.

In Relationship with the CI

With respect to follow-up in CI management, being able to watch the video makes it possible to check whether everything was done according to the rules. Sometimes there are questions or discussions, but once the final report is drafted, the matter is closed.

In Relationship with Their Own Well-being

Depending on what time the CI occurred and how long they were on site, MTOs returned home to sleep. Otherwise, they had a meal or stayed with the engineers at the terminal, or returned to the office to continue working. Even when sleep hours were greatly reduced, the MTOs still returned to work the day after the incident.

After Engineers Returned to Work

The engineers' return to work was never accompanied by an offer to supervise their first train trip. However, in some cases, the MTO proposed a flexible return to work. In half the cases, the MTOs checked the general condition of the engineers when they returned to work (with a few general questions about their well-being). In very rare cases, they followed up after the CI (general questions about their well-being in the days following the CI). Similarly, the follow-up after the return to work remained highly variable. In the cases studied, there was no supervised trip or flexible options (in one case, another MTO took care of it).

5.10.2 Results Concerning the General Conditions and Organizational Context of CI Management for MTOs

Previously, we showed that the organizational context affects the implementation of CIMSPs and employee satisfaction. This section will analyze the effect of this context on MTOs' perception of their own application of CIMSPs.

Labour Relations and the Organization of Work (or Perception Related to Their Workplace)

The MTOs value their work highly; for some, it is stimulating and challenging. They enjoy their jobs, despite the inherent challenges and difficulties. These difficulties relate to the workload (pressure, atypical working hours, respecting a tight schedule, long weeks, the need to be flexible), employee relations (complaints, being caught between managers and engineers), relations with authorities (being monitored more), unexpected events and CI management (especially those that have caused injuries). They assess the work as being moderately to slightly stressful, and very rewarding to moderately rewarding; thus, more rewarding than stressful. Their relationship with the employer is positive and their opinion did not change after the CI. Their level of trust in the company, their superiors, co-workers and employees is quite high, with little difference between opinions (slightly lower with respect to the company). With respect to their follow-up in terms of their own well-being in the context of a CI, they have no expectations regarding the company and are satisfied with the existing services they can access if need be.

Support of MTOs

With respect to pressure to restore rail traffic, this is mainly linked to the fact trains carry passengers, who are immobilized because of the CI. They say that they do not feel direct pressure from their employer to speed up the return to normal.

History of Experience with CIs

During their careers, the MTOs who were interviewed experienced between 15 and 60 CIs (M=30), derailments, accidents, suicides, etc. CIs are quite frequent, and four out of seven MTOs who participated in the second interview had to manage a CI after the first interview, three of which were caused by suicides.

In the questionnaire on workplace perception, *Areas of Worklife Scale*, the average score was 151.666 (SD: 27.703), which means that MTOs generally have a positive perception of their workplace. The mean subscale scores show very little variation and that perceptions are fairly good and similar in terms of workload, control, reward, community and fairness.

5.10.3 Results Concerning MTOs' Satisfaction with Respect to CIMSPs

The MTOs are all familiar with the CIMSP guide and have received training, except for those MTOs who had been in the position for a very short period of time. All are very satisfied with their management of the CI, except for one, who mentioned that he would have preferred to have arrived on the scene more rapidly. All are satisfied with the interactions with first responders and other professionals on the site. Their experience was thus very similar and our data showed no observable variance.

5.10.4 Results Concerning the Effects of CIs on MTOs

Better understanding of how CIs affect MTOs could help develop components within CIMSPs to support them and to ensure that their interactions with employees are satisfactory. MTOs say they are not disturbed by exposure to injured people, bodies or human remains, except in rare cases, such as when the victim reminds them of their own child, or when the victim is a young

child. One MTO mentioned being more emotionally affected when it was an employee who was injured.

Regarding their feelings during the management of the CI, for half the MTOs, there was an emotional detachment or a sort of insensitivity; the focus was on the work to be done. Before arriving at the site of the CI, there was, however, nervousness or some anxiety in not knowing what awaited them. Clearly, the MTOs are very dedicated to their jobs; they may go to the site of a CI because they heard the call when there was no obligation to do so, even if sometimes they feel torn between going there anyway, or staying at home with their family.

A week after the CI, few emotions remain, except, sometimes, a little anger or frustration about someone using a train to commit suicide. However, it was mentioned that suicides are less emotionally charged than accidents. The idea that someone would commit suicide by throwing him or herself in front of a train remains difficult for some to come to terms with. After these incidents, some feel powerless. They feel that the time taken by this CI and its consequences are useless and sterile, but they may also feel a greater appreciation of life.

The emotional management of CIs by MTOs is generally more difficult when the victim is a child, if that child was the same age as their own, or if an employee was killed. Sometimes MTOs find it difficult to sleep. They can feel sad and concerned about the engineers affected by a CI, or about CIs with multiple deaths, or CIs that were less successfully managed. But in general, the CIs have little hold over them. No reactions or symptoms persisted three months after the CI.

In terms of their health, the few remaining problems are not ascribed to work. The MTOs rate their general state of health as being fairly good to very good, and consider it better than that of people of their age among the general population.

5.10.4.1 MTOs' Coping Mechanisms when Faced with CIs

The MTOs were asked about how they deal with a CI. This information is useful to those providing support to MTOs. The hypothesis is that MTOs with good coping mechanisms for dealing with CIs will be better able to effectively support workers through a modelling mechanism. They mainly cited coping methods, such as continuing their normal personal and professional routine, keeping busy, going to work, not drinking and smoking, not feeling personally targeted or responsible, talking, distancing themselves, reducing tensions, having a good cup of coffee at home, making time for their spouse and family, making sure they ate well, even if they were not hungry, laying the responsibility for the act on the individual who did it, telling themselves that it was no one's fault and that the engineers could not have done anything to prevent the CI.

The MTOs did not report using the professional resources provided by the employer. Their sources of support were most often their spouses, peers, co-workers, family members, friends, family physicians, and the fact that they could use an EAP if necessary. Several had family members who work in the rail industry; they could also provide support and lend an attentive and understanding ear. They all felt that their social network had not been disrupted by the CI. The MTOs also emphasized the importance of having a healthy lifestyle, including getting enough rest, sleeping well, exercising, going out, and getting fresh air to better deal with the CIs that they had to manage. In terms of social support, membership in groups (for example, religious, recreational or volunteer groups) is not very widespread among the MTOs, however, all considered their spouses as being very important or quite important sources of support.

MTOs must apply the CIMSPs, but they are also faced with these CIs. This study shows that the CIMSPs cannot be limited to adequately supporting engineers. The protocols should be extended to MTOs reporting on site and they should be provided with the tools and support necessary to adequately support the employees and reduce the risk of accumulating negative effects over time.

5.10.5 Findings Regarding What MTOs Feel Is Needed to Improve CI Management and to Reduce the Effect of CIs on Them

The CoA MTOs drew a positive portrait of their role and identified minimal effects of CIs on their well-being. Their experience could be used to improve the situation in other rail companies, where the role of MTOs seems to be more problematic. The recommendations that they make about CIMSPs are thus useful in developing more efficient CIMSPs and will be used to respond to Objective 4 of the study.

5.10.6 Employers' Role

In the context of post-CI follow-up and CIMSPs, MTOs are sometimes contacted by their superiors to check their physical and psychological condition, but this is not done systematically. Few MTOs feel that they need specific care after managing a CI, however, telephone contact would be appreciated. Overall, they are satisfied with the support received and don't expect to receive more. However, they make some suggestions that could improve interactions with the employer during CIs:

- MTOs should have a mechanism to enable them to receive backup, without feeling like they are bothering their co-workers (e.g., one of them said that he wanted help from a co-worker, but did not want to call him at night because he was not on call, so he only sent emails);

- An MTO should not be asked to manage a CI over two consecutive days.

5.10.7 First Responders on CI Sites

The MTOs would like to have a protocol with the various police forces so that the engineers could be released more quickly, for example, by giving MTOs immediate access to the scene, by making it possible for engineers not to be interviewed so quickly by the police, and by reducing the time it takes to go to the site. They reported having problems getting to the scene when the police had previously closed off the parameters of the CI as a crime scene.

5.11 Participants' Recommendations to Improve CIMSPs (Objective 4)

When asked at each measurement period, the participants (engineers/conductors and MTOs) formulated recommendations to improve practices and to promote faster recovery. Each time, they had to explain what could have been done differently or better to help them at the stage they were at during at the interview (on leave or upon return to work, rapidly after the CI or during follow-ups further along in time).

Their responses were the subject of thematic analyses of content and are described in Appendix 2. To sum up, the recommendations of participants to improve CIMSPs focused on the need to raise employees' awareness of the resources available, the actions to take to protect themselves and employees, the need to systematically ensure the presence of an MTO

at a CI site and to train MTOs to provide positive and empathetic support without putting pressure on the employees to continue working. Most of the engineers and conductors interviewed also wanted clear, predetermined and systematically applied demobilization and leave procedures, and for the return-to-work process to be more flexible and adapted to the needs and particularities of each situation. The employees wanted to receive confidential professional follow-up provided by the employer and regular follow-up that shows concern for their well-being during their recovery period.

6. DISCUSSION

In this section we will discuss the findings in terms of the objectives and hypotheses formulated.

