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INCOG 2.0 Guidelines for Cognitive Rehabilitation Following Traumatic Brain Injury: Methods, Overview, and Principles

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Introduction: Moderate to severe traumatic brain injury (TBI) results in complex cognitive sequelae. Despite hundreds of clinical trials in cognitive rehabilitation, the translation of these findings into clinical practice remains a challenge. Clinical practice guidelines are one solution. The objective of this initiative was to reconvene the international group of cognitive researchers and clinicians (known as INCOG) to develop *INCOG 2.0: Guidelines for Cognitive Rehabilitation Following TBI*. **Methods:** The guidelines adaptation and development cycle was used to update the recommendations and derive new ones. The team met virtually and reviewed the literature published since the original INCOG (2014) to update the recommendations and decision algorithms. The team then prioritized the recommendations for implementation and modified the audit tool accordingly to allow for the evaluation of adherence to best practices. **Results:** In total, the INCOG update contains 80 recommendations (25 level A, 15 level B, and 40 level C) of which 27 are new. Recommendations developed for posttraumatic amnesia, attention, memory, executive function and cognitive-communication are outlined in other articles, whereas this article focuses

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on the overarching principles of care for which there are 38 recommendations pertaining to: assessment (10 recommendations), principles of cognitive rehabilitation (6 recommendations), medications to enhance cognition (10 recommendations), teleassessment (5 recommendations), and telerehabilitation intervention (7 recommendations). One recommendation was supported by level A evidence, 7 by level B evidence, and all remaining recommendations were level C evidence. New to INCOG are recommendations for telehealth-delivered cognitive assessment and rehabilitation. Evidence-based clinical algorithms and audit tools for evaluating the state of current practice are also provided. **Conclusions:** Evidence-based cognitive rehabilitation guided by these recommendations should be offered to individuals with TBI. Despite the advancements in TBI rehabilitation research, further high-quality studies are needed to better understand the role of cognitive rehabilitation in improving patient outcomes after TBI.
Key words: *cognitive rehabilitation*, *guidelines*, *knowledge translation*, *neuropsychology*, *rehabilitation*, *therapeutic approaches for the treatment of CNS injury*, *traumatic brain injury*

MODERATE TO SEVERE TRAUMATIC BRAIN INJURY (MS-TBI) is a significant public health concern. It can cause cognitive deficits, as well as other impairments, that have a serious impact on an individual's independence in daily living and relationships. Hundreds of research trials have explored the impact of rehabilitation on cognitive impairments post-TBI; however, there remains a significant gap in translation of research evidence into frontline clinical practice.[1] Due to the complexity of interventions available, clinicians need assistance in deciding which cognitive rehabilitation interventions apply to which person with TBI; clinical practice guidelines (CPGs) are a proposed solution. CPGs are systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances.[2] CPGs provide evidence-based practice recommendations and offer concise instructions to guide healthcare services and are considered promising tools for improving healthcare.[3–6] Previous work by the international panel of experts in cognitive rehabilitation after TBI (referred to as the INCOG team), including clinicians, researchers, and knowledge translation experts, found that few TBI CPGs had a high-quality development process, and few provided clinicians with implementation tools and criteria for auditing their practice.[7] To address this gap, specifically in cognitive rehabilitation post-TBI, the INCOG team published the first version of INCOG guidelines (2014).[8–13] The purpose of this article is to provide detailed methodology for the development and update of the INCOG guidelines. Further, this article also included principles and telerehabilitation techniques for cognitive rehabilitation.

SCOPE AND PURPOSE

The purpose of the INCOG 2022 guideline is to provide evidence-based recommendations for the cognitive rehabilitation of persons with MS-TBI in all relevant phases of care. These guidelines aim to improve patient outcomes and reduce the impact of cognitive deficits on individuals after TBI. Although the literature reviewed was largely focused on MS-TBI, there were some studies that also included people with mild TBI, and some approaches may be applicable with this group. The team decided not to cover mild TBI because of the multifactorial nature of cognitive complaints in this group and the challenge of comparing rehabilitation outcomes across levels of severity. The guideline covers key areas of cognitive rehabilitation including assessment and intervention for posttraumatic amnesia (PTA), attentional deficits, memory impairment, cognitive-communication disorders, and executive dysfunction. It is not the purpose of this guideline to cover the assessment of low level of consciousness, or the management of posttraumatic behavioral disturbances, or mood and adjustment disorders, including depression, as these other topics required more detailed review by experts in mental health. The guideline was also not intended to cover deficits more commonly associated with focal brain injury including aphasia, visuoperceptual deficits, acalculia, and apraxia. Comprehensive coverage of treatment for these deficits can typically be found in stroke guidelines.[14,15]

TARGET USERS

The primary users of INCOG 2022 are anticipated to be healthcare professionals. However, it may also be used by stakeholders (ie, policy makers, funding bodies) or rehabilitation support workers who provide, or make decisions about, rehabilitation care for persons with TBI, and persons with brain injury and their families.

