

Title: Prognostication and Goals of Care Decisions in Severe Traumatic Brain Injury: A Survey of The Seattle International Severe Traumatic Brain Injury Consensus Conference (SIBICC) Working Group

Authors:

First Author: Buse Sarigul,
Tuzla Public Hospital
34947 Icmeler mah. Piri Reis cd. No:74,
Tuzla, Istanbul, Turkey
busesarigul90@hotmail.com

Second Author: Randy S. Bell,
Adjunct Professor of Surgery
Uniformed Services University of Health Sciences,
Neurosurgeon, Avera Brain and Spine Institute,
1301 S Cliff Ave, Ste 610
Sioux Falls, South Dakota
57105
kamandybell@gmail.com

Third Author: Randall Chesnut, MD, FCCM, FACS, FAANS^{3,4}
Professor of Neurosurgery
Integra Endowed Professor of Neurotrauma
Department of Neurological Surgery
Department of Orthopaedic Surgery
Adjunct Professor, School of Global Health
Harborview Medical Center, University of Washington
Mailstop 359766
325 Ninth Ave
Seattle, Washington
98104-2499
chesnutr@uw.edu

Fourth Author: Sergio Aguilera, MD
Neurosurgeon, Almirante Nef Naval Hospital,
Viña del Mar, Chile
Associated Professor Valparaiso University
aguilera71@gmail.com

Fifth Author: Andras Buki, MD, D.Sc
Department of Neurosurgery
Faculty of Medicine and Health
Örebro University
SE 70182 Örebro, Sweden
andras.buki@oru.se

1
2
3 **Sixth Author:** Giuseppe Citerio, MD
4 Professor, School of Medicine and Surgery,
5 University of Milan-Bicocca, Milan, Italy;
6 Neuro-Intensive Care, Department of Emergency and Intensive Care,
7 ASST, San Gerardo Hospital, Monza, Italy
8 giuseppe.citerio@unimib.it
9

10 **Seventh Author:** D. Jamie Cooper, AO, BMBS, MD, FRACP, FCICM, FAHMS
11 Professor, Intensive Care Medicine
12 Australian and New Zealand Intensive Care Research Centre,
13 Monash University.
14 Department of Intensive Care, Alfred Hospital,
15 Melbourne, Victoria, Australia
16 Jamie.Cooper@monash.edu
17
18

19 **Eighth Author:** Ramon Diaz Arrastia, MD, PhD
20 Professor of Neurology,
21 University of Pennsylvania Perelman School of Medicine
22 Penn Presbyterian Medical Center
23 51 North 39th Street
24 Philadelphia, PA 19104
25 Ramon.Diaz-Arrastia@uphs.upenn.edu
26

27 **Nineth Author:** Michael Diring, MD
28 Professor, Neurology
29 Washington University School of Medicine
30 Department of Neurology
31 Barnes-Jewish Hospital
32 1 Barnes-Jewish Hospital Plaza
33 St. Louis, MO 63110
34 diringerm@neuro.wustl.edu
35
36

37 **Tenth Author:** Anthony Figaji, MD, PhD, FCS
38 Professor of Neurosurgery,
39 Division of Neurosurgery and Neuroscience Institute
40 University of Cape Town
41 H53 Old Main Building
42 Groote Schuur Hospital
43 Main Road
44 Observatory, 7925
45 anthony.figaji@uct.ac.za
46

47 **Eleventh Author:** Guoyi Gao, MD, PhD
48 Professor of Neurosurgery,
49 Department of Neurosurgery, Renji Hospital
50 Shanghai Institute of Head Trauma
51 Shanghai Jiaotong University School of Medicine
52 1630 Dongfang Road, Shanghai, 200127 China
53 guoyigao@gmail.com
54
55
56
57
58
59
60

1
2
3 **Twelfth Author:** Romer Geocadin, MD
4 Professor of Neurology,
5 Johns Hopkins University School of Medicine
6 1800 Orleans St. Sheikh Zayed Tower,
7 Baltimore, MD 21287
8 rgeocad1@jhmi.edu
9