6.1 Analyze the Degree of Implementation of the Various Components of CIMSPs by Rail Companies in Canada (Objective 1)

In Canada, there is generally only partial implementation of CIMSPs in the rail industry. No company included in the study fully applies all the elements of the CIMSPs described in their documents (Appendices 1.A and 1.B). However, the most frequently applied actions constitute the central corpus of CIMSPs as they are currently deployed. These include the presence of an MTO on site, employees being asked about their condition or well-being by the MTO, being treated with empathy, being demobilized and removed from the scene of the CI. The presence of undesirable actions during the management of the CI (blaming the employee for the CI or pressuring him to move the train and to continue working) is independent of the presence of expected actions. These problems can occur, regardless of the MTO's level of application of the CIMSP. The observed variations in the application of the CIMSPs are thus associated with different factors.

Interestingly, the CIMSPs were less comprehensive in the western provinces (MB, SK, AB, BC); several elements were absent and numerous undesirable actions were present. This indicates that the location of the CI seems to be more related to the application of the CIMSP than employer affiliation. These local variations are found at every level of implementation, which may indicate a lack of uniformity in the application of CIMSPs with the same employer across regions or terminals. Efforts should be made to ensure that the CIMSPs are implemented in the same way everywhere, so that all employees of the same company have access to the same degree and quality of services following a CI regardless of their location in the network. In the western provinces, workers are strongly pressured to move the train, and the time it takes before being able to leave the site is longer. This is important to consider when a CI occurs, because actions can be taken remotely, by telephone or radio, to limit the effects of distance or isolation (empathetic radio contact, remote clinical intervention, continuously providing information to reduce uncertainty about what is happening, etc.).

Some elements related to the CI affect the quality of implementation of a CIMSP. When there are injuries, but no deaths, the CIMSPs are applied less rigorously. The effect is the same as when a vehicle collides with a locomotive (most often these are accidents with injuries). The following hypothesis is formulated: when there is a death, the site of the CI is treated as a crime scene for a certain time, the coroner is called to the site and it is often him or her who decides when the body can be transported and thus when the train can be moved. The presence of a coroner can reduce some of the pressure felt by MTOs and employees to rapidly return traffic to normal. As well, an event that has caused a death may be perceived as being more serious. It leads to considerable additional effort to care for those who were involved. A previous study (Bardon, 2014) showed that the presence of injured people at the site of a CI can increase stress and feelings of powerlessness among engineers and conductors, who must then interact with one or more people in distress, which can cause them feet to feel extremely helpless. CIs without death cannot therefore be considered *a priori* as having less serious consequences than those with death.

In the context of the analysis of CIMSP implementation, engineers' and conductors' satisfaction level was assessed in terms of CI management and the support received from their employers and the EAPs. The satisfaction indicators were assessed at different points in time (interviews 1, 2 and return to work) to verify the persistence of this feeling over time and so as not to overload each interview.

Generally, the perception of having been pressured at the site of the CI or in the following days considerably lowers employees' satisfaction levels. That pressure may start when the CI occurs (checking whether there are any survivors to help) and it may continue over time (when moving the train, completing one's work shift, returning to work). Being pressured and being affected by that pressure is an important dissatisfaction factor. It decreases employees' feelings of control over events and increases their feelings of powerlessness. As noted in a previous study of the general population, the feeling of being control in a chaotic, potentially traumatic situation is important to reduce the risk of posttraumatic stress (Brillon, 2010).

Two thirds of the participants feel that the time between the occurrence of the CI and when employees leave the site is too long. It is, however, interesting to note that those who did not consider this delay as being too long are those who remained for a long time on the site. They expected that it would be long, for example, because they were far from everything, understood the constraints of the situation or knew, by experience, that a CI of that nature would cause such delays. Knowing what to expect, being informed of the situation and keeping their mind occupied during the waiting period makes it possible to adjust to the situation. Previous training and receiving ongoing information on site can help engineers and conductors adjust their perceptions and expectations during a CI, which could increase their sense of satisfaction.

In general, the perception that the CIMSPs were applied properly is relatively low (50%), but the feeling of being supported by the employer was present among two thirds of participants at the time of the CI and this perception remained unchanged over time (60% at the second measurement period). This reflects the uneven application of CIMSPs, depending on the CI, but also a lack of communication among employees, MTOs and employers. If engineers or conductors who have been shaken up by a CI don't know exactly what to expect from their MTO or employer, they may, without formulating them, develop expectations according to their condition and needs, and will therefore be dissatisfied with what is being done around them. Assessing the person's needs and informing him or her of the actions that can be taken in this context are thus elements that could be improved in the implementation of CIMSPs.

Beyond the immediate interactions, the role that engineers and conductors assign to their employer with respect to the difficulties they experience after a CI was explored, as was the share of responsibility that they attribute to it for their difficulties associated with the incident. Half of the respondents assign part of the responsibility to their employer. This reflects certain tensions in the workplace that intensify during CIs. Improving labour conditions can enhance satisfaction with CI management and increase the acceptability of the employer's support resources. In fact, as our qualitative analyses show, some employees are reluctant to accept assistance from an employer with whom they do not have good relations.

The level of implementation of CIMSPs has an influence on employee satisfaction. The perception that the employer is responsible for the negative effects experienced by the employee is associated with fewer desirable actions and more undesirable actions, particularly when the employee is not asked about his or her well-being and the immediate effects of the CI. Another factor is the lack of information on best practices to protect one's health and to better cope with CIs. It is important to note that these elements have few links with concrete

management actions. The feeling that the employer is responsible or to blame for the negative effects experienced as a result of the CI appear to be associated with the attitude of MTOs and managers: taking charge of things, asking how the employee is feeling, proposing solutions to improve his/her well-being, accompanying him during his/her return to normal after the CI. These attitudes show employees that their employers recognize that they have experienced something difficult in the course of their jobs and that they understand and accept the potential effects of the event and offer support to deal with it.

The perception that the CIMSP was applied depends on the number of desirable actions, but does not depend on the number of undesirable actions. As a result, employees may feel that the CIMSP was applied, even if inappropriate actions were taken or there were inappropriate attitudes at the time. As expected, most of the CIMSP actions taken individually are associated with the sense that they were applied appropriately. Employees' prior knowledge of the components of CIMSPs can allow them to adjust their expectations and contribute to the feeling that they have been treated fairly by the employer if the CIMSP is well applied. The link between the application of the CIMSP and employee satisfaction is thus strengthened.

The perception of tension at the site of the CI was not associated with the intensity of the application of the CIMSPs, but rather with the presence of rare behaviours and attitudes, such as the lack of management of the scene by the MTO or not being accompanied (for CoB and CoC employees), thus not being supported.

6.2 The Effects of CIs on the Employees Involved (Objective 2)

Generally, employees experience a wide range of effects from the CIs in which they were involved. This may run from a complete absence of perceptible reactions on site and in the weeks following to the development of mental health disorders (depression, PTSD), which corresponds to what has been observed in previous studies (Bardon, 2014; Briem *et al.*, 2007; Cothereau, 2004; Kim *et al.*, 2012; Kim *et al.*, 2014; Limosin *et al.*, 2006; Theorell *et al.*, 1994; Tranah and Farmer, 1994).

Most employees recovered from the CI over the six-month period covered by the study, which is important information for them and their employers. However, the speed of recovery can vary greatly from one person to another. It is important to understand why such variations occur.

The types of immediate reactions identified by the study (horror and fatigue, shock, extreme fear) can be used to guide training of employees and MTOs on the potential effects of CI and on-site assessment by MTOs of employees' condition to adapt their intervention. The description of these psychological and emotional reactions can also help employees to better understand what is happening to them on site and to regain a sense of control over the situation. At the same time, feelings of helplessness are frequent (75.7%) and can be a significant risk factor in the development of posttraumatic effects among rail employees (Brillon, 2010). It is therefore important to identify this among the employees at the site and to try to reduce it by giving employees the means to regain control of themselves and the situation they are experiencing. Anger is also common (44.6%) at the CI site and it tends to persist over time. This anger is directed at the victim, the MTO, emergency services, and the employer, depending on the circumstances. As this study demonstrates, a correct application of CIMSPs (including the absence of undesirable actions) can reduce anger directed against the MTO or the employer.

The effects experienced in the week following the CI are substantial. Employees may be affected cognitively or emotionally, or they may feel exhausted. All these effects can have a significant impact on employees' ability to concentrate and to do the job properly for several days. They can also be used to observe and assess employees' condition in the days after the CI. MTOs can use these types of effects to support their employees and EAP practitioners by proposing actions to reduce them. This finding emphasizes the importance of mandatory post-CI leave, during which these effects may be reduced or eliminated, as highlighted by Cothereau (2004), Holland and Bultz (2007), Limosin *et al.* (2006) and Malt *et al.* (1993).

The five recovery trajectories identified in this study are relevant for clinicians to assess the various types of short-, medium- and long-term risks for engineers and conductors. While some of participants' recovery occurs naturally, a proportion of it comes from things that they and their employers can do something about. Generally, a month after the CI, the level of negative effects for two thirds of participants was low; they recovered rapidly. However, 20% still perceived negative effects three months after the CI, and 13% felt effects after six months. Most of the time these effects consist of flashbacks, fatigue, difficulties concentrating, anger (often related to how the CI was managed and subsequent conflicts with the employer). These effects have previously been described in previous studies by Briem *et al.* (2007), Limosin *et al.* (2006), Cothereau (2004), Tranah *et al.* (1995) and Bardon (2014). They are also reported in recent literature reviews on trauma in the rail industry (Bardon and Mishara, 2015b; Clarner *et al.*, 2015).