TARGET POPULATION

The target population for whom these recommendations are developed includes adults 18 years and older with MS-TBI and residual cognitive impairments. MS-TBI is defined by a Glasgow Coma Scale score of less than 13 at any point following injury. This guideline does not cover children as there are limited studies and challenges in appraising cognitive rehabilitation interventions in children who still have developing brains. While there were some systematic reviews, we were unable to find a CPG for children.[16,17]

METHODS

INCOG guideline update

The INCOG guideline update followed a rigorous process that is based upon the guideline adaptation cycle by Graham and Harrison[18] (outlined in Figure 1) including these steps:

1. *Convene an international expert panel in cognitive rehabilitation*. The INCOG team identified members of the panel that were willing to participate again and some new members. The expert consensus group included all professions usually engaged in cognitive rehabilitation (ie, neuropsychology, occupational therapy, speech-language pathology, physicians, and physical therapists), researchers, and individuals with guideline development expertise. All members participated in the development of the principles of care recommendations and smaller expert groups, specific to each cognitive domain, were created to develop those recommendations.
2. *Update literature search.* A systematic search (2014 to July 2021) of multiple databases (Medline, Embase, Cochrane, CINAHL, and PsycINFO) was conducted to identify MS-TBI articles published in the English language since the original INCOG. The search consisted of terms related to brain injury and cognition, as well as the specific domains of attention, memory, executive functions, and cognitive-communication/social cognition. A search following the same methodology was conducted specifically for PTA. The full search strategy can be found in the Supplemental Digital Content (available at: http://links.lww.com/JHTR/A632). All references were exported and refined using Endnote X9 (Clarivate, Pennsylvania). After duplicates were removed, all articles underwent a title/abstract screen, and if appropriate a full-text review, by 2 independent reviewers. Articles were extracted and provided to the working groups if they met the following criteria: (1) interventional study, (2) more than 3 participants, (3) human participants, (4) at least 50% of the participants had am MS-TBI, and (5) mean age of participants was 18 years and older. Systematic reviews and meta-analyses were separated from the search and summaries were provided to the expert panels. All relevant references from 2014 were consolidated into a reference library that was made available to the author teams. A detailed PRISMA flowchart can be found in the Supplemental Digital Content (available at: http://links.lww.com/JHTR/A632). Research articles meeting inclusion but published after July 2021 were added based on the discretion of the expert panel. The Evidence-Based Review of Acquired Brain Injury (ERABI: www.erabi.ca) was cross-referenced to ensure no articles were missed.
3. *Search and retrieve guidelines.* A systematic Medline search (2014 to October 2021) was conducted to identify new MS-TBI and cognitive rehabilitation evidence-based guidelines. An internet search (ie, Google and guideline search sites) was also conducted. Search terms and results can be found in the Supplemental Digital Content (available at: http://links.lww.com/JHTR/A632). Guidelines focused on MS-TBI and published in English were reviewed. Recommendations were only included if they specifically focused on cognitive rehabilitation.

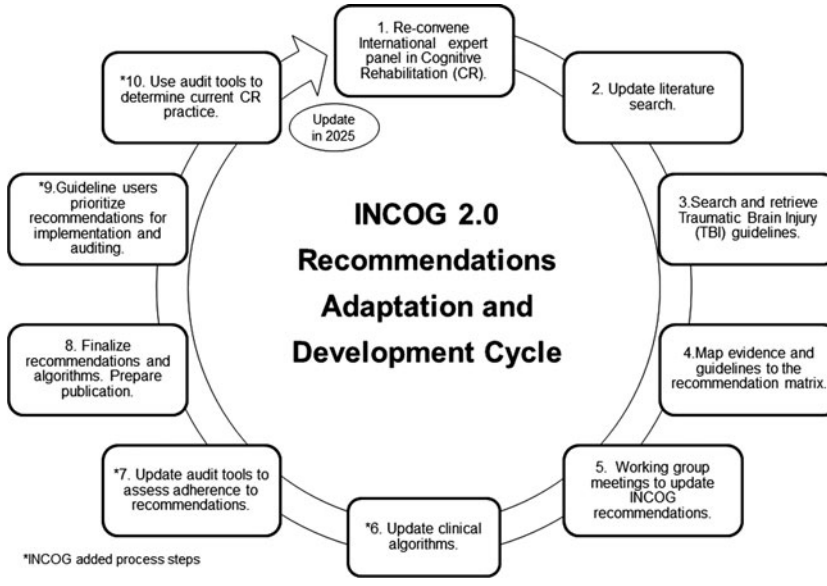

Figure 1. INCOG 2022 recommendations adaptation and development.