10 **Thirteenth Author:** Jamshid Ghajar, MD, PhD, FACS
11 Clinical Professor of Neurosurgery,
12 Stanford Neuroscience Health Center,
13 213 Quarry Rd 4th Fl MC 5958
14 Palo Alto, CA 94304
15 jghajar@stanford.edu
16

17 **Fourteenth Author:** Odette Harris, MD, MPH
18 Professor of Neurosurgery
19 Department of Neurosurgery
20 Pasteur Drive, Room R205
21 Edward's Building, MC: 5327
22 Stanford, California 94305
23 odette@stanford.edu
24

25 **Fifteenth Author:** Alan Hoffer MD,
26 Associate Professor, Department of Neurological Surgery, School of Medicine
27 Case Western Reserve University
28 11100 Euclid Avenue, HAN 5042
29 Cleveland, OH 44106
30 Alan.Hoffer@uhhospitals.org
31

32 **Sixteenth Author:** Peter Hutchinson, BSc, MBBS, FRCS(SN), PhD, FMedSci
33 Professor, Division of Neurosurgery,
34 Department of Clinical Neurosciences,
35 Addenbrooke's Hospital and University of Cambridge,
36 Cambridge Biomedical Campus,
37 Cambridge CB20QQ, U
38 pjah2@cam.ac.uk
39

40 **Seventeenth Author:** Mathew Joseph, MCh
41 Department of Neurological Sciences,
42 Christian Medical College
43 Ida Scudder Road,
44 Vellore, Tamil Nadu, India
45 mjoseph@cmcvellore.ac.in
46

47 **Eighteenth Author:** Ryan Kitagawa, MD
48 Associate Professor of Neurosurgery
49 Vivian L Smith Department of Neurosurgery
50 McGovern Medical School at UTHealth
51 6400 Fannin St, Suite 2800
52 Houston, TX 77030
53 Ryan.S.Kitagawa@uth.tmc.edu
54
55
56
57
58
59
60

1
2
3 **Nineteenth Author:** Geoffrey Manley, MD, PhD
4 Professor of Neurosurgery,
5 University of California San Francisco
6 San Francisco General Hospital & Trauma Center
7 1001 Potrero Ave., Bldg 1, Room 101
8 San Francisco, CA 94110
9 manleyg@ucsf.edu
10

11 **Twentieth Author:** Stephan Mayer, MD, FCCM
12 Professor of Neurology
13 Henry Ford Hospital
14 2799 W Grand Blvd
15 Neurology - K-11
16 Detroit, MI 48202
17 stephanamayer@gmail.com
18
19

20 **Twenty-First Author:** David K. Menon, MD, PhD
21 Professor, Division of Anaesthesia, Cambridge, UK
22 University of Cambridge and Addenbrooke's Hospital,
23 Box 93,
24 Addenbrooke's Hospital,
25 Hills Road,
26 Cambridge CB2 0QQ
27 dkm13@cam.ac.uk
28
29

30 **Twenty-Second Author:** Geert Meyfroidt, MD, PhD
31 Associate Professor
32 Department and Laboratory of Intensive Care Medicine,
33 University Hospitals Leuven and KU Leuven,
34 Herestraat 49 - Box 7003 63
35 3000 Leuven
36 geert.meyfroidt@uzleuven.be
37

38 **Twenty-Third Author:** Daniel B. Michael, MD, PhD
39 Professor of Neurosurgery
40 Oakland University William Beaumont School of Medicine, Beaumont Health
41 Michigan Head & Spine Institute,
42 Southfield, MI, USA
43 danielm@mhsi.us
44

45 **Twenty-Fourth Author:** Mauro Oddo, MD
46 Associate Professor,
47 Department of Intensive Care Medicine,
48 CHUV-Lausanne University Hospital,
49 University of Lausanne, Faculty of Biology and Medicine
50 Lausanne, Switzerland
51 mauro.oddo@chuv.ch
52
53
54
55
56
57
58
59
60