This study confirms that it is important to consider these undiagnosed effects, as they can have an impact on the ability of these employees to do their jobs without making mistakes. Some may feel caught in a vicious circle in which CIs cause fatigue that becomes chronic, disrupting their concentration, causing errors, and attracting sanctions. All this leads to a sense of injustice and a deterioration in the relationship with the employer. This pattern has been observed in previous studies (Bardon, 2014).

The proportion of employees who have developed effects significant enough to have been diagnosed with a mental disorder (9.4%) is similar to that found in other studies on trauma among conductors (Clarner *et al.*, 2015). These people expressed feeling socially vulnerable at work. The data from this study do not enable us to determine whether those employees were psychologically fragile in the past; or if this fragility affected their relationships at work and was a predisposing factor in the development of mental disorders, or that the presence of social vulnerability at work alone could increase the risk of suffering such disorders after a CI. This study was not intended to explore the life histories of the participants and thus establish factors related to past trauma, which are elements in which employers and CIMSPs would not have an impact. The objective was to identify work-related elements that could affect the development of mental disorders following a CI, and the results show that, unlike the undiagnosed effects, the context of the CI and its management do not appear to affect the development of such disorders. However, employers, EAP workers and health professionals must be informed of this risk and equipped to identify and prevent it.

This study confirms the conclusions of other research (Bardon, 2014; Briem *et al.*, 2007; Cothereau, 2004; Limosin *et al.*, 2006; Tranah and Farmer, 1994; Tranah *et al.*, 1995) concerning the significant presence of subclinical effects (meaning that they do not lead to a mental health diagnosis but could be significant for the person) of railway CIs and the importance of taking into account the treatment and management of the return to work in the assessment.

The ability to return to work is an important issue but the assessment of it appears deficient, given the description of the experience of employees and MTOs. In fact, in almost 75% of cases, there was no procedure to assess employees' ability to return to work. Moreover, 27% of them would have appreciated more recovery time, while 8% wanted to return more rapidly, and 26% said they felt pressure to return to work prematurely. This is an important clinical, administrative and labour relations issue (Abbott *et al.*, 2003; Briem *et al.*, 2007; Burrows, 2005). Going back to work under pressure before feeling ready to do so could have considerable consequences for the employee (fatigue, discouragement, unfavourable opinion of the employer, errors) that could be costly for both him/her and the employer. The management of the return to work must therefore be subject to a clear and systematically applied process.

6.3 The Effectiveness of CIMSPs (Objective 3)

The results of the linear growth model analyses show that a major proportion of participants' recovery is due to elements that are different than the normal course of events. This means that there may be mechanisms to accelerate this process and to improve the well-being of employees after a CI. Beyond the basic descriptive analyses, the evaluation of effects of the elements of a CIMSP was carried out by including all the participants in the same analyses, without separating them by employer. In fact, since the implementation levels were not optimal for all the companies and given the study's second objective (to identify the most useful elements of CIMSPs), the research team analysed the role of these elements for all the participants in the same analysis. The recommendations describe courses of action, regardless of employer.

The following subsections summarize and discuss the responses to the hypotheses accompanying this objective to evaluate the effects of CIMSPs. For ease of reading and the identification of noteworthy elements in the deployment of CIMSPs, only significant data were included in the Findings section and are discussed in terms of the research hypotheses.

6.3.1 Hypothesis 1: The Quality of Labour Relations and the Interaction Between Employees and Managers Influences the Incidence and Duration of Traumatic Symptoms, the Ability to Work, the Time Required for and the Degree of Recovery

Qualitative analyses are particularly relevant to this hypothesis. The quality of labour relations was observed and assessed by the way in which employees spoke of their employers and the relationships they had with them. The quality of this relationship is particularly important when employees feel a strong sense of belonging to their work community. In these cases, employees develop expectations regarding their care, but also ask to be treated with respect. This type of good relationship becomes a protective factor for employees during CIs. However, when expectations are not met (inadequate or incomplete CI management in a context in which the previous level of trust was high), CIs may then have potentially deleterious effects. Statistical analyses have also shown that the negative effects of CIs can be associated with a high level of stress at work, and the perception that the job is not very rewarding. These findings show that beyond the specificities of the CI and what occurs on site, the work context, measured in terms of stress and gratification, plays a role in the development of effects caused by CIs.

The quality of relationships with MTOs and employees' trust in them also influence the development of negative effects. As described in the qualitative analyses, when employees do not have a lot of respect for their MTOs, and don't think that they are capable of understanding or managing the CI adequately (no matter the reason), they are more likely to develop negative

effects after the CI. Moreover, when employees attribute some of the negative effects they experience to their employers, their values, attitudes and behaviours, the CIs are more likely to result in negative effects.

This study thus shows that labour relations and the interactions between conductors and engineers, on the one hand, and MTOs and employers, on the other, play an important role in the development of negative post-CI effects. These labour relations, when they are good, help speed up recovery time and result in CIs having less severe effects. Hypothesis 1 is therefore confirmed.

6.3.2 Hypothesis 2: How Well the CIMSP Is Implemented Has an Influence on Negative Effects, Post-CI

With respect to MTOs' actions in managing the CI on site, some effects were also observed. The qualitative analyses show that how MTOs behave towards the employees play a key role in the development of negative effects and when they show empathy, focus on their employees' well-being and provide them with information, support and resources, the negative effects are minimal and disappear rapidly. The robustness of these data is confirmed by trajectory analyses, which show that the extent of implementation of CIMSPs is associated with rapid recovery trajectories. The statistical data also illustrate that the negative effects experienced in the hours and days following the CI are associated with pressure exerted by MTOs during and after the CI, the perception that MTOs are not adequately managing the CI or that they don't care about how the employees are doing and do not support them.

Beyond the situation at the CI site, the provision of services and the use of resources offered by the employer are also associated with shorter recovery trajectories. However, it is interesting to observe that the satisfaction with respect to CIMSPs does not appear to have a direct influence on recovery trajectories. It is therefore important to take satisfaction into account in the development of practices and communication on CIMSPs and services offered, as well as in the improvement of relationships between employees and managers.

Although infrequent, cases in which employees must take more time or who develop health problems after experiencing a CI should be treated with care and empathy by employers to reduce the magnitude of the effects and subsequent recovery time, reinforce the employees' positive perceptions of the employer and reduce the long-term financial, organizational and human costs of CIs and their consequences.

This study thus confirms that the quality of implementation of CIMSPs and the behaviours and attitudes of MTOs and employers on site and in the weeks following the CI contribute to the development of negative post-CI effects. Two previous studies have looked into this issue and show the significant effects of CI management on the recovery of rail employees (Bardon, 2014; Cothereau, 2004). Hypothesis 2 is therefore supported.

6.3.3 Hypothesis 3: The Negative Effects of CIs Can Be Reduced by Positive and Proactive Measures by MTOs and the Employer

As expected, the complexity of the CI influences the duration of the recovery trajectory. Some events are difficult to manage and absorb, regardless of the quality of the support provided by the employer. However, in many cases, this potential effect does not really develop. The qualitative analysis provides a good illustration of situations in which participants were exposed to complex CIs, but felt supported, mentored, understood by their MTO, and accepted the

support resources offered by their employer. They did not develop significant negative effects. The trajectory analyses also show that being provided with well-defined support (e.g., EAP, peers, debriefing) reduced recovery time.

Specific CI management actions that can reduce the negative effects include effective management of the scene by the MTO, the absence of pressure on individuals to move the train, to continue working or to return to work, being asked about how they were feeling, their well-being and needs on site and in the following days, and being offered support and EAP services proactively and repeatedly. Generally, this study confirms that when the CIMSP is rigorously implemented (including as many expected actions as possible) and when the support offered is adapted to the employees individually, their recovery trajectories are shorter. These elements are thus crucial points that should be emphasized in the deployment and implementation of CIMSPs. Moreover, the findings also indicated that in some cases in which the CI was very complex, or when the employee was faced with a very upsetting situation (multiple victims, presence of serious injuries, etc.), an empathetic, proactive management that is consistent with expectations and adapted to employees' needs may mediate the potentially traumatic effect of the CI. Hypothesis 3 is thus confirmed.

6.3.4 Hypothesis 4: Access to and Use of the Resources Offered by the Employer After a CI Facilitate the Recovery Process; and Hypothesis 5: The Long-term Recovery of Employees Who Use Specialized Clinical Resources Is Better Than Those Who Did Not Use Them

These hypotheses were grouped together because they deal with two aspects of the same issue and the data from the study did not make it possible to respond to them directly.

For people who do not develop mental disorders, but who still experience effects that are below a diagnostic threshold, the clinical assistance provided by employers is associated with slower recovery. This means that those who suffer negative effects use the services offered. This proactive provision of clinical services and post-CI support in the days and weeks following the CI is an essential component of CIMSPs and this finding suggests that those who need services use them. However, for those who have developed diagnosed mental disorders, the situation is more difficult to analyze. In fact, the sample includes seven people (9.4%) who developed negative effects severe enough to obtain a diagnosis (PTSD, ASD, depression, anxiety). These people generally consulted professional services outside of those offered by their employer. Generally, access to specialized mental health and trauma services appears to be essential for successful recovery after a rail CI with major (diagnosed) effects. However, it is also true that those with the most long-term negative effects, who develop symptoms and obtain a diagnosis, use more resources. Their recovery trajectory is therefore longer.

These results indicate that people who suffer the most from CIs are those who seek and use the most help available (offered by the employer and external professionals). Further analyses would be necessary to provide more details about the interactions between long-term negative effects and the use of services.

This study constitutes an advance in knowledge in terms of the recommendations made in previous studies. Indeed, the study provides research data to support the need to adequately train and inform engineers/conductors and MTOs about the effects of CIs and the components of CIMSPs and to have a manager on site to take charge of the situation (Margiotta, 2000; Neary-Owens, 2001; Teneul, 2009). These data also support mandatory demobilization

(Abbott *et al.*, 2003; Burrows, 2005; Margiotta, 2000), a minimum of three days of mandatory leave (Abbott *et al.*, 2003; Margiotta, 2000), the importance of having a clear return-to-work policy, including a rigorous assessment of the person's ability to return to work (Briem *et al.*, 2007; Burrows, 2005). In terms of support, the findings confirm the important role played by peer helpers (Briem *et al.*, 2007; Burrows, 2005; Margiotta, 2000). The data do not make it possible to assess the specific effect of debriefing sessions (Abbott *et al.*, 2003; Cothereau, 2004), but they give weight to recommendations on how to conduct them, while confirming that they are generally appreciated and are often seen as useful support measures by those who have recovered the most rapidly. These sessions are likely to respond well enough to the needs of employees who are seeking support, but who are not at risk of developing mental disorders as a result of a CI. They also make it possible to make an initial identification of those who present with risk factors and who should be supported for a longer period. This study adds important dimensions related to the quality of the interaction, the essential role of good relations and interactions with the MTOs, information sharing and the concept of being in control of the event.

The hypothesis that the availability and use of the resources offered by the employer are useful to those who have developed undiagnosed negative effects and that seem to accelerate their recovery process is thus plausible. However, there is no evidence to support the hypothesis that the use of professional resources accelerates the recovery of those who have developed mental health disorders. It also appears that people who use the services are those who need them the most (more negative effects that last longer.)

6.4 Risk and Protective Factors Unrelated to CI Management

The main objective of this study was to assess the effects of CIMSPs. However, a set of known risk factors in the literature, related to various aspects of the individual and the CI, were taken into account.

Unlike other studies, this one did not show direct effects of certain personal characteristics on the recovery trajectories of employees.

- The cumulative effect of CIs, which was shown in several studies (Austin and Drummond, 1986; Briem *et al.*, 2007; Karlehagen *et al.*, 1993; Margiotta, 2000; Vatshelle and Moen, 1997), could not be demonstrated here. However in agreement with the authors of the previous studies, it is a significant risk factor in the development of traumatic reactions. Some employees in the sample experienced flashbacks from other CIs when they were talking about their current experiences, which may indicate the presence of an accumulation effect. A different research design with qualitative life course analyses would make it possible to better circumscribe this phenomenon and to contribute to its understanding.

- Life events occurring in the period surrounding the CI may make the individual more fragile (Abbott *et al.*, 2003; Limosin *et al.*, 2006). Although this aspect was explored, no data were gathered to confirm this risk factor. It remains very relevant to explore when an employee is faced with a CI.

- Coping strategies based on the suppression of emotions have been identified as a risk factor associated with masculinity among conductors (Abbott *et al.*, 2003). The analysis of participants' coping mechanisms (Brief Coping Scale) did not reveal specific effects of different mechanisms on the recovery trajectories.

- However, social support was associated with post-CI recovery (Abbott *et al.*, 2003) and a major effect of support in the speed of recovery was also observed. This factor is important and should be explored during the evaluation; the employees' social network could also be included to help loved ones after a CI.

The complexity of the CI, as defined in this study, was originally noted by Holland and Bultz (2007) and by Bardon (2014). This complexity is expressed through staying with the victim for a long time waiting for help, and seeing, touching or talking to the victim increases the risk of negative effects. This study confirms the major role of these CI characteristics in the negative effects experienced and the speed at which employees recover.

6.5 The Managers of Train Operations

This part of the study concerns only CoA MTOs, and the data gathered can only be used to describe their situation. However, their experience may be instructive with respect to the needs and role of MTOs in CI management and to provide ideas for improving their role and practices. This subsection identifies these general ideas.

6.5.1 Control

MTOs have a different experience than employees, one that is closer to that of first responders; they know more or less in what kind of situation they will have to work and do not experience the initial shock experienced by employees. They are also there to manage the situation, thus, they most likely feel more in control than the employees with whom they work on the CI site. This feeling of being in control of the situation is essential to reducing the negative effects of CIs, as observed among the engineers and conductors, as well as in the literature on trauma in the general population (Brillon, 2010).

6.5.2 The Difficulties in Managing CIs

Repeated contact with injured people or human remains can become problematic over time. The following hypothesis is proposed: if they are not supported and protected from these cumulative effects, MTOs may develop defence mechanisms that will then hinder their ability to adequately support employees (an increase in undesirable actions on the site and in the days following the CI, increased irritability). These negative effects of cumulative CIs have been clearly seen among engineers and conductors (Austin and Drummond, 1986, Bardon, 2014, Briem *et al.*, 2007, Karlehagen *et al.,* 1993, Margiotta, 2000, Vatshelle and Moen, 1997), and may also occur among MTOs.

Multiple CIs can generate fatigue or at least susceptibility among MTOs. A structure that would enable them to receive support or to choose not to go to the site of a CI when they feel that it is too demanding of their physical and mental well-being would help them manage the multiplicity of these CIs in their workload. In this regard, the rail industry could learn from what is in place to support police and firefighters.

6.5.3 Employee Follow-up in the Days/Weeks Post-CI

Follow-up of employees is rarely rigorous after the immediate management of the CI, although the MTOs agree that it would be useful. It is important to develop management structures on the organizational level that would support these follow-ups by MTOs. The return to work of employees is a critical time and the data from this study show that the decision to return to work

is rarely formally assessed in a pressure-free context. Employees are assessed by their MTO, who makes a decision according to management pressures. This context is generally not very conducive to making a decision based on the employee's actual health needs. Formalized procedures to assess the employee's ability to return to work independently of the chain of command would make it possible to better assess the employee's condition and thus proceed with a more appropriate return to work.

MTOs should also be supported to ensure follow-up with the employees (reminders, ways of asking questions, resources that can be recommended in case of need, etc.) so that they can, in turn, demonstrate empathy and ensure follow-up other than the technical follow-up in the days, weeks and months after the return to work, in order to assess the employees' reintegration and psychological and professional functioning. In this, they could be supported by EAP clinicians or companies' occupational health services.

7. BEST PRACTICES FOR THE MANAGEMENT OF POTENTIALLY TRAUMATIZING INCIDENTS

In order to fulfil the study's final objective, and to include the knowledge available and necessary for the development of good practices, this section will describe a set of principles upon which recommendations adapted to the Canadian rail industry context could be based. These principles are based on the findings from this study on the effects of current CIMSPs, suggestions made by the conductors, engineers and MTOs interviewed, the scientific literature on the treatment of potentially traumatic situations in general, and on previous work focused on trauma among rail industry employees.

7.1 The Role of Control in Recovery and How to Help Employees Regain Control

The loss of control over the experience is a significant risk factor in the development of posttraumatic reactions (Brillon, 2010). CIMSPs should focus on employees' regaining control of the situation, what they are going through and the processes triggered by CIs (including taking time off, returning to work and care). This taking of control is based on two key elements that will be employed throughout the recommendations: the communication of clear and accurate information about processes and resources, and participation in decision-making regarding key recovery steps.

7.2 Systematic Clinical Intervention

It is important to recognize that intensive clinical intervention is not necessary for everyone who has experienced a potentially traumatizing event. As shown in this study, a third of employees do not suffer significant negative effects in the week following the CI and another third see the effects disappear by the next month. Intensive intervention is unnecessary for them, and even potentially harmful (Wessely, Rose and Bisson, 1999). The aim of CIMSPs is thus to identify people who are at risk of developing longer-term traumatic reactions and to provide them with the appropriate support. When specialized clinical intervention is necessary, it is outside of the scope of CIMSPs and must be carried out by specialized clinicians. A systematic offer of this type of clinical intervention should therefore not be part of the development of CIMSPs.

7.3 Psychological First Aid

Psychological first aid is part of the contemporary arsenal in managing crises with high traumatic potential in various fields of intervention (Brillon, 2010).[10] It appears particularly relevant in terms of guiding the intervention immediately after the CI and in addressing concerns about the need to identify individuals at risk. Psychological first aid accompanies the recovery phase after a CI or any potentially traumatic event (Brillon, 2010). To ensure that they are administered properly and to enable the identification of those who may need more services, the following instructions and steps should be followed:

- In the hours following the CI: ensure the physical safety and well-being of the person, do not start an intervention at that time, as the person is often not in any condition to benefit

[10] See also information available at http://www.ptsd.va.gov/professional/materials/manuals/psych-first-aid.asp, which provides valuable insights into how to carry out psychological first aid (US Department of Veteran Affairs).

from it (due to fatigue, stress, being cognitively and emotionally overwhelmed by the situation), communicate information about the process and next steps, encourage contact with family and friends, identify and respond to the individual's immediate concerns, give advice that emphasizes relaxation and reducing pressure (coping mechanisms for the hours following the CI), commit to supporting and helping the person, provide a suitable space to calm down and to stabilize emotions.

- Do not impose a debriefing session to soon. This could result in an inability to assimilate the event and could cause the trauma to crystallize (Wessely, Rose and Bisson, 1999).

- The next day or within 48 hours: put the person in contact with the appropriate services to assess the presence of risk and protective factors for the development or maintenance of negative effects and acute stress (use a tool such as the rapid diagnosis toolkit for symptoms associated with posttraumatic stress and by using the risk factors identified in this study for the negative effects associated with CI[11]), encourage the use of effective coping strategies and healthy behaviours (by the employee, but also by the employer), encourage social support, identify and reduce dissociative behaviours (derealization, depersonalization).

An empathetic, warm and comforting attitude is essential. It is a non-interventionist accompaniment, for which some components can be put in place by the MTO and peer helper trained in this regard, and others by the EAP counsellor.

7.4 Social Support

The access to and use of sources of personal support are important components in recovery after a potentially traumatic event, as observed in the sample in the study and in the general population (Brillon, 2010, Guay, 2006). CIMSPs must include steps to facilitate this access.

In this respect, peer helpers are a good strategy (Creamer *et al.*, 2012, Hughes *et al.*, 2012). However, the choice and the training of peer helpers should take into account the following factors in the rail industry context:

- Offer a diversity of peers at the same terminal. Relationships are not equal and being received by a peer helper co-worker with whom the employee has no affinity can limit the effectiveness of the intervention.

- Ensure adequate peer training, including knowledge of resources available within the company, the EAP and outside, active listening and follow-up training (within days of the CI).

- Select peer helpers for the program who no longer experience significant negative effects from CIs that they may have experienced in the past.

[11] Available online at http://www.info-trauma.org/flash/media-e/diagnosisToolkit.pdf, developed by the team of Alain Brunet, trauma specialist at the Douglas Mental Health University Institute, affiliated with McGill University.

Other actions can be taken during the immediate follow-up after the CI to encourage employees to access their personal social network and to provide substitute resources if the personal network is deficient (peer helpers, co-workers, union representative).

7.5 The Organizational Context and Support of MTOs

CI management begins from the instant the crew applies the emergency brakes and reports the event by radio. From that moment on, all the actors play a role and can be trained and equipped so that their contribution will foster employee recovery. In the midst of chaos, technical procedures and administrative and legal obligations, some simple things can be done to help engineers and conductors develop fewer negative effects and recover more rapidly (Hughes *et al.*, 2012).

Some practices in place are a step in the right direction, such as the CI description forms that crews can fill out to provide the necessary information to those who need it on site.

However, other actions can go further:

- The operation control centre officers are the first people to come into contact with the employees aboard the trains. Being confronted with human remains and feeling forced to get off the train to check a victim's vital signs when they know that there is nothing they can do constitute significant risk factors for employees in developing negative effects. It may be appropriate to provide the control centre with a checklist to help assess the complexity of the CI with the crew and to decide with them whether they need to get off the train;

- When a CI occurs in an isolated place and the first emergency measures have been applied, while waiting for the first responders and the MTO, the control centre could complete a preliminary assessment of the employee's condition to accelerate the subsequent adapted service provided by specialized professionals, and to inform the MTO of the situation. This assessment could be done with a few simple questions;

- It is essential to foster communication between the control centre and the MTO so that everyone involved is well informed of the situation and the crew's condition. The MTOs reported that they don't always know what kind of situation they will encounter and would like better guidance to prepare and to be able to better respond to the employees and first responders;

- MTO training in CI management, psychological first aid and support are essential to properly accompany employees and limit the risk of actions that could interfere with their recovery;

- Accompaniment and support of MTOs by their managers are also essential. As indicated by many engineers and conductors, if an MTO is being pressured to get the traffic moving, he/she will transmit this pressure to the employees, with potential negative consequences to their recovery and their satisfaction.

These are all examples of brief, concrete actions that take little time to implement but that can save time and energy later, when they are systematically integrated into CIMSPs.

7.6 The Union's Role

Very few participants mentioned the union as a source of assistance after a CI. Some noted that they had been contacted by the local representative to see if they needed help, others received help in filing claims with the workers' compensation board. It appears that, for the employees interviewed, the union does not play an important role in CI management, except in cases of administrative, procedural, or legal difficulties with the employer

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8. RECOMMENDATIONS FOR THE DEVELOPMENT AND DEPLOYMENT OF CIMSPs

The recommendations presented here are based on the findings from this study, the good practices described in the previous section (section 7) and recommendations from previous studies on the effects of CIs in the rail network.

The recommendations were categorized according to how they play out over time: before and during the CI, in the following hours, days, weeks and months, during the rest leave, upon the return to work and after the return to work.

The objectives of the recommendations are to suggest practices aimed at the following:

- Ensuring CI management that takes into account the needs of engineers, conductors and MTOs in order to limit the negative effects experienced in the short term (in the days following the CI);

- Developing employer-supported processes to accelerate employees' recovery process after the CI (weeks, months);

- Identifying and referring employees who have developed more severe problems and who require additional longer-term assistance to appropriate professional resources;

- Implementing follow-up procedures and measures to assess employees' ability to resume work activities;

- Developing efficient processes (i.e., cost-effective in terms of the expected impacts) to ensure that they will be adopted in the rail industry.

The recommendations are also based on the premise that CI management and support intervention cannot be done by a single person (in particular, the MTO), but must be a collective process in which several actors should play a part. CIMSPs must therefore identify, train and equip all the actors who can participate. The actors in CI management and support who can help improve employee recovery are illustrated in Figure 3.

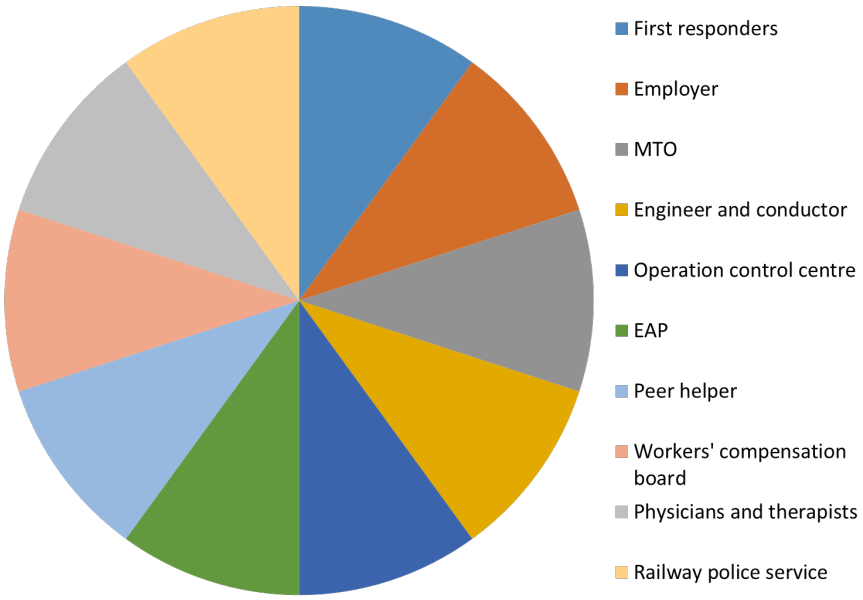

Figure 3. CI management and support actors

The development of a specific CIMSP, the prior training of actors and the deployment of support and follow-up mechanisms increase the chances that the programs will be well implemented and will produce positive effects. For a CIMSP to be used properly and to produce results, the various actors and their roles must be well defined and the program well explained (e.g., being able to differentiate between the role of a peer helper and that of an EAP professional). Much of CI management and support is therefore done even before the CI occurs, and information sharing and training are the key elements for their success. The data gathered show that unmet expectations in terms of support play an important role in the development of negative effects, anger and resentment among employees. It is therefore essential that CIMSPs be implemented as a whole in order to meet their objectives.

The effects of CIs can continue for a long time after the event and CIMSPs must include medium-term (three months) and long-term (six months) follow-up. A CIMSP must be easy to implement and cost-effective to be adopted as a standard practice by the rail industry.

Foster positive labour relations

- Objectives: to ensure that the professional context in which CIs occur are supportive and conducive to employees' recovery. Good working relationships, as observed in the study, are important protective factors (reduced stress, high reward).
- Who: employer.
- When: before CIs, in the context of development of the company's policies.

Clearly define what constitutes a CI in the context of the company's work

- Objectives: to find a consensus between the employer, managers, MTOs and employees about what should be considered and treated as a CI, to limit the risks of conflicts and dissatisfaction.
- Who: occupational physician, workers' compensation board officers, employer.
- How: by being based on the best knowledge about trauma, its prevention and treatment, including vicarious trauma and delayed effects. It is important to note that some near misses may be included in CIs, depending on the context.

Needs and expectations in terms of EAP services

- In the context of services that they receive from companies offering employee assistance programs (EAP), employers should require that specialized trauma professionals be trained in the specific field of railways and rail CIs to provide support to employees.

Support to MTOs to ensure adequate CI management

- Objectives: to support MTOs so that they can effectively implement CIMSPs.
- Who: employer
- When: during MTO training, at crew meetings, after a CI.
- How: training, post-CI follow-up by a manager, avoid sending MTOs out to CIs too closely after a previous one, emergency kit, including gloves, a survival blanket, a checklist to assess the complexity of the CI, and the psychological first-aid steps, EAP contact information.

Training for all employees

- Objectives: training employees about CIs, their management, possible consequences, and the CIMSPs in place, the role of the MTO, reducing feelings of helplessness, increasing the acceptability of assistance offered under the CIMSP, understanding the various diagnoses and their consequences with regard to medical regulations, reframing perceptions, prejudices.
- Who: employer, MTOs, employees, peer helpers.
- When: during continuing education, engineer requalifications, online, during union meetings, etc.
- How: use of short, structured training programs, leaflets or information sheets, video tools, podcasts, self-assessment checklists, etc.

Provide emergency kits on locomotives

- Objectives: to provide basic tools to assist in the management of the CI, beyond the contents of the first aid kit.

- Who: employer.

- How: with the first aid kit and CI report form, include a sturdy pair of gloves and a pair of plastic gloves, a survival blanket, a guide summarizing emergency procedures and psychological first aid.

Assessment of the complexity of the CI

- Objective: to assess the need for employees to get off the train, to adapt MTOs' actions to the situation, to anticipate employees' potential needs. When employees know that they cannot do anything, it is important to keep them from having to face the most traumatic and avoidable aspects of the CI (being confronted with human remains).

- Who: the operation control centre (OCC) officers on first contact with the crew, the MTOs upon arrival to the CI site and upon return to the terminal.

- How:

  - A few key questions should be asked by the OCC officer: did you see the person get hit? Did you see body parts? In your opinion, is the person dead, and how did he/she die? Is there a risk of fire? Do you feel that you could be in danger if you get off the train, or if you stay on board? Do you think you could do something for the victim if you get off the train? Are there people around? The officer must also estimate the time it will take before help arrives and, if it is likely to be long, offer to establish contact with the EAP or a loved one and maintain empathetic radio contact. These questions only take a few minutes longer and the answers provide the basis on which to provide psychological first aid;

  - A checklist of items to be discussed with employees can be used by the MTO prior to arrival and at the site of the CI: the CI occurred in an isolated location, there are many witnesses present, the CI occurred at a crossing or in a highly urbanized area, presence of injured people, severity of the injuries, direct contact between victims and employees. Did the employee see the victim before the collision? Are there victims, including children? How many CIs has the employee experienced and when was the last one? Do you detect the presence of emotional, psychological, cognitive or derealization reactions? Can you identify physical needs (to warm up, to drink, to change his/her clothes, etc.) and social needs (contact with a loved one, etc.)? These few questions make it possible to determine the complexity of the situation, to assess the person's initial needs and to identify some of the important risk factors. These questions require little time but they reassure the employees that their needs are understood and make it possible to gather the information necessary for a subsequent assessment of the needs and the services to provide.

Normalization of employee reactions

- Objectives: reassure the person that what he/she is going through is normal, ease the tension and anxiety at the site of the CI.
- Who: first responders, MTOs.
- When: at the CI site.
- How: validate the employee's emotions and reactions, explain that he/she is in no way responsible, provide reassurance, let the employees know that they can ask for help from the first responders if necessary and that these feelings and reactions are normal. They can get first aid, protection from the elements, and comfort.

Management of the scene of the CI

- Objectives: keep employees away from the various workers on site who may ask the same questions several times, assess the employees' well-being and needs, protect employees from additional difficulties related to the CI, provide remote follow-up if a MTO cannot get to the site.
- Who: MTO.
- When: at the CI site.
- How: sometimes, several MTOs will be onsite, which can negatively affect the consistency of the intervention. Good coordination among them is then necessary. Validate the actions taken by the employees during the CI, ask them what they need, use the resources present on site to assist (e.g., ask an ambulance attendant to assess employees' needs while the MTO takes care of other tasks). The apparent severity of the CI (injuries rather than fatalities, vehicles and no injuries) should not influence the intensity or quality of application of the CIMSP.

Demobilization

- Objectives: this practice is one of the most widely implemented. A few adjustments can make it more effective in terms of increasing the feeling of being taken care of, reducing tension and accelerating recovery.
- Who: MTOs.
- When: as soon as possible at the CI site.
- How: inform the employees of delays and explain the reasons, ensure that the employees have realistic expectations in that regard, offer to contact the EAP while they wait, ensure the physical well-being of employees while they wait, keep them away from the more traumatic aspects of the situation, demobilize them without discussion or pressure to work.

Ensure physical safety and well-being (outside of medical Emergencies that will require treatment by the first responders at the CI site)

- Objectives: ensure basic psychological first aid, promote a return to calm and the well-being of the employee.
- Who: MTO, peer helper, EAP counsellor.
- When: at the scene, immediately upon returning to the terminal.
- How: do not carry out a debriefing before the employees are able to change their clothing, to warm up or rest, address all their needs and concerns related to the CI, and also with anything else that arises at that time.

Assess the presence of risk and protective factors related to the development of negative effects and posttraumatic stress and validate/normalize employees' experiences

- Objectives: identify risk factors, adapt service provision and referrals to the appropriate resources, continue to provide psychological first aid.
- Who: MTO, peer helper, EAP counsellor.
- When: as soon as safety and physical well-being are assured, and the employee is receptive (postpone the assessment if the person is too tired or upset).
- How: compilation of information gathered by the OCC, by the MTO on site and through a checklist to be used at the terminal, hold one-on-one meetings, allow employees to express their emotions and anger as needed, assure the employee that he/she was not responsible for the occurrence of the CI.

Psycho-education

- Objectives: remind the person what he/she can do to help reduce the negative effects of the CI in the following hours and days.
- Who: MTO, peer helper, EAP counsellor;
- When: as soon as the risk factor assessment has been done, and the employee is receptive (postpone the psycho-education when the person is exhausted).
- How: during an individual or group meeting, clearly communicate information about the resources available, everyone's role in helping the employee recover, provide descriptive documents of the various support resources and the potential effects of CIs, including cumulative effects, inform them of potential delayed effects, and the possibility of consulting a professional even if they have not experienced a CI recently.

Provide three days of mandatory leave by the employer following a CI

- Objectives: ensure that the stress level caused by the CI decreases sufficiently to enable the employee and other actors to assess the ability to return to work and subsequent needs.
- When: immediately after the CI;
- How: by systematically applying the regulations and not pressuring the employee to shorten the leave; offering to extend it for a few days, if necessary, and in accordance with a collaborative assessment of the employee's conditions.

Planning of an action plan for the leave period

- Objectives: ensure that the employee is not alone and without support or clinical care for the duration of the leave. Reduce the risk of isolation and the use of negative coping strategies.
- Who: MTO, peer helper, EAP counsellor.
- When: the same day, at the terminal, or the day after the CI, depending on the employee's level of fatigue and receptivity.
- How: suggest coping strategies, identify activities that can contribute to the employee's well-being, establish proactive contact with support resources when needed, promote the use of social networks in concrete activities, provide the person with a copy of the action plan for reference, follow up on how he/she is feeling during the leave (telephone call), include family and friends in the action plan (social support) and train them in how to use it.

Ensure a safe return home

- Objectives: ensure that the employee's safety is not at risk if he/she shows signs of difficulties in concentrating.
- When: immediately after the return to the terminal.
- Who: MTO, peer helper, EAP counsellor, loved ones.
- How: offer to drive the person home, arrange transportation with a loved one.

Debriefing

- Objectives: assess and prevent the risk of developing PTSD, promote a return to pre-CI functioning, encourage the use of healthy coping mechanisms and social support, decrease dissociative behaviour, identify and manage grief and guilt.
- Who: EAP counsellor, health professional.
- When: the day after the CI, as debriefing too rapidly may be useless or even counterproductive if the person is not in a state to participate.

- How: suggest a one-on-one meeting, hold it when the person is mentally able to participate (perhaps the next day or during the leave period, if the person is exhausted or not very receptive after the return to the terminal).

Assessment of the ability to return to work

- Objectives: ensure that the employee is ready to return to work; that the decision has been discussed with the employee and that he/she agrees with the proposed plan.
- Who: MTO, EAP counsellor, physician, with the employee.
- When: depending on the duration of the leave taken by the person, at the end of the leave period granted, which can be extended as needed or as recommended by a physician.
- How: use of standardized tools and processes based on employee well-being and the assessment of the presence of negative effects and clinical symptoms, in collaboration with the employee.

Ensure a follow-up with the employees the day of the return to work

- Objectives: verify whether the employee is capable of returning to work, that he/she is comfortable with that decision, assess his/her possible needs for additional support to ensure that the return is sustainable, acknowledge what the person has experienced and the potential consequences.
- Who: MTO, peer helper, EAP counsellor.
- When: the day of the return to work, before the shift starts, and then after the first shift.
- How: conduct a face-to-face individual meeting, coach and support the MTOs so that they carry out this follow-up using a checklist.

Follow-up with employees after the return to work

- Objectives: verify whether residual negative effects from the CI persist or if the employee needs additional support.
- Who: MTO, peer helper, EAP counsellor, physician.
- When: in the weeks or months following the return to normal work.
- How: by making a phone call or holding a face-to-face meeting, setting up a reminder system for the MTOs to follow up with the checklist, ensuring that the person can access support resources and professional services as needed in the weeks and months following the C.

9. CONCLUSION

This report presents a longitudinal prospective study of the experience of Canadian railway employees and MTOs dealing with critical incidents at work. Its aim is to document the implementation of critical incident management and support protocols during these events, the effect of CIs and of the protocols applied by employers to reduce the negative consequences of these incidents. Based on these data and recommendations about trauma management in the workplace (Hughes *et al.*, 2012), the study focused on providing a series of recommendations to improve existing protocols in the rail industry.

Despite its limitations, the study has significantly advanced knowledge in the field and its translation into concrete practices that are easily applicable in the industry. One of the most important conclusions for employees, employers and organizations that manage work-related accidents is that the manner in which CIs are managed and the work environment in which they occur have a major influence on the recovery and well-being of employees (strict adherence to the protocol, empathy, presence of an MTO on site, management of the CI scene, absence of pressure, demobilization, systematic taking of leave, proactive offer of support, clear procedure for the return to work and the assessment of the worker's ability to return, deferred offer of support, follow-up after the return). This finding reinforces the importance and usefulness of management and support protocols offered by employers and emphasizes the power of the work environment to reduce the harmful effects of these events that are often difficult to prevent.

10. LIMITS OF THE STUDY

This study presents certain limitations that should be taken into account in the use of its findings. The sample is smaller than that planned because of difficulties in identifying and contacting employees, the refusal of some to participate (mainly because of their perception that they had not experienced any after-effects and that their contribution would add nothing) and an involuntary pause in our recruitment because of a student strike (the coordinator's absence for two months; in addition, the complexity of her task and the personalized contacts that she had developed with the recruitment partners made her difficult to replace). The sample of engineers and conductors thus includes 74 participants instead of the 90 desired. The study's findings should therefore be considered with caution. However, the adoption of a mixed approach, combining the results of the statistical analyses with in-depth qualitative analysis, enriches the data and qualitatively confirms what the statistical analyses indicate.

The sample of MTOs is also small (N=9) and the experiences described are relatively homogenous, which may limit the scope of the conclusions drawn from the qualitative analyses. The objective of the analysis was to identify favourable conditions in which the MTOs could make better use CIMSPs and to inform the employer of their needs in that area. Although the analysis involved only one employer, it made it possible to identify important success factors in the CIMSPs in terms of the role and needs of MTOs across the entire industry.

The participation level in the project was limited by difficulties in identifying the engineers and conductors involved in CIs and obtaining their contact information. This means that only 24% of the 306 engineers and conductors involved in CIs over the study period participated. The difficulties in finding employees may limit the scope of the data, because the sample was not completely representative of engineers and conductors in Canada. However, the participation rate was 54% for employees whose contact information was obtained. This high participation level shows that employees are interested in the project and the issues associated with CIs and want to contribute their experiences to the development of good practices.

Another limitation of the project comes from the fact that the data were collected through interviews, which creates a possible memory and recall bias, a reinterpretation by the person after the event, the desire to respond well or to hide certain things that cause the person discomfort. One of the major limitations to this approach is the data related to the presence of mental health disorders after a CI. Because of the size of the study and the numerous questions asked at each of the measurement periods, it was not possible to include standardized diagnostic tools for disorders potentially associated with traumatic events (depression, PTSD, anxiety). This information was gathered using open-ended questions about the diagnoses received by the employees. The respondents often had a limited understanding of the various diagnoses they had received and may have provided inaccurate information. However, it was not the project's objective to precisely determine the presence of mental health disorders following a CI. Nevertheless, these data made it possible to validate the fact that engineers and conductors need better information about the health problems associated with the events they have experienced.

With respect to the choice made about the alpha level of 0.05, a Bonferroni correction was applied when statistical tests were repeatedly performed on the same dependent variable, in accordance with Armstrong's instructions (2014). This approach avoided type I error inflation, because although the research was carried out in a context of discovery, it was important to identify the specific elements derived from the independent variables (for example, the impact of

a specific action of CIMSPs on post-CI effects). Of course, this approach increases the probability of type II errors (Cabin, 2000). However, it was deemed preferable to focus on reducing type I errors so that only the results with medium to large effect sizes “resist” the application of corrections in order to direct the readers to those elements most likely to produce useful changes in practice.

Finally, the correlational nature of statistical analyses limits the possibility of establishing causal relationships based solely on these data and thus to model a process of development of the negative effects of CIs and the effect of CIMSPs. However, the qualitative analysis enables this type of interpretation and helps to reduce the causal uncertainty (Teddlie and Tashakkori, 2006). The comparison of aspects that converge and diverge from results taken from qualitative and quantitative data correspond to the triangulation of methods (Bergman, 2008). This methodological system makes it possible to benefit from the strength of strictly quantitative or qualitative approaches (Teddlie and Tashakkori, 2006). In particular, through the triangulation of methods, a mixed approach is better at assessing the accuracy of the measurements (Van der Maren, 1996). In addition, the quantitative aspect makes it possible to respond to verifying aspects of the hypotheses, while the qualitative aspect makes it possible to contextualize the results and to refine the information derived from the quantitative data (Teddlie and Tashakkori, 2006).

This study is based on a social sciences approach and methodology, which does not make it possible to perform a cost-benefit analysis of the application of the proposed measures. Such an analysis would be a major argument in favour of the adoption of the recommendations by the industry.

11. SCOPE OF THE STUDY

This study empirically evaluated CI management and support measures in order to identify the most promising practices for reducing the impact of rail CIs among employees. The authors believe that this is the only study to have evaluated the implementation and effects of strategies used in various railway environments. It confirmed a lead from previous work by the research team about the importance of labour relations. If these relationships are negative, CIs may have greater negative effects. On the other hand, good labour relations are a protective factor.

By including engineers and conductors working for all the class I railway companies in Canada, this project provided an overview of the current situation and proposed recommendations that can be adapted throughout the country.

Conducting this study in partnership with CoA and the TCRC, two key industry players, facilitates the transfer of knowledge and the application of results within the rail network, as the partners are well aware of the issues related to this dissemination.

This project contributes to the definition of CI management practice and support standards to assist engineers and conductors after a CI, in Canada and around the world. It enriches the discussion regarding the need to develop occupational health and critical incident management regulations. It contributes to advancing knowledge useful to the services and professionals involved in managing the consequences of these CIs:

- Employers will find simple strategies to help them establish efficient CIMSPs (with advantageous cost-benefit ratios), and to improve them;

- EAP services will find important elements to ensure a follow-up that is well adapted to the particular characteristics and needs of engineers and conductors, especially with respect to psychological first aid, and risk and protective factors specific to the railway context;

- The union will find information to better support its members;

- The various occupational health and safety services will find ways to develop strategies to prevent workplace trauma in the rail industry, but also in other industrial sectors where these types of CIs can occur and during which employees may face potentially traumatic situations.

12. RESEARCH AVENUES

To follow up on work carried out in this project, it will be important to evaluate the implementation and the effects of a knowledge transfer program in order to disseminate the best practices in CI management and support among rail industry stakeholders. This project would focus on raising awareness, information, training, acquisition of new knowledge, and changes in practices by the employees, MTOs, unions and EAPs targeted by the strategy.

An actuarial study would also be useful to rigorously assess the financial costs of this type of CIMSP, in comparison with current practices, and to assess the potential financial benefits associated with the proposed arrangements.

Finally, a research project could examine the applicability of the CI management strategy to other industrial sectors in Québec and the rest of Canada that are not systematically equipped to deal with CIs involving employees or people from the outside, such as the trucking, mining, petroleum and construction industries.

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APPENDIX 1.A: THE ACTIONS INCLUDED IN THE CI MANAGEMENT AND SUPPORT PROTOCOLS OF THREE CLASS I RAIL COMPANIES IN CANADA

Table
Description of the various actions and components found in incident management protocols in class I companies in Canada

	CoA Protocol 2013	CoB	CoC
Demobilization	x	x	x
Peer helper	x	x	x
Clinical consultation at the terminal (EAP)	x		
Positive and empathetic attitude of the manager	x		x
Taking charge of the situation by the manager	x	x	x
Treating the employee as a victim of the incident	x		
72 hour leave	x	x	x
Additional 48 hour leave	x		
Offering transportation home	x		
Clinical follow-up with EAP	x	x	x
Contacted by the EAP		x	x
Offer of referrals		x	x

APPENDIX 1.B: CI MANAGEMENT PROTOCOL USED BY COA (DOCUMENT PROVIDED TO SUPERVISORS FOR IC MANAGEMENT)

Critical Incident Support Guidelines for managers

Critical Incident Support: Is essential for an employee that has been involved in a critical incident. It will help reduce the effects of unusually strong emotional reactions, which have the potential to interfere with their ability to function, either at the scene or later. It's all about normalizing the situation. All efforts are to be made for the well being of the employees. These guidelines are also applicable to all employees present at the time of the incident in the cab

12.1.1 Operations Control Centre

12.1.1.1 Once advised incident has happened:

- Ask how the Locomotive crew are
- Inquire about the rest of the crew (OTS).
- Make necessary arrangements to replace crew.
- Activate Peer Support.
- Make necessary arrangements for an EAP counselor to meet Locomotive crew upon arrival at the terminal.
- If law enforcement officers are involved, contact VIA Rail Canada Police Service (VRCPS) officer for liaises with police forces.
- Ask crew how they would like to be brought back home.

12.1.1.6 Once employees arrive at the terminal:

- Ensure employees have an opportunity to make contact with the Employee Assistance Program Counselor
- Advise employees that they are relieved for a minimum 72 hours with pay, from the time they arrive at their home terminal
- An additional 48 hours to be granted at the employee's request.
- Crew members should be encouraged to accept transportation home.
- Retrieval of their personal vehicle should be mutually arranged.

12.1.1.1.1 On-Site

12.1.1.2 Managers arriving on-site:

- Take charge of the situation in a way that makes the crews feel supported and be the single point of *reference.
- Treat crew members as victims of the incident
- Ask employees how they are doing
- Listen to the employee with empathy
- Ensure employees are removed from the scene as soon as possible and keep them informed of the next steps
- **Do not probe employees to try and find out if an error was done by a crew member**
- **Do not ask the engineers to move the train unless it creates a safety hazard**

12.1.1.3 If a VIA Rail manager presence is not possible;

12.1.1.4

- There should be compassionate contact with the crew.
- This guideline should be provided to the partners
  - CN, CP, CN and CP police, GEXR

12.1.1.5 *There should not be several people giving orders and asking repeatedly the same questions to the crew members.

12.1.1.7 Ongoing care and follow up:

- Support should be offered systematically at the terminal by a supervisor and a Peer support member
- Follow-up after the incident should be conducted by manager and Peer Support member.
- The Employee Assistance Program counselor will make arrangements for follow up with the crew.
- The manager should refrain from asking operational questions.

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APPENDIX 2: RECOMMENDATIONS FORMULATED BY THE PARTICIPANTS DURING THE INTERVIEWS TO IMPROVE CI MANAGEMENT

This appendix brings together the participants recommendations before, during and after the CI. It summarizes the responses that they gave to questions asked at every measurement period ("do you have any recommendations to improve CIMSPs?," "What could have been done to better help you after the CI?"). They reflect their perceptions, realistic or not, about how CIs and their consequences should or could be managed. Some of these recommendations have been repeated in the final recommendations of the report for improving CIMSPs.

Before a CI occurs

- Ensure that employees better understand the services available through the EAP;
- Provide better training about CIMSPs to peer helpers;
- Train MTOs about the CIMSPs and the various assistance services available, and about the psychological processes in play during CIs (develop communication skills and empathy) in order to better understand the different possible effects of CIs on employees.

Train employees so that they are better prepared to act, to understand what is occurring during a CI, and to offer the various services available. Make this information available at all times to all employees.

At the site of the CI

- Guarantee the presence of an MTO on the site of the CI, no matter its severity, and within a reasonable time;
- Ensure that MTOs adopt a calm, cordial, reassuring and friendly attitude when they take charge of the situation, to lessen the pressure on the employees, to be attentive to their well-being, available and flexible, to model their behaviour according to the seriousness of the situation and the state of the various employees on site, to be proactive in the exploration of emotions and in the offer of help, to take care of people and their safety before examining the technical aspects of CI management;
    - Make it mandatory to be relieved—no engineer or conductor should have to work after having experienced a CI, or have to make a request to be temporarily relieved of his/her functions. Never ask an employee, who has just experienced a CI, to move the train. Lessen pressure on the employees and do not ask that they continue to work after a CI;
    - Be released from the scene as quickly as possible by providing for the rapid arrival of the relief team (demobilization);
    - Ensure that the employee does not have to see or pass by the victim's body when leaving the scene;
- Take depositions away from the IC site;
- Ensure that only one person asks questions and that only one report is written and sent to other stakeholders by the responsible third party;
- Make sure the engineer and conductor stay together to look after each other, instead of moving away from each other to see the CI scene;
- Apply the CIMSPs even if the CI has not resulted in any fatalities and take into account the employee's employment history and number of CIs, to avoid the effects of delayed trauma;
- Ensure that everything runs as it should during and after the CI, that management errors are avoided, especially in cases where employees must respond to repeated requests for information by multiple stakeholders (police, MTO, coroner, first responders);
- Have a checklist with a procedure to follow that lays out the immediate steps and actions to be taken during a CI;
- Ensure that employees are able to stay safe and to secure the scene, that they have the training to properly manage a CI so as to be able to adequately cope with the emotional impact and stress, while performing all the actions expected of them;
- Offer specific support processes when CIs occur far from the terminal or in an isolated area.

When returning to the terminal

- Ensure the presence of an MTO at the terminal when employees arrive.
  - Ensure that the MTO assesses the condition of employees, provides information on support services, is knowledgeable about the components of the CIMSP, supports the employees and encourages them to consult and to use services;
  - Schedule a meeting within 24 hours with a clinical worker who is familiar with the railway environment and the employees;
  - Offer employees the choice of individual or group support meetings;
  - Separate technical debriefings from psychological debriefings;
  - Adapt the time of the meeting to the condition and responsiveness of the employees;
  - Facilitate contacts between employees and EAP services, and ensure that these stakeholders are responsive to employees' needs;
  - Ensure that employees are able to complete forms and absorb all the information provided to them, including at the site of the CI, and defer administrative procedures if necessary;
- Let employees go as they wish without waiting for everyone to be debriefed;
- Have a quiet and private room at the terminal to decompress and debrief;
- Set up a systematic medical evaluation after a CI;
- Identify effective versus ineffective coping strategies.

During the recovery leave

- Systematically offer leave to employees who have undergone a CI;

- Give employees the opportunity to decide for themselves when they feel able to return to work, and above all, do not set a return date based on contingencies unrelated to the employee's welfare;

- Ensure that the recovery period (three days appears adequate) can be extended without having to invest in complex administrative procedures that discourage the applicant;

- Ensure the presence of a structured peer support group;

- Receive signs of recognition from the employer in connection with the CI, which should acknowledge errors if management was inadequate or incomplete;

- Provide the necessary administrative support to employees in their efforts to file an employment injury claim with their workers' compensation board and harmonize the demands of the various internal services concerned, and avoid making employees feel that their recourse to the board could compromise their employability with the company;

- Reduce the consequences sometimes associated with obtaining a leave related to a mental disorder (depression, posttraumatic stress);

- Have the opportunity to communicate regularly with the MTO about the length of the leave and know that the MTO is available when needed;

- Avoid pressuring workers to return to work prematurely or to perceive harassment in this regard by the employer;

- Distribute information on claim opportunities and leave and care options available beyond what EAP services can offer, to speed recovery.

- Verify, through a formal evaluation, the employee's ability to operate a train after the leave. Employees express a desire to meet with the MTO before returning to work for informal discussions. They also express the need to participate in the assessment of their needs and decisions on the length of the leave.

- Consult a physician before returning to work to assess the employee's ability to return to work;

Upon the return to work

- Do not require the engineer to have an employee in training in the locomotive after a CI until the employee feels able to deal with it, especially if an engineer was in training when the CI occurred;

- Suggest adjustments to the employee's duties, without having to change everything, to promote a sustainable return to work. If necessary, have him/her do a test run or offer a familiarization trip.

In the weeks after the return to work

- Maintain regular communication between the employee and his/her MTO to discuss the emotions related to the CI and identify signs of depression or difficulties in getting back into regular activities;
- Encourage the employee to maintain a connection with an EAP professional to ensure his/her recovery. Do what is necessary for the employee to feel that the employer cares about his/her well-being;
- Provide employees with administrative support for the procedures taken with the workers' compensation board so that they do not feel they have to fight to have their rights to compensation recognized;
- The employer should make efforts to improve the safety of certain sites identified as dangerous (e.g., presence of trespassers on the tracks, numerous near accidents, lack of visibility or signage).

Generally speaking, a number of participants wanted to see an improvement in labour relations. They do not want to feel as if they are "disposable" and want the employer to resolve persistent problems attributable to the company and the difficult work environment, and not to the IC, and to mitigate the impact of unpredictable work hours on family life.

Recommendations taken from interviews with MTOs to improve CI management

The MTOs also made recommendations to improve CI management and CIMSPs. These recommendations pertain to different areas and actors involved in the management of CIs. Like those suggested by the employees, some are more feasible than others and make it possible for them to clearly discern how realistic the MTOs' expectations are.

<u>Relations with the police</u>

- Less exhaustive police investigation in cases of suicide. This type of investigation also increases stress on the passengers;
- Faster authorization by the police to move the train;
- Establishment of a standard intervention protocol with the police forces and coroners, with the content being controlled by all stakeholders, including the engineers.
- Greater empathy by the police for the engineers, who should be considered as victims.

<u>Relationships with peers and co-workers</u>

- Establishment of a system whereby MTOs can call another MTO for help or support after a CI, without feeling that they are bothering the co-worker.

<u>Relationships with the engineers</u>

- Implementation of a more rigorous follow-up procedure by MTOs after the CI, upon the return to work and afterward, in order to improve the engineers' well-being;
- Protection of engineers by not asking them to go to the scene of the CI, especially when there is no chance that the victim is still alive.

They also made recommendations to facilitate their involvement. In particular, they suggested that MTOs not be called to go to a CI when they have just experienced one a short time before, and that the employer follow up with them to assess how they are feeling after the CI.