4. *Map evidence to guidelines in matrices.* Matrices were created based on the original INCOG 2014 recommendations. Recommendations abstracted from the new guidelines identified through the search were added to this matrix. For each recommendation, a synopsis of evidence was provided (ie, studies, systematic reviews, and meta-analyses). Evidence synopses for newly emerging areas were flagged for the panel as potential new recommendation topics.
5. *Working groups were convened to update the guidelines*. Panel experts reviewed the matrix and new evidence prior to convening. During a series of videoconference meetings, each group discussed and arrived at a consensus as to the recommendations for the following 6 topics: principles of cognitive assessment or intervention, PTA, attention, memory, executive functions, and cognitive-communication. Occasionally, the experts identified studies that provided background regarding a topic or were in press. These were then abstracted to determine whether they met inclusion criteria. The experts either updated recommendations or articulated novel recommendations based on the new evidence while considering the clinical applicability of recommendations to enhance outcomes for individuals with TBI. Once a recommendation was drafted, the level of evidence (A, B, or C) was determined based on the strength of the supporting evidence (see Table 1). Consensus of the working group was reached when members unanimously agreed to the wording and the evidence grading assignment of all the recommendations. Each group required about 3 to 4 virtual meetings per topic to complete this work.
6. *Update clinical algorithms.* Once the recommendations were finalized, the working groups reviewed the algorithms from INCOG 2014, examined individual publications, and drew upon their clinical experience to modify the algorithms. This process included examining the inclusion and exclusion criteria for each study. This process aided in the identification of decision points and characteristics upon which clinicians could tailor treatment to an individual person with TBI and their cognitive impairments. By understanding the subpopulations of patients with TBI to whom the evidence applies (eg, considering time post-injury, severity of memory impairment, or types of comorbidities), the team derived a consensus as to what treatments are appropriate for each individual with TBI.
7. *Update audit tools.* Clinical care may be improved if clinicians follow guideline recommendations; audit and feedback can be an effective method for promoting guideline uptake.[19–21] Therefore, the INCOG 2022 guideline team identified and prioritized the finalized recommendations that could be audited within patient health records to determine adherence to that recommendation. For each selected recommendation, the group identified indicators for adherence and where the information could be found within a patient medical record.
8. *Finalize recommendations grading and tools.* The recommendations, clinical algorithm, and audit tool were examined in their entirety for consistency and accuracy. These were then integrated into the INCOG manuscripts. The guidelines were then peer-reviewed as part of the manuscript submission process by external reviewers. The guidelines were amended based on these reviews.
9. *Prioritize recommendations for implementation.* The next recommended step is for guideline users to identify those areas of practice that they most would like to focus implementation efforts locally. The INCOG team intends to audit current practices to inform future guidelines and implementation efforts and hopes to update the guidelines in 3 years' time.
10. *Use audit tools to determine current cognition rehabilitation practice.* Guideline users are encouraged to audit their current practice.

TABLE 1 *INCOG level of evidence grading system*

A: Recommendation supported by at least one meta-analysis, systematic review, or randomized controlled trial of appropriate size with relevant control group.
B: Recommendation supported by cohort studies that at minimum have a comparison group (includes small randomized controlled trials) and well-designed single-case experimental designs.
C: Recommendation supported primarily by expert opinion based on their experience, though uncontrolled case studies or series may also be included here.

LIMITATIONS OF USE AND DISCLAIMER

These recommendations are informed by evidence for MS-TBI cognitive rehabilitation interventions that was current at the time of publication. Relevant evidence published after the INCOG guideline could influence (ie, the strength of the evidence or directionality) the recommendations contained herein. Clinicians must also consider their own clinical judgment, patient preferences, and contextual factors such as resource availability in their healthcare system in their decision-making processes when implementing these recommendations.

Note: The INCOG developers, contributors, and supporting partners shall not be liable for any damages, claims, liabilities, costs, or obligations arising from the use or misuse of this material, including loss or damage arising from any claims made by a third party.

RESULTS

INCOG recommendations overview

The INCOG 2022 guidelines include 80 recommendations relating to best practice for cognitive rehabilitation following brain injury. Of these, 27 recommendations are new to this update. While there are numerous level A ($n = 25$) and level B ($n = 15$) recommendations, half of the recommendations are based on level C evidence (ie, consensus of the experts; 40 recommendations). The recommendations for PTA ($n = 6$),[22] attention ($n = 11$),[23] memory ($n = 8$),[24] executive functions ($n = 8$),[25] and cognitive-communication ($n = 9$)[26] are provided within other articles in this series. Foundational to all the articles are recommendations for the assessment of persons with TBI requiring cognitive rehabilitation (see Table 2; 10 recommendations), as well as general principles for cognitive rehabilitation (see Table 3; 6 recommendations) and pharmacological management (see Table 4; 10 recommendations). Despite the growing body of TBI literature, many of these recommendations remain consensus-based. This is heavily influenced by the challenges of studying these foundational overarching principles using rigorous study designs. In light of the emergence of coronavirus disease-2019 (COVID-19) and the impact of the pandemic globally, there is hastened need to adopt telerehabilitation techniques for cognitive rehabilitation. As such, this article also provides recommendations for telehealth-assisted cognitive assessment (see Table 5; 5 recommendations) and intervention (see Table 6; 7 recommendations).

Approach to the assessment and treatment for the person with traumatic brain injury

INCOG recommends the completion of a detailed assessment prior to initiating cognitive rehabilitation. During the early stages of recovery from MS-TBI, individuals typically progress through a variable period of loss of consciousness, low level of arousal, and then PTA. During this phase, comprehensive cognitive assessments are not recommended, as the status of individuals typically changes hourly and daily. Assessment at this stage is discussed further in the INCOG guidelines for PTA.[22]

Please note that the INCOG team decided that, in general, we would not specify the battery of tests that should be used in assessment or evaluation of cognitive domains, given the influence of clinical judgments, licensing issues, and local preferences. The reader is referred to systematic reviews of current assessment tools used in TBI rehabilitation[27] and specific guidelines for cognitive and communication assessment.[28]

During an assessment it is necessary to rule out medical and iatrogenic causes of cognitive impairment by appropriate medical evaluation and review of all medications prescribed. Principles for pharmacological management of cognitive sequelae are included in this version. Given these principles are foundational to all pharmacological management, they remain largely unchanged from INCOG 2014.

Recommendations for telehealth-supported assessment and telerehabilitation in cognitive rehabilitation with TBI

Given the COVID-19 pandemic and rapid transition to telehealth, the INCOG team felt that it was necessary to develop recommendations for cognitive rehabilitation that utilizes advanced communications technology. Telerehabilitation is defined as the individualized and personalized delivery of rehabilitation care and services (including assessment, diagnosis, goal-setting, therapy, education, and monitoring) using a variety of technologies including the telephone and/or internet-based videoconferencing.[29] For the purposes of this guideline, telerehabilitation involves a minimum of 2 people communicating. It does not include automated internet or computer-based training that is delivered by programmed software to the person with TBI without a clinician or trainer present.

Use of telehealth for assessment may yield different results than in-person assessment. For example, nonverbal cues may not be as apparent, and some information gleaned from physical examinations may be missed. Unfortunately, given the rapid implementation of virtual care due to the pandemic and the resulting inequities in access to healthcare, researchers and clinicians have been compelled to adapt quickly using assessments that appear appropriate for deployment over telehealth, despite the reality that these measures have not been evaluated (ie, validity and reliability) properly through that mode of delivery. Despite the limited number of studies published thus far, consensus-based recommendations have been provided. It is important to remember that in-person and virtual care can be provided as a hybrid model and should be based on what is best for the individual with TBI.

Algorithm for individualized cognitive rehabilitation

Clinicians are encouraged to follow the decision algorithm in Figure 2 that outlines how to navigate through this whole series of guideline topics. After experiencing

TABLE 2 *INCOG 2.0 recommendations for assessment of the person with traumatic brain injury requiring cognitive rehabilitation and new supporting evidence*[a]

	Guideline recommendation	Grade	Reviews	RCTs	Other
	Section title				
Assess #1	All individuals with TBI who are conscious, including those in posttraumatic amnesia should be assessed for common impairments including: • Motor impairments, such as weakness, altered tone, balance, and incoordination • Previously missed MSK injuries/skeletal fractures • Pain • Bulbar problems affecting speech and swallowing • Sensory dysfunctions that may impact on safety including hearing loss, numbness, visual problems (eg, reduced acuity, visual field loss, and gaze palsies) • Autonomic dysfunction • Cognitive dysfunctions such as impairments in attention, communication, orientation, and memory • Behavioral dysregulations including potential emotional/behavioral issues. (INCOG 2014,[8] Assess 1)	C			
Assess #2	Posttraumatic amnesia assessment of a person with TBI should be performed daily using the Westmead Post-Traumatic Amnesia Scale, until resolution of PTA. (INCOG 2014,[8] Assess 2 and PTA 1) *Note*: Please see the detailed rationale for this recommendation in the PTA paper within the INCOG series.[22]	B			Hennessy et al[30] Ponsford et al[1] Spiteri et al[31]
Assess #3	After emerging from posttraumatic amnesia, all individuals with TBI should be assessed for the presence of cognitive impairments in the following areas: • Attention (including speed of processing) • Executive function • Language, social communication • Social cognition • Cognitive communication • Learning and memory • Awareness of impairments • Detection/expression of emotion • Visuospatial function The purpose of this assessment is to plan treatment. The assessment may either be standardized or nonstandardized depending on a number of factors, such as apparent rate of recovery and need of data for future planning. This assessment should include observation of the functional impact of cognitive impairments in a real-world setting. A formal standardized evaluation should be completed before initiating a cognitive rehabilitation program. The selection of tests used should consider language, race/ethnicity, acculturation, and culture. (INCOG 2014,[8] Assess 3)	-C			

(*continues*)

TABLE 2 *INCOG 2.0 recommendations for assessment of the person with traumatic brain injury requiring cognitive rehabilitation and new supporting evidence*[a] (Continued)

	Guideline recommendation	Grade	Reviews	RCTs	Other
Assess #4	The assessment and planning of rehabilitation should be undertaken through a coordinated, interdisciplinary team and follow a patient-focused approach responding to the needs and choices of individuals with TBI as they evolve over time. (Updated from INCOG 2014,[8] Assess 3)	C			
Assess #5	All individuals with TBI who have emerged from posttraumatic amnesia should have their cognitive function evaluated by a: • Neuropsychologist: to conduct a cognitive assessment using validated neuropsychological tests including measures of effort, emotional status, and behavioral problems • Occupational therapist: to assess the impact of cognitive impairments on performance of meaningful activities and participation • Speech-language pathologist: to assess the impact of cognitive impairments on communication (listening, speaking, reading, and writing) Assessment should be collaborative, and all professionals involved should aim to integrate their assessment findings, and avoid overtesting or duplicating tests with each other. (INCOG 2014,[8] Assess 10)	-C			
Assess #6	All people with TBI should be assessed for related functional limitations in activities and participation. (INCOG 2014,[8] Assess 4)	C			
Assess #7	Assessment should include seeking information from the individual with TBI and from family and individuals who knew the person before their injury and/or who may be caring for the person post-injury (ie, close others and friends) to obtain information about changes within different domains. (INCOG 2014,[8] Assess 5)	B			
Assess #8	During assessment of a person with TBI, clinicians should consider the possibility of other factors that may be contributing to cognitive performance impairments and functional limitations including personal factors, preinjury medical conditions, injury-related conditions, and postinjury factors. *Personal factors include:* • Cultural background, fluency, and literacy in language of assessment • Level of education/academic history/premorbid learning difficulties • Premorbid intellectual level of functioning • Occupational/vocational history • Recreational, hobby history • Eating disorders • Sex and gender	C			

(*continues*)

TABLE 2 *INCOG 2.0 recommendations for assessment of the person with traumatic brain injury requiring cognitive rehabilitation and new supporting evidence*[a] (Continued)

	Guideline recommendation	Grade	Reviews	RCTs	Other
	Preinjury medical conditions include: • Substance use/abuse • Mental health issues • Psychosocial trauma or abuse • Neurological disorders (eg, dementia and seizures) • Hearing or vision impairment • Nutritional status *Injury-related factors and conditions include*: • Medical conditions • Psychiatric conditions, especially mood disorders • Fatigue • Sleep-wake disorders • Medications (pre- and postinjury) including over-the-counter remedies, herbs, or supplements • Seizures • Sensorimotor changes • Endocrine dysfunction (eg, growth hormone deficiency) • Pain • Acquired language changes (eg, aphasia and dysgraphia) • Injury-related vision or hearing deficits • Manual limb or oral-motor dysfunction (eg, weakness and incoordination) • Sense of smell/taste (olfactory) • Vestibular function • Consider the possibility of other comorbid factors *Postinjury factors include:* • Psychological response/coping style, cognitive status • Social/economic changes • New-onset mental health disorders • Medical conditions (eg, seizures, sensorimotor changes, endocrine dysfunction, pain, and sleep/wake disturbance) • Medication effects • Assessing literacy for technology (ie, ability to use mobile apps) (Adapted from INCOG 2014,[8] Assess 6)				
Assess #9	Appropriate investigations should be completed prior to medication trials to rule out and minimize metabolic abnormalities including evaluation of plasma blood sugar, electrolytes, hormones, hemoglobin, cardiorespiratory function, and infection. (INCOG 2014,[8] Assess 8)	C			
Assess #10	Clinicians should make efforts to use standardized, norm-referenced tests validated for use in individuals with TBI and should exercise caution, as many of the tests recommended by publishers, distributors, and clinicians were not developed for persons with TBI and do not address TBI in their development or standardization. (Updated from INCOG 2014,[8] Assess 11)	C			Honan et al[32]

Abbreviations: MSK, musculoskeletal; PTA, post-traumatic amnesia; RCT, randomized controlled trial; TBI, traumatic brain injury.
[a]Refer to Bayley et al[8] for evidence contributing to the recommendations prior to 2014.

TABLE 3 *INCOG 2.0 general principles for cognitive rehabilitation with traumatic brain injury*[a]

Section title	Guideline recommendation	Grade	Reviews	RCTs	Other
Principle #1	Individuals with persistent cognitive deficits due to TBI should receive functionally oriented cognitive rehabilitation. Treatment must be considered within a framework that considers the person's preinjury characteristics, stage of development and recovery, and personally meaningful everyday activities, life contexts, and goals. (INCOG 2014,[8] Assess 12 and Principle 1)	B			
Principle #2	Cognitive rehabilitation should incorporate (where applicable): • Restorative treatments focused on real-world activities • Training in compensatory strategies • Caregiver training • Education about cognitive consequences of TBI • Functional adaption, and • Environmental manipulations. (INCOG 2014,[8] Principle 3)	C			
Principle #3	Cognitive rehabilitation should: • Focus on engaging in activities that are meaningful to the person with TBI and relevant stakeholders. • Include therapy interventions in the affected person's own environment and/or applicable to the person's own life. • Incorporate strategies for generalization. (INCOG 2014,[8] Principle 5)	C			
Principle #4	Group-based interventions may be considered as part of cognitive rehabilitation to address: • Social skills • Emotional self-regulation • Goal attainment • Problem-solving • Communication • Attention • Memory (INCOG 2014,[8] Principle 6)	B			
Principle #5	Reassessment of cognition should be undertaken on a regular basis using standardized and functional outcome measures to determine effectiveness of interventions. (INCOG 2014,[8] Principle 7)	C			
Principle #6	Consider the use of nonpharmacological interventions prior to the initiation of pharmacological interventions. (INCOG 2022)	C			

Abbreviations: RCT, randomized controlled trial; TBI, traumatic brain injury.
[a]Refer to Bayley et al[8] for evidence contributing to the recommendations prior to 2014.

TABLE 4 *INCOG 2.0 general principles of pharmacological management for cognition*[a]

Section title	Guideline recommendation	Grade	Reviews	RCTs	Other
Medication principle #1	All people with TBI should have their medications reviewed on a regular basis. (INCOG 2014,[8] Medication principle 1)	C			
Medication principle #2	Careful drug selection and monitoring is required when initiating pharmacological interventions to minimize potential adverse effects on arousal, cognition, motivation, and motor coordination following TBI. Objective outcome and assessment measures should be used. (Adapted from INESSS-ONF 2015[33])	C			
Medication principle #3	Use of medications that target more than one brain injury–related symptom/syndrome is recommended, if possible (eg, one agent targeting both mood and insomnia, or headache and insomnia). (INESSS-ONF 2015[33])	C			
Medication principle #4	The introduction of medications for individuals with TBI should be started at the lowest effective dose and be titrated slowly upward, based upon tolerability, clinical response, and situational urgency. Drug trials should allow adequate duration and dosing. Therapeutic goals should be clearly established and serve as indicators for the efficacy. If those goals are not met, ending the use of medication must be considered. (INESSS-ONF 2015[33])	C			
Medication principle #5	Medications with potentially detrimental side effects, or that may be contributing to confusion or sedation, should be weaned where possible while continuing to monitor the patient regularly. (INESSS-ONF 2015[33])	C			
Medication principle #6	Serum drug levels in the person with TBI should be monitored as necessary to prevent toxicity. (INESSS-ONF 2015[33])	C			
Medication principle #7	Due to potential limits in self-awareness of the patient with TBI, collaboration with family and/or significant others, if possible and accepted by the patient, may be useful to monitor the efficacy and side effects of treatment. (INESSS-ONF 2015[33])	C			
Medication principle #8	The use of neuroleptics and benzodiazepines to treat agitation or aggression in individuals with TBI should be minimized, as these medications may slow recovery after brain injury and may have a negative effect on cognition. It is recommended to start low, go slow, and monitor impact on agitation and cognition using standardized tools. (Updated from INCOG 2014,[8] PTA 4)	C	Hicks et al[34]	Phyland et al[35]	McKay et al[36]
Medication principle #9	Anticonvulsants, particularly phenytoin and levetiracetam, are indicated to reduce the incidence of posttraumatic seizures in the first 7 d post-injury. Routine use of anticonvulsants to prevent late posttraumatic seizures 7 d post-injury is not recommended. (INESSS-ONF 2015[33])	A	Bakr and Belli[37] Khan et al[38] Wang et al[39] Wat et al[40] Wilson et al[41] Xu et al[42] Yang et al[43]		
Medication principle #10 for persistent coma or vegetative state	Amantadine can be considered to enhance arousal and consciousness and accelerate functional recovery in the short term in individuals in vegetative or minimally responsive state or in coma following TBI (updated from INCOG 2014,[9] Attention 10, pp. 328-329).	A	Loggini et al[44]	Abbasivash et al[45] Giacino et al[46] Ghalaenovi et al[47]	

Abbreviations: RCT, randomized controlled trial; TBI, traumatic brain injury.
[a]Refer to Bayley et al[8] and Ponsford et al[9] for evidence contributing to the recommendations prior to 2014.

TABLE 5 *INCOG 2.0 recommendations for teleassessment in traumatic brain injury*

	Guideline recommendation	Grade	Reviews	Rcts	Other
	Section title				
Teleassess #1	Clinicians should assess suitability of virtual care/telerehabilitation on an individual basis, taking into consideration: • The patient's abilities, goals, preference, and capacity and experience with telerehabilitation • Feasibility of access to in-person rehabilitation therapy • Risk and benefits based on the patient profile (ie, chance of adverse events) • Availability of caregiver/close other to offer support • Inventory of equipment available to patient • Familiarity with that technology and WiFi capabilities (INCOG 2022)	C			
Teleassess #2	Prior to commencing telerehabilitation, clinicians should obtain informed consent from the person with TBI, and be aware of the policies of their local organization and accrediting organizations including security and privacy considerations. The designated healthcare team member in-person, or over the phone, should ensure that the contact information of the patient (where telerehabilitation is occurring); the first responder or local nonemergency phone number; the emergency contacts (eg, family member); and the physician and other relevant HCP are all identified and documented. (Adapted from Toronto Rehabilitation Institute[48])	C			
Teleassess #3	Prior to a virtual care appointment, clinicians should ensure that: • All resources required are prepared for the session (eg, digital documents and web pages), so they can be easily retrieved and shared • The room set-up promotes safety, privacy, and confidentiality, as well as focus and attention by reducing visual stimuli on the walls and in the space • Cameras are positioned appropriately. For example, if the provider needs to demonstrate an exercise or activity, the camera is positioned for a full body view • The patient/close other has contact information for the provider if they experience any set-up or administration difficulties/technological challenges • You are selecting the most user-friendly option of equipment possible • The patient has had the opportunity to trial and troubleshoot any of the technology being used • The roles and expectations of caregiver involvement have been discussed (Adapted from Toronto Rehabilitation Institute[48])	C			
Teleassess #4	Videoconference assessment is preferred over telephone because it allows direct observation of performance, nonverbal behavior, and effort level. (INCOG 2022)	C			
Teleassess #5	Clinicians should consider utilizing assessment tools for cognitive and communication functions that have been evaluated for their feasibility, reliability, and validity using telehealth. Some assessments that have been evaluated for use in telephone include the assessment of discourse ability, the Brief Test of Adult Cognition by Telephone, and the Glasgow Outcome Scale. (INCOG 2022)	B			Dams-O'Connor et al[49] DiBlasio et al[50] Pettigrew et al[51]

Abbreviations: HCP, healthcare professional; RCT, randomized controlled trial; TBI, traumatic brain injury.

TABLE 6 *INCOG 2.0 recommendations for telerehabilitation treatment in traumatic brain injury*

	Guideline recommendation	Grade	Reviews	RCTs	Other
Telerehab #1	Clinicians should consider the use of telerehabilitation, in addition to in-person visits to provide timely and equitable access to care for individuals with a TBI with cognitive or cognitive communication difficulties. (INCOG 2022)	B	Ownsworth et al[52] Tran et al[53]	Rietdijk et al[54] Rietdijk et al[55]	
Telerehab #2	The characteristics of the person with TBI who would be ideal for cognitive rehab interventions that have been proven in-person but not in the virtual environment are: • Their goals are well aligned and can be developed in concert with the person with TBI virtually • Patient has a history of following instructions well • Person has reasonable ability to self-monitor and is self-aware • Family support is available (INCOG 2022)	C			
Telerehab #3	Videoconference assessment is preferred over telephone because it allows direct observation of performance, nonverbal behavior, and effort level. (INCOG 2022)	C			
Telerehab #4	Hybrid models may be required if the person requires training in the use of technology or if there are concerns about safety. (INCOG 2022)	C			
Telerehab #5	To facilitate participation in each session, clinicians should: • Maintain eye contact by looking at the webcam and not the screen • Speak at a reasonable pace and pause frequently to allow patients to process information • Clarify the patient's understanding of the material using several strategies, such as teach-back strategies • Ask clarifying questions • Offer/inquire about need for pauses to allow for cognitive fatigue induced by videoscreens (Adapted from Toronto Rehabilitation Institute[48])	C			
Telerehab #6	Group interventions provided by telehealth technology are recommended if there is evidence supporting that intervention using an in-person format and they are feasible in the telerehabilitation environment. (INCOG 2022)	C			
Telerehab #7	The use of telerehabilitation should be monitored and evaluated frequently, and adapted as necessary, for each patient. Patient's level of engagement should be monitored closely. (INCOG 2022)	C			

Abbreviations: RCT, randomized controlled trial; TBI, traumatic brain injury.

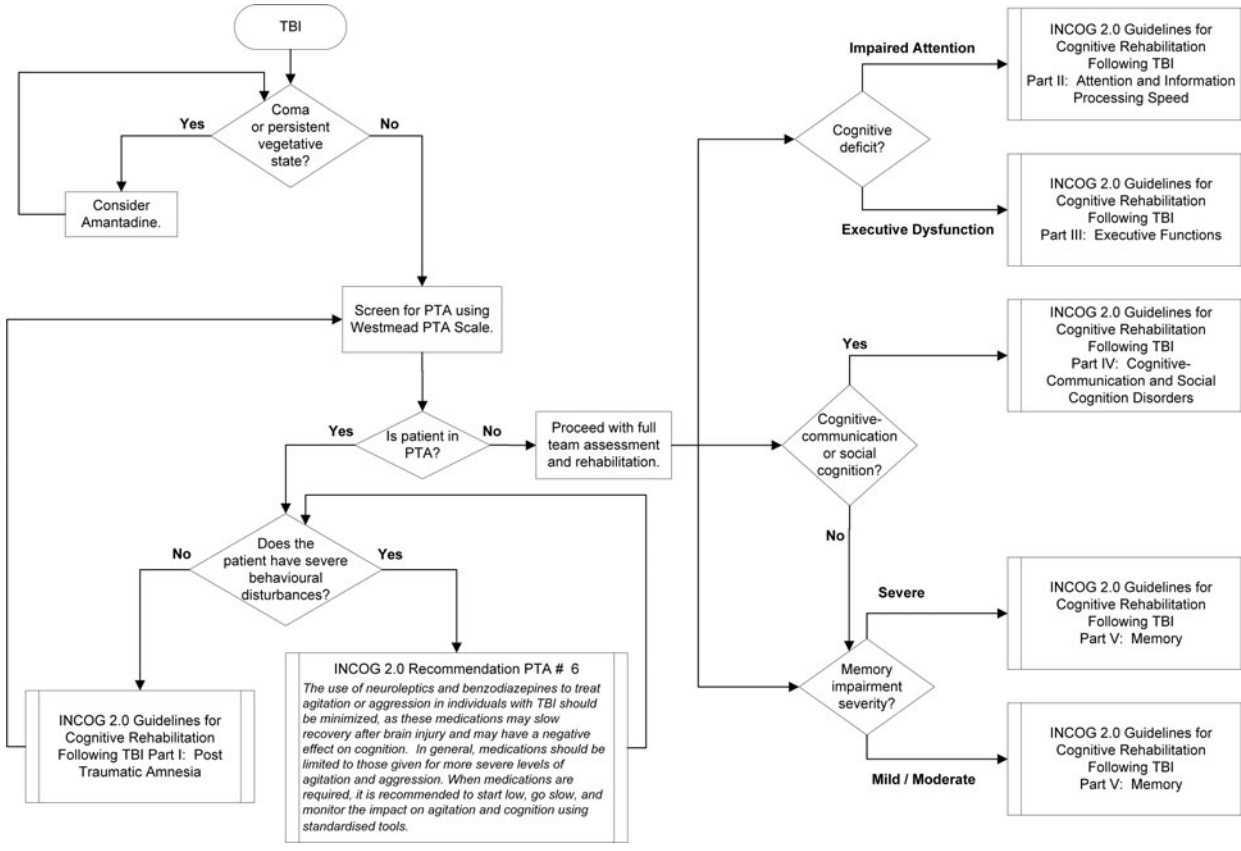

Figure 2. INCOG 2022 algorithm for clinician decision-making.

an MS-TBI, most individuals have a period of unconsciousness and then PTA. The evidence suggests that individuals with TBI still in PTA are candidates for functionally oriented rehabilitation and not comprehensive cognitive assessment and rehabilitation. Recommendations for management of PTA are provided in the next article in the series.[22] Once PTA is resolved, detailed cognitive assessment and rehabilitation strategies should be offered. The INCOG guideline algorithm suggests that once a detailed cognitive assessment has been completed, 4 main domains of cognition may be amenable to intervention: attention and processing, executive dysfunction, cognitive communication, or memory that is covered in the relevant sections of this supplement. The reader is referred to the relevant articles for specific algorithms for these topics.[23–26]

Health records chart audit items to assess adherence to general recommendations for cognitive assessment and rehabilitation

Table 7 outlines the items that could be audited from the patients' health record. The expert panel prioritized the recommendations for a comprehensive evaluation of cognition after resolution of PTA as a key audit item to ensure that the correct treatment is prescribed. They also highlighted that the assessment should be conducted by a professional with training in cognition (eg, neuropsychology, occupational therapy, or speech-language pathology). Audit item number 7 also emphasizes the importance of ascertaining that clinicians have obtained detailed information about the person with the brain injury from their family and/or caregivers. The audit items also recognize the importance of offering cognitive rehabilitation and use of pharmacological treatments when indicated.

Please note that each subsection of the INCOG guidelines includes audit criteria specific for that cognitive area.

CONCLUSION

This updated set of cognitive rehabilitation guidelines was developed using a rigorous process and provides updated guidance for clinicians. Since the last publication of the INCOG 2014 recommendations, there continues to be an increasing number of publications in the field. Despite the advancements in TBI rehabilitation research, further high-quality studies are needed to better understand the role of cognitive rehabilitation in improving outcomes among individuals with TBI. The team recommends use of the algorithm and audit tools to support implementation into practice.

TABLE 7 *Audit guidelines for priority recommendations: General principles*

Health records chart audit									
Assessment	**Indications**	**Evaluations**							**Found in**
Assessment #3 After emerging from posttraumatic amnesia, all individuals with TBI should be assessed for the presence of cognitive impairments in the following areas: • Attention (including speed of processing) • Executive function • Language, social communication • Social cognition • Cognitive communication • Learning and memory • Awareness of impairments • Detection/expression of emotion • Visuospatial function • Sleep/wakefulness The purpose of this assessment is to plan treatment. The assessment may either be standardized or nonstandardized depending on a number of factors, such as apparent rate of recovery and need of data for future planning. This assessment should include observation of the functional impact of cognitive impairments in a real-world setting. A formal standardized evaluation should be completed before initiating a cognitive rehabilitation program (INCOG 2014,[8] Assess 3).	• Patient out of PTA/PTD • Patient oriented to person, place and time for 2-3 consecutive days if a formal tool has not been used • Other (please specify):	**Evaluation tool or cognitive domain tested**	**Discipline**		**Assess dates**	**Test scores or normal/ abnormal**			• Admission history • NP notes • OT notes • SLP notes • MD notes • PT notes • Other
Assessment #7 Assessment should include seeking information from family and individuals who knew the person before their injury and/or who may be caring for the person post-injury (ie, close others and friends) to obtain information about chance within different domains (updated from INCOG,[8] Assess 5). Other	• Patient information collected • Information is used to inform treatment • Other (please specify):	Premorbid health Social situation Family situation	**PT**	**OT**	**NP**	**Rehab MD**	**SLP**	**Other/ SW**	• Admission history • NP notes • OT notes • SLP notes • MD notes • PT notes • Other

(*continues*)

TABLE 7 *Audit guidelines for priority recommendations: General principles* (Continued)

Health records chart audit

Assessment	Indications	Evaluations				Found in
Assessment #5 All individuals with TBI who have emerged from posttraumatic amnesia should have their cognitive function evaluated by a: • Neuropsychologist (NP) • Occupational therapist (OT) • Speech-language pathologist (SLP). (INCOG 2014,[8] Assess 10)	• Patient out of PTA • Patient oriented to person, place, and time for 3 consecutive days • Other (please specify):	Seen Cognitive assessment Validated tests/tools used Informal/other tests (describe)	**NP**	**OT**	**SLP**	• Admission history • NP notes • OT notes • SLP notes • MD notes • PT notes • Other

Intervention	Indications	Interventions/Outcome measures	Discipline
Cognitive rehabilitation principle #1 Individuals with persistent cognitive deficits due to TBI should receive functionally oriented cognitive rehabilitation. Treatment must be considered within a framework that considers the person's preinjury characteristics, stage of development and recovery, and personally meaningful everyday activities, life contexts, and goals (INCOG 2014,[8] Assess 12 and Principle 1).	• Assessment for need conducted	• Any evidence that cognitive rehabilitation has been provided • Specify any interventions recorded:	• NP • OT • SLP • MD • PT • Other
Telerehabilitation Clinicians should consider the use of telerehabilitation, in addition to in-person visits to provide timely and equitable access to care for individuals with a TBI with cognitive or cognitive communication difficulties. (INCOG 2022)	• Assessment for need conducted	• Any evidence that cognitive rehabilitation has been provided	• NP • OT • SLP • MD • PT • Other

Abbreviations: MD, medical doctor; NP, neuropsychologist; OT, occupational therapist; PT, physiotherapist; PTA, posttraumatic amnesia; PTD, posttraumatic depreciation; SLP, speech-language pathologist; SW, social worker; TBI, traumatic brain injury.

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