1
2
3 **Twenty-Fifth Author:** David O. Okonkwo MD, PhD
4 Professor, Department of Neurosurgery,
5 University of Pittsburgh Medical Center,
6 Pittsburgh, PA, USA
7 okonkwodo@upmc.edu
8

9 **Twenty-Sixth Author:** Mayur Patel MD, MPH, FACS, FCCM
10 Associate Professor of Surgery
11 Vanderbilt University Medical Center,
12 mayur.b.patel@vumc.org
13

14 **Twenty-Seventh Author:** Claudia Robertson, MD
15 Professor of Neurosurgery,
16 Baylor College of Medicine
17 One Baylor Plaza,
18 Houston, TX 77030, USA
19 claudiar@bcm.edu
20
21

22 **Twenty-Eighth Author:** Jeffrey V. Rosenfeld, MD, MS, FRACS, FACS, IFAANS
23 Professor, Department of Neurosurgery,
24 Alfred Hospital, Melbourne, Australia;
25 Department of Surgery, Monash University, Melbourne, Australia
26 j.rosenfeld@alfred.org.au
27

28 **Twenty-Ninth Author:** Andres M. Rubiano, MD, PhD(c)
29 INUB/MEDITECH Research Group, Neurosciences Institute
30 El Bosque University, Bogotá, Colombia.
31 MEDITECH Foundation, Clinical Research
32 Calle 7-A # 44-95, Cali, Colombia 760036
33 andresrubiano@aol.com
34
35

36 **Thirtieth Author:** Juan Sahuquillo, MD, PhD
37 Professor of Neurosurgery,
38 University Hospital Vall d'Hebron,
39 Barcelona, Spain
40 sahuquillo@neurotrauma.net
41

42 **Thirty-First Author:** Franco Servadei, MD, PhD
43 Professor, Department of Neurosurgery
44 IRCCS Humanitas Research Hospital and Humanitas University
45 Milano Italy
46 franco.servadei@hunimed.eu
47

48 **Thirty-Second Author:** Lori Shutter, MD, FNCS, FCCM
49 Professor of Critical Care Medicine, Neurology and Neurosurgery
50 University of Pittsburgh Medical Center
51 3550 Terrace St, Room 646
52 Pittsburgh, PA 15261, USA
53 shutterla@upmc.edu
54
55
56
57
58
59
60

1
2
3 **Thirty-Third Author:** Deborah Stein, MD, MPH, FACS, FCCM
4 Director of Critical Care Services,
5 University of Maryland School of Medicine,
6 655 W. Baltimore Street, Baltimore MD 21201
7 dstein@som.umaryland.edu
8

9 **Thirty-Fourth Author:** Nino Stocchetti, MD
10 Professor, Department of Pathophysiology and Transplantation
11 Fondazione IRCCS Cà Granda Ospedale Maggiore Policlinico Milano".
12 Dipartimento Fisiopatologia e Trapianti Univ di Milano
13 Scuola di Specializzazione Anestesia, Rianimazione, Terapia Intensiva e del
14 Dolore
15 Neuroranimazione Fondazione IRCCS Cà Granda Ospedale Maggiore
16 Policlinico
17 Milano
18 nino.stocchetti@policlinico.mi.it
19

20
21 **Thirty-Fifth Author:** Fabio Silvio Taccone MD, PhD
22 Professor, Department of Intensive Care
23 Hospital Erasme, Université Libre de Bruxelles (ULB) Brussels, Belgium
24 ftaccone@ulb.ac.be
25

26 **Thirty-Sixth Author:** Shelly D. Timmons, MD, PhD
27 Professor, Department of Neurological Surgery,
28 Indiana University School of Medicine,
29 IU Health Neuroscience Center--Goodman Hall
30 355 W. 16th Street, Suite 5100
31 stimmons@mac.com
32

33
34 **Thirty-Seventh Author:** Eve Tsai, MD, PhD, FRCSC
35 Assistant Professor of Neurosurgery,
36 Suruchi Bhargava Chair in Spinal Cord and Brain Regeneration Research
37 University of Ottawa, The Ottawa Hospital
38 C2 Neurosciences Unit
39 The Ottawa Hospital – Civic Campus
40 1053 Carling Avenue,
41 Ottawa, Ontario, K1Y 4E9
42 etsai@toh.ca
43

44 **Thirty-Eighth Author:** Jamie S. Ullman, MD
45 Professor, Department of Neurosurgery,
46 Donald and Barbara Zucker School of Medicine at Hofstra/Northwell 805
47 Northern Boulevard, Suite 100
48 Great Neck, NY 11021
49 jullman1@northwell.edu
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5 **Thirty-Ninth Author:** Paul Vespa, MD, FCCM, FAAN, FANA, FNCS
6 Gary L. Brinderson Family Chair in Neurocritical care
7 Assistant Dean of Critical Care Medicine Research
8 Professor of Neurosurgery and Neurology, UCLA School of Medicine
9 Director of Neurocritical Care
10 Ronald Reagan UCLA Medical Center
11 UCLA Medical Center, Santa Monica
12 pvespa@mednet.ucla.edu
13

14
15 **Fortieth Author:** Walter Videtta, MD
16 Professor of Intensive Care Medicine,
17 Posadas Hospital, Buenos Aires, Argentina,
18 wvidetta@yahoo.com.ar
19

20 **Forty-First Author:** David W. Wright, MD
21 Professor of Emergency Medicine,
22 Emory University School of Medicine
23 49 Jesse Hill Jr Dr
24 Atlanta, GA 30303
25 dwwrigh@emory.edu
26

27 **Forty-First Author:** Christopher Zammit, MD
28 Assistant Professor of Emergency Medicine,
29 University of Rochester Medical Center
30 School of Medicine and Dentistry
31 601 Elmwood Ave, Box 655C
32 Rochester, NY 14642
33 Christopher_Zammit@URMC.Rochester.edu
34

35
36 **Corresponding/Senior Author:** Gregory W. J. Hawryluk, MD, PhD, FRCSC
37 Neurosurgeon, Cleveland Clinic
38 Neurological Institute, Akron General Hospital
39 762S Cleveland-Massillon Road, Fairlawn, OH, 44333
40 hawrylg@ccf.org
41
42
43
44
45
46
47
48
49

50
51 **Abbreviations:** CNS = central nervous system; SIBICC = Seattle International severe
52 traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury
53
54
55
56
57
58
59
60

Abstract (Words 303):

Best practice guidelines have advanced severe traumatic brain injury (TBI) care, however, little currently informs goals of care decisions and processes despite their importance and frequency.

Panelists from the Seattle International severe traumatic Brain Injury Consensus Conference (SIBICC) participated in a survey consisting of 24 questions. Questions queried use of prognostic calculators, variability in and responsibility for goals of care decisions, acceptability of neurological outcomes as well as putative means of improving decisions which may limit care.

Responses were analyzed with the Chi-Square test. 97.6% of the 42 SIBICC panelists completed the survey. Responses were highly variable to most questions. Overall panelists reported infrequent use of prognostic calculators and observing variability in patient prognostication and goals of care decisions. They felt that it would be beneficial for physicians to improve consensus on what constitutes an acceptable neurological outcome as well as what chance of achieving that outcome is acceptable. Panelists felt that the public should help to define what constitutes a good outcome and expressed some support for a 'nihilism guard'.

Over 50% of panelists felt that if it was certain to be enduring, a vegetative state or lower severe disability would justify a withdrawal of care decision while 15% felt that upper severe disability justified such a decision. Whether conceptualizing an ideal or existing prognostic calculator to predict death or an unacceptable outcome, a 64-69% chance of a poor outcome on average was felt to justify treatment withdrawal. These results demonstrate important variability in goals of care decision making and a desire to reduce this variability. Our panel of recognized TBI experts opined on the neurological outcomes and chances of those outcomes which might prompt consideration of care withdrawal, however imprecision of prognostication and existing prognostication tools is a significant impediment to standardizing the approach to care limiting decisions. **Keywords:** nihilism, withdrawal of care, survey, SIBICC, brain injury, prognosis

1
2
3 **Words (2,993)**
4

5 **Introduction:**
6

7 Traumatic brain injury (TBI) is an important cause of death and disability worldwide¹.
8
9 Advancement in TBI care has been slower to realize than in other areas of medicine - targeted
10 therapeutics for central nervous system (CNS) injury have yet to be realized². Best practice
11 evidence-based guidelines³⁻⁶ have been impactful, however, and have been associated with a
12 50% reduction in mortality from severe TBI over the last 27 years^{7,8}.
13
14
15
16
17

18 A problem of at least equal importance to determining best care in TBI is the decision of
19 when to apply best care and when to instead limit care, allowing a patient's death to occur^{9,10}.
20
21 Despite the frequency and the paramount importance of these decisions, very little research and
22 few resources are available to guide clinicians and families through relevant decision-making¹¹.
23
24 It is unclear how much responsibility for the decision-making truly falls to physicians versus
25 substitute decision makers^{12,13}. There is substantial variation in how different clinicians make
26 and manage these decisions.
27
28
29
30
31

32 Prognostic calculators have also been an important advance for TBI care, but their
33 predictions are as yet imprecise for individual patients^{14,15}. As the accuracy and precision of
34 prognostic calculators improve over time it is possible that they could play a greater role in
35 decisions to limit care. Inappropriate therapeutic nihilism is a concern in TBI care as it can see
36 patients deprived of a reasonable chance of an acceptable outcome^{16,17}. **We consider**
37 **inappropriate therapeutic nihilism to be an overly pessimistic view of prognosis which would not**
38 **be shared by a majority of physicians or the patient if informed by a truly accurate assessment**
39 **of prognosis.** As they advance, objective predictions from prognostic calculators could be used
40 to guard against inappropriate therapeutic nihilism¹¹.
41
42
43
44
45
46
47
48
49
50

51 The Seatle International severe traumatic Brain Injury Consensus Conference (SIBICC)
52 recently convened over forty recognized TBI experts from diverse disciplines and regions of
53 the world. They produced the first algorithms for severe TBI management in a generation
54
55
56
57
58
59
60

1
2
3 utilizing a rigorous Delphi consensus process^{18,19}. The SIBICC algorithms broke ground by
4 addressing insufficiently informed aspects of TBI care such as when and how to de-escalate
5 therapy. We felt that this panel could also inform important issues surrounding patient
6 prognostication and withdrawal of care decisions for which there is currently very little guidance.
7
8
9
10

11 12 13 **Methods:**

14 We constructed a 24 question survey within SurveyMonkey (*Appendix 1*). Questions
15 queried use of prognostic calculators, variability in and responsibility for withdrawal of care
16 decisions, acceptability of neurological outcomes as well as putative means of improving
17 withdrawal of care decisions. All questions were closed in nature but each question provided
18 respondents with the opportunity for free text comment. The survey was made available to
19 SIBICC panelists on December 9, 2021 and was closed on December 25, 2021. In this time
20 non-respondents were provided with up to two reminders encouraging survey completion.
21 Respondents' names were not associated with their responses to facilitate blinded analysis.
22
23
24
25
26
27
28
29
30
31

32 Questions 21-24 considered scenarios of death and undesirably poor outcomes. They
33 also considered existing prognostic calculators as well as a theoretical ideal severe TBI
34 prognostic calculator. Panelists were told that the ideal prognostic calculator was constructed
35 from an extremely large population and that it performs extremely well in repeated large external
36 validation studies. Moreover, the ideal prognostic calculