



Physicians' beliefs and perceived importance of traumatic brain injury-associated agitation in critically ill patients: a survey of Canadian intensivists

Croyances et importance perçue par les médecins de l'agitation associée aux traumatismes crâniens chez la patientèle gravement malade : un sondage réalisé auprès d'intensivistes au Canada

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Abstract

Purpose Agitation is a common behavioural problem following traumatic brain injury (TBI). Intensive care unit (ICU) physicians' perspectives regarding TBI-associated agitation are unknown. Our objective was to describe physicians' beliefs and perceived importance of TBI-associated agitation in critically ill patients.

Methods Following current standard guidance, we built an electronic, self-administrated, 42-item survey, pretested

it for reliability and validity, and distributed it to 219 physicians working in 18 ICU level-1 trauma centres in Canada. We report the results using descriptive statistics.

Results The overall response rate was 93/219 (42%), and 76/93 (82%) respondents completed the full survey. Most respondents were men with ten or more years of experience. Respondents believed that pre-existing dementia (90%) and regular recreational drug use (86%) are risk factors for agitation. Concerning management,

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91% believed that the use of physical restraints could worsen agitation, 90% believed that having family at the bedside reduces agitation, and 72% believed that alpha-2 adrenergic agonists are efficacious for managing TBI agitation. Variability was observed in beliefs on epidemiology, sex, gender, age, socioeconomic status, and other pharmacologic options. Respondents considered TBI agitation frequent enough to justify the implementation of management protocols (87%), perceived the current level of clinical evidence on TBI agitation management to be insufficient (84%), and expressed concerns about acute and long-term detrimental outcomes and burden to patients, health care professionals, and relatives (85%).

Conclusion Traumatic brain injury-associated agitation in critically ill patients was perceived as an important issue for most ICU physicians. Physicians agreed on multiple approaches to manage TBI-associated agitation although agreement on epidemiology and risk factors was variable.

Résumé

Objectif L'agitation est un problème de comportement courant à la suite d'un traumatisme crânien (TC). Le point de vue des médecins des unités de soins intensifs (USI) sur l'agitation associée aux traumatismes crâniens est inconnu. Notre objectif était de décrire les croyances et l'importance perçue par les médecins de l'agitation associée aux traumatismes crâniens chez les patient-es gravement malades.

Méthode Conformément aux lignes directrices standard actuelles, nous avons élaboré un sondage électronique auto-administré de 42 questions, l'avons testé au préalable pour en vérifier la fiabilité et la validité, et l'avons distribué à 219 médecins travaillant dans les USI de 18 centres de traumatologie de niveau I au Canada. Les résultats sont présentés à l'aide de statistiques descriptives.

Résultats Le taux de réponse global a été de 93 sur 219 (42 %) et 76 sur 93 (82 %) personnes interrogées ont

répondu à l'ensemble du sondage. La plupart des répondant-es étaient des hommes comptant dix ans ou plus d'expérience. Les répondant-es sont d'avis que la démence préexistante (90 %) et la consommation régulière de drogues à des fins récréatives (86 %) sont des facteurs de risque d'agitation. En ce qui concerne la prise en charge, 91 % des répondant-es estiment que l'utilisation de contentions physiques peut aggraver l'agitation, 90 % croient que le fait d'avoir de la famille au chevet du patient ou de la patiente réduit l'agitation et 72 % pensent que les agonistes alpha-2 adrénergiques sont efficaces pour gérer l'agitation causée par les traumatismes crâniens. Une variabilité a été observée dans les croyances concernant l'épidémiologie, le sexe, le genre, l'âge, le statut socio-économique et d'autres options pharmacologiques. Les répondant-es considéraient que l'agitation liée aux traumatismes crâniens était suffisamment fréquente pour justifier la mise en œuvre de protocoles de prise en charge (87 %), estimaient que le niveau actuel de données probantes cliniques sur la prise en charge de l'agitation causée par un traumatisme crânien était insuffisant (84 %), et se sont dit-es préoccupé-es par les conséquences préjudiciables aiguës et à long terme et par le fardeau pour les patient-es, les professionnel·les de la santé et les proches (85 %).

Conclusion L'agitation associée à un traumatisme crânien chez les patient-es gravement malades était perçue comme un problème important pour la plupart des médecins des soins intensifs. Les médecins s'entendaient sur plusieurs approches pour gérer l'agitation associée aux traumatismes crâniens, bien que l'accord sur l'épidémiologie et les facteurs de risque était variable.

Keywords agitation · intensive care medicine · physicians · survey · traumatic brain injury

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In Canada, more than 21,000 individuals are hospitalized annually for traumatic brain injury (TBI) with an expected increase of 28% over the next 20 years.¹ Traumatic brain injury is a worldwide leading cause of mortality and disability in individuals under the age of 40, causing considerable social and economic burden.^{2–6} Around 20% of individuals with TBI have moderate and severe TBI, which involves alterations in consciousness, and these individuals are most often admitted to the intensive care unit (ICU) for advanced care and monitoring.^{7–9} Alterations of consciousness are associated with sleep/wake cycle dysregulation and difficulty in processing stimuli such as pain, anxiety, and environmental stimulation, which may lead to agitation.¹⁰ Among the complications of TBI developed by patients in the ICU, agitation creates significant challenges for health care providers and impedes bedside care.

Agitation following TBI has been defined as a subtype of delirium that occurs during the stage of posttraumatic amnesia, whereby the patient exhibits extreme behaviour including aggression, akathisia, disinhibition, and emotional lability.^{9,11} Typically, TBI-associated agitation resolves by the end of posttraumatic amnesia and is associated with frontotemporal lesions and impaired cognition.^{12,13} Traumatic brain injury-associated agitation is worrisome for patients, families, and health care professionals as it compromises patient safety, often requires chemical and/or physical restraints, delays weaning from mechanical ventilation, delays rehabilitation, interferes with usual care, and can be challenging for caregivers.^{14–16}

Despite ICU-acquired delirium being different than TBI-associated agitation in terms of etiology and symptoms, treatment approaches in TBI are often extrapolated from the literature on non-TBI delirium. Patients with TBI have been systematically excluded from ICU-delirium studies and concerns have been raised that drug interventions, such as antipsychotics and benzodiazepines, studied in the non-TBI population may have a negative impact on TBI recovery.¹⁷ Based on limited evidence and expert opinion, TBI rehabilitation guidelines have recommended minimizing the use of physical restraints, maintaining a quiet environment limiting overstimulation, and evaluating the impact of visitors on agitation.¹⁷ The applicability of these recommendations to ICU patients, however, remains unclear.

The lack of evidence on TBI-associated agitation management brought us to explore the ICU physicians' beliefs and perceived importance inspired by the primary drivers on the current management. Therefore, we aimed to describe physician's beliefs towards agitation, the concerns caused by this condition, and the perceived needs.

Methods

Survey development and validation

With approval by the Research Ethics Board of the Hôpital Sacré-Coeur de Montréal – CIUSSS NÎM (Montreal, QC, Canada; approval number, 2021-2263), we conducted a cross-sectional survey study of ICU physicians to identify their beliefs and perceived importance of TBI-associated agitation in critically ill patients in level-1 adult trauma centres in Canada. The survey research method is intended to be used to assess opinions, feelings, and thoughts.¹⁸ We developed a electronic self-administered questionnaire following current recommendations for item generation, questionnaire formatting, and survey instrument validation.^{19,20} First, we established survey constructs through literature search and research group discussions. Following a literature review, a conceptual framework (Table 1) was proposed and modified by an expert panel consisting of critical care physicians (V. M., E. C., H. T. W., M. A., F. B.), nurses (C. A.), pharmacists (L. B., A. J. F., D. W., M. S. M.), and survey methodologists (M. S. M., A. J. F., D. W.). The definitions of each domain and subdomain of the conceptual framework can be found in the Electronic Supplementary Material (ESM) eAppendix 1.

An extended preliminary list of items was developed by the lead investigator (M. S. M.), and the ten-expert panel reduced the list in a first electronic round. Once the questions were refined, the ten experts were asked to assess each question in a second electronic round and a final virtual meeting. The assessment focused on the clarity, comprehensiveness, and face validity of the questions. The final survey instrument included 42 questions using five-point Likert-scale answers (totally disagree, disagree, neither agree nor disagree, agree, and totally agree) and 12 demographic and practices questions. Following the development of the questionnaire, five ICU physicians, not part of the study population, assessed test-retest reliability. They were asked to complete the questionnaire on two different occasions with a two-week interval. We calculated a Krippendorff's alpha reliability coefficient for each domain to assess the intrarater reliability of the questionnaire. A cut-off of > 0.61 was reached for each domain (substantial agreement).²¹ We assessed answer time stability for each question and either modified or removed items with less stability ($> \pm 2$). We also tested the time required to complete the questionnaire, which took on average 12 min. Finally, two investigators tested the penultimate draft of the survey instrument focusing on relevance, flow, arrangement, and wording (M. S. M., D. W.). The final survey instrument and survey responses are included in ESM eAppendices 2 and 3.

Table 1 Conceptual framework

Belief domains	Subdomains
Epidemiology	
Risks factors	Sex and gender, age, education, medical comorbidities
Management	Pharmacologic, nonpharmacologic
Perceived importance domains	
Self-perceived need of maintaining competency	Personal interests, need for research, and identifying knowledge gaps
Importance of the outcomes	Acute risks, long-term consequences, burden
Peer influence	

Survey population and administration

The ICU physicians practicing in adult level-1 trauma hospitals in Canada were approached for participation. The participant list was initially assembled in 2018 (by V. M.) by contacting all level-1 trauma centres and was updated in June 2021 (by D. W.). The list included the 219 ICU physicians practicing full-time or part-time in 18 level-1 adult trauma centres across Canada (Alberta, $n = 2$; British Columbia, $n = 2$; Manitoba, $n = 1$; New Brunswick, $n = 1$; Newfoundland, $n = 1$; Nova Scotia, $n = 1$; Ontario, $n = 6$; Quebec, $n = 3$; Saskatchewan, $n = 1$). The electronic self-administered questionnaire was sent to all physicians using Research Electronic Data Capture (REDCap; Vanderbilt University, Nashville, TN, USA), a secure web-based platform that adheres to Canadian privacy laws.^{22,23} Participants were sent an email with the project description and an individualized link to the questionnaire. Five reminders were sent every two weeks over a three-month period. The first page of the questionnaire was an informed consent form and, if accepted, led to the questionnaire.

Statistical analyses

Survey responses are reported using descriptive statistics, proportions for count data, means, and standard deviations. The overall response rate was calculated as the sum of partially and fully completed questionnaires divided by the number of invited persons, and full completion rate is the sum of respondents who answered $\geq 80\%$ of questions divided by the sum of partial and total respondents.²⁴ To facilitate reporting, we merged “agree” and “totally agree” responses as well as “disagree” and “totally disagree” responses in the Results section. We included all responses and adjusted the denominator of respondents to account for those who did not respond to each specific question. Statistical analyses were performed using IBM SPSS

Statistics for Windows version 28.0 software (IBM Corp., Armonk, NY, USA).

Results

Characteristics of survey respondents

The survey was sent to the 219 ICU physicians between 7 April 2022 and 15 July 2022. The overall response rate was 93/219 (42%), representing each level-1 trauma centre ($n = 18$) and every province in Canada with a level-1 trauma centre ($n = 9$), and the full completion rate was 76/93 (82%) among questionnaires received. Most respondents identified as men (67/85, 79%), were older than 40 yr (64/85, 75%), and had more than 11 years of practice after critical care training (58/85, 68%); two out of three practiced in Ontario, Alberta, or Quebec (27/85, 32%; 16/85, 19%; 13/85, 13%, respectively) (Table 2). Full-respondents and partial-respondents had comparable demographic characteristics.

Agitation and delirium scales

When surveyed about local practices, the most frequently used tool to assess agitation and sedation in critically ill patients with TBI was the Richmond Agitation Sedation Scale (RASS) (68/82, 83%).²⁵ The most commonly employed delirium scales were the Confusion Assessment Method for the Intensive Care Unit (46/80, 57%) and the Intensive Care Delirium Screening Checklist (36/80, 45%).^{26,27} The Critical Care Pain Observation Tool was the most widespread pain assessment tool used (61/79, 77%) followed by the Numerical Relative Scale (15/79, 19%).²⁸ Seventy-nine out of 81 respondents (97%) declared not having a specific protocol for the management of agitation in patients with TBI in their ICU.

Table 2 Characteristics of study participants

Variable	<i>N</i> = 85
Gender identity, <i>n</i> /total <i>N</i> (%)	
Men	67/85 (79%)
Women	17/85 (20%)
Other	1/85 (1%)
Age group (yr), <i>n</i> /total <i>N</i> (%)	
31–40	21/85 (25%)
41–50	33/85 (39%)
> 51	31/85 (36%)
Province practice, <i>n</i> /total <i>N</i> (%)	
Ontario	27/85 (32%)
Alberta	16/85 (19%)
Quebec	13/85 (13%)
British Columbia	7/85 (8%)
Manitoba	7/85 (8%)
Nova Scotia	7/85 (8%)
Saskatchewan	4/85 (5%)
Newfoundland and Labrador	3/85 (3%)
New Brunswick	1/85 (1%)
Primary medical speciality, <i>n</i> /total <i>N</i> (%)	
Internal medicine	34/85 (40%)
Surgery	20/85 (23%)
Anesthesia	17/85 (23%)
Other	
< 5 years	11/85 (13%)
6–10 years	16/85 (19%)
> 11 years	58/85 (68%)
Types of ICU, <i>n</i> /total <i>N</i> (%)*	
Medical, surgical, and medicosurgical	146/314 (46%)
Trauma	61/314 (19%)
Neurotrauma	57/314 (18%)
Neurologic	46/314 (15%)
Other	4/314 (1%)
ICU with 24-hr in-house intensivist coverage, <i>n</i> /total <i>N</i> (%)	
15/82 (18%)	
Patients with TBI admitted per year, <i>n</i> /total <i>N</i> (%)	
< 100	26/82 (32%)
101–200	31/82 (38%)
> 200	13/82 (16%)
Don't know	12/82 (14%)

*The types of ICU are not mutually exclusives

ICU = intensive care unit; TBI = traumatic brain injury

Perceived incidence of traumatic brain injury-associated agitation, risk factors, and potential interventions

A significant proportion of respondents (48/80, 60%) believed that ICU clinicians underestimate the real frequency of TBI agitation whereas most respondents (66/76, 87%) considered TBI agitation frequent enough to justify the implementation of management protocols. Interestingly, 45% (34/76) of respondents believed that TBI agitation is self-resolving and 90% (71/79) believed that the severity of agitation could be reduced by the presence of family at the bedside.

Many respondents neither agreed nor disagreed with the idea that men may develop more agitation than women (38/79, 48%), but agreed that aggression as a clinical manifestation of agitation is more frequent in men (37/76, 49%) and that agitation episodes are more at risk of being underreported in women (38/81, 47%).

When respondents were asked about age as a risk factor for agitation in patients with TBI, they agreed that the diagnosis of TBI agitation is more challenging in older individuals (39/81, 48%) and that younger patients more frequently develop physical agitation (35/77, 44%). Neither a higher level of education nor a higher family income was considered a protective factor for agitation (both 50/81, 62%). Responses concerning the influence of lower social economic status on risk of TBI agitation also suggested a perceived limited effect (disagree/strongly disagree: 32/80, 40% and neither agree nor disagree: 35/80, 44%).

Most respondents agreed that pre-existing dementia, regular recreational drug use, and anxiety disorders are risk factors of developing agitation following TBI (70/78, 90%; 65/76, 86%; 54/79, 68%, respectively). Less agreement was noted when respondents were asked about attention deficit hyperactive disorder, bipolar disorder, or previous antipsychotic drug use (agree/strongly agree 42/77, 54%; 38/79, 48%; 31/81, 38%, respectively), where an important portion of respondents neither agreed nor disagreed with these potential risk factors (34/77, 44%; 36/79, 46%; 38/81, 47%, respectively). Seventy-three out of 80 (91%) believed the use of physical restraints could worsen agitation episodes.

Half of respondents agreed that agitation in patients with TBI should not be treated with the same approach as hyperactive delirium (39/79, 49%). A majority of respondents believed that alpha-2 adrenergic agonists (i.e., clonidine and dexmedetomidine) and beta blockers (i.e., propranolol) are efficacious in managing TBI agitation (agree/strongly agree, 57/79, 72%; 43/79, 54%, respectively). Regarding the use of antipsychotics, 44% (36/81) of respondents believed their use is safe, while 38%

(31/81) neither agreed nor disagreed regarding their safety. Respondents judged opioids as nonefficacious for managing TBI agitation (39/81, 48%, respectively), but agreed that withdrawal from benzodiazepines or opioids increases the risk of agitation (69/76, 91%). Two thirds of respondents believed the presence of a sitter at the bedside could decrease the use of pharmacologic agents (54/81, 68%).

Perceived importance, significance, and impact of traumatic brain injury-associated agitation

Respondents perceived the topic of agitation in patients with TBI as being interesting or very interesting (61/76, 80%) and two thirds of respondents would be interested in gaining more knowledge on the topic (51/76, 67%). Most respondents perceived the current level of evidence to be insufficient to guide the management of patients with TBI and agitation (64/76, 84%) and believed that there was a need for validated specific monitoring tools to TBI-associated agitation (56/76, 74%). More than three-quarters of respondents agreed that agitation in TBI should be a high priority for trauma research (58/76, 76%).

Seventy of 76 respondents were worried that an agitated patient with TBI could injure a health worker (agree 43/76, 57%; strongly agree 27/76, 35%) and 56/76 (agree 46/76, 60%; strongly agree 11/76, 14%) were concerned about patient self-injury and device removal. Concerning long-term outcomes, respondents agreed agitation in the ICU affects the rehabilitation pathway of a patient with TBI (agree 44/76, 58%; strongly agree 12/76, 16%) and were worried about the potential unfavourable long-term cognitive consequences secondary to ICU management of agitation and the potential chronic behavioural problems some TBI-agitated patients might develop (47/76, 62%; 47/75, 63%, respectively).

Most respondents perceived TBI-associated agitation to be a burden for both families and the clinical care team. Nearly all respondents' agreed agitation was an important source of distress on families (agree 40/76, 53%; strongly agree 33/76, 43%) and its management required more human resources (agree 44/76, 58%; strongly agree 21/76, 28%). More than two-thirds agreed agitated patients increased their daily workload (agree 48/76, 63%; strongly agree 7/76, 9%) but when asked if agitation increased their stress level, the responses were more diverse (agree/strongly agree: 32/76, 44%; disagree/strongly disagree: 29/76, 38%). Respondents affirmed that bedside nurse evaluations influenced their medication (agree 53/76, 70%; strongly agree 17/76, 22%) and physical restraint prescription practices (agree 52/76, 68%; strongly agree 15/76, 20%) and agitation management was discussed among the multidisciplinary

team (agree 44/76, 58%; strongly agree 25/76, 33%). Interestingly, respondents perceived that a psychiatric consultant does not facilitate the management of TBI-associated agitation (42/76, 55%).

Discussion

In this study, we examined the beliefs and perceptions of Canadian ICU physicians working at level-1 trauma centres regarding TBI-associated agitation. We observed variable beliefs on factors perceived to increase the risk of TBI-associated agitation, as well as on interventions potentially helpful to manage this condition in the ICU and on its perceived importance in the care of critically ill patients with TBI. Nevertheless, several patient-related, ICU-related, and management-related risk factors identified by respondents are potentially modifiable while suggested interventions, including pharmacologic interventions, are easily available at the bedside.

Our observations are in accordance with previous studies and knowledge. Respondents perceived the typical patient with acute TBI developing agitation as a young man, a recreational drug user, and having medical comorbidities such as anxiety disorders, attention deficit hyperactive disorder spectrum, or older individuals with pre-existing dementia. These beliefs are supported by previous observational studies in critically ill patients with TBI.^{8,9} Several interventions were believed to be potentially effective at managing TBI-associated agitation. Among those, alpha-2 adrenergic receptor agonists were the most often mentioned drugs to potentially manage agitation. Dexmedetomidine has been suggested as a option to manage delirium in the general ICU population, although the evidence supporting its use for this indication is limited.²⁹ The use of dexmedetomidine in critically ill patients with TBI has only been described in retrospective observational studies.^{30,31} More than half of respondents also believed beta blockers could be a useful pharmacologic intervention to treat acute TBI-associated agitation. This belief is aligned with findings from a small single centre placebo-controlled trial, which evaluated propranolol and reported a reduction in agitation intensity after five weeks of treatment.³² The respondents' beliefs regarding the potential of beta blockers and alpha-2 adrenergic receptor agonists may be explained by the high proportion of patients with acute TBI developing symptoms of paroxysmal sympathetic hyperactivity, which is often accompanied by episodes of agitation, and for which these interventions may have a role.³³⁻³⁶ Respondents also believed that antipsychotics could be beneficial for managing agitation. In a recent systematic review, our

team did not find strong evidence supporting the use of antipsychotics in critically ill patients but observed the potential for prolonged posttraumatic amnesia recovery with their use.³⁷ In a recent international survey of health care professionals mostly working in rehabilitation centres, respondents reported pharmacologic interventions such as atypical antipsychotics, anticonvulsants, antidepressants, and beta-blockers as being potentially useful.³⁸ Unlike our findings, alpha-2 adrenergic receptor agonists were not mentioned, likely because of sedative effects, route of administration, and need for continuous monitoring. The disparity between physicians' beliefs and current evidence underlines the equipoise concerning the efficacy and safety of pharmacologic interventions to manage TBI-associated agitation.

Respondents unanimously believed in the role of family and sitters at the bedside to help manage TBI-associated agitation. These findings are in accordance with the beliefs of rehabilitation setting health care professionals who deemed essential the presence of family members and stressed the need to educate families about agitation following a TBI.³⁸ Although current evidence is limited, different family involvement strategies are suggested to prevent delirium in the ICU.³⁹ These strategies include flexible and extended visiting hours, setting up family activities, and directly (in person) or indirectly (through voice-recorded messages) reorienting critically ill patients.^{40–45} Flexible visiting reduces delirium incidence and when added to patient reorientation leads to more delirium-free days, shorter delirium durations, lower infections rates, and shorter ICU and hospital stays.^{39,40,42,46} Interestingly, almost all respondents considered agitation as a source of stress for patients' relatives. Based on a recent meta-analysis, family member involvement in managing delirium also reduces their own anxiety.⁴⁷ The effects of visitor restrictions imposed by the COVID-19 pandemic is an excellent example supporting the benefits of the presence of families and relatives at the bedside.⁴⁸ In the ABCDEF bundle, the "F" element focuses on promoting family presence in the ICU and identifying strategies to engage and empower families. According to guidelines, engaging families in patient care during critical illness has a positive impact and can decrease anxiety, confusion, and agitation.⁴⁹ Nevertheless, most published studies were conducted in nonneurocritically ill populations and did not specifically look at agitation.

Consensus was found when respondents were asked about the effects of physical restraints on TBI-associated agitation. More than 90% of respondents considered that physical restraints worsen agitation episodes while observational studies suggest that agitation is the most common reason for their use.⁵⁰ Almost 90% of respondents believed that nurses influence physical restraint prescription. Unfortunately, we ignore how exactly

physicians are influenced by nurses as physical restraints are prescribed by physicians but the need for their use is often evaluated by bedside nurses. Nevertheless, this problem is well known in the ICU, and nursing-led educational measures have been identified to reduce the use of physical restraints.⁵¹ Our findings are corroborated by a recent qualitative study in which health care providers caring for agitated patients with TBI believed both chemical and physical restraints might negatively impact patient recovery, despite their usefulness in ensuring both patient and health care provider safety.⁵²

Respondents recognized the significance, burden, and consequences of TBI-associated agitation. The risk of a harmful event, such as self-injury or injury to third parties, was a cause for concern among most respondents. While there are no consistent data concerning the long-term impacts of ICU agitation episodes on patients with TBI, respondents expressed concern not only about the agitation by itself but also about current ICU management strategies for agitation. Unanimity was displayed among respondents regarding the increased time, workload, and human resources required for the management of TBI-associated agitation.

Traumatic brain injury-associated agitation was perceived as a significant clinical issue for most respondents. They showed a substantial interest in the topic and believed there is a need for further research. Interestingly, this opinion aligns with the existing literature, which highlights an absence of evidence supporting therapies used to manage TBI-associated agitation, resulting in a lack of clinical guidelines to aid ICU professionals.³⁷ This lack of clinical guidelines for managing TBI-associated agitation extends beyond the intensive care settings and persists throughout the entire care trajectory, as observed in a recent international survey in rehabilitation settings.³⁸ The first course of action for the research agenda should be to better identify patient characteristics associated with the development of agitation. Second, evidence is needed regarding optimal TBI-associated agitation prevention and management strategies. Lastly, but equally crucial, is ensuring knowledge translation to health care professionals to eliminate beliefs and practices that may hinder optimal recovery.

Strengths and limitations

This study has several strengths, including rigorous survey methodology using current guidelines for self-administered questionnaires to ensure clarity, relevance, and validity. We also used an exhaustive list of potential respondents developed by contacting level-1 trauma centres to ensure having an updated list of practicing physicians. Moreover, we obtained good pan-Canadian representation with respondents from all level-1 trauma centres and Canadian

provinces. Although not perfect, our response rate (42%) is good for inquiries in this population and is comparable to previous ICU physicians self-administered surveys.^{53–55} Nevertheless, we cannot exclude potential selection bias if nonrespondents had different opinions than respondents regarding TBI-associated agitation. Nevertheless, respondents who partially completed the survey had comparable characteristics to those who fully completed it. Important efforts were made to ensure that participants received the email invitation in their inbox, giving them the option to participate in the survey or not, although some servers may have classified our email invitation as spam. The survey population is limited to a fraction of ICU physicians working in level-1 trauma centres and may not reflect the opinions of nonrespondents and also excludes ICU physicians practicing in other levels and/or pediatric trauma centres.

Conclusions

In this health care survey of Canadian ICU physicians, TBI-associated agitation was believed to be an important clinical issue in respondents' practices and several risk factors were believed to be associated with its incidence. On the other hand, the potential impact that TBI-associated agitation might have on patients' recovery, health care professionals, and relatives was also believed to be significant. Nevertheless, variable beliefs were identified regarding its epidemiology and management. The results of our survey emphasize the need for future research to better understand TBI-associated agitation in the ICU and its management.

Author contributions Mar Saavedra-Mitjans and David Williamson contributed to all aspects of this study, including study conception and design; acquisition, data analysis, interpretation of data; and drafting the article. Anne Julie Frenette, Victoria A. McCredie, Lisa Burry, Caroline Arbour, Sangeeta Mehta, Emmanuel Charbonney, Han Ting Wang, Martin Albert, and Francis Bernard contributed to study design and revised the article.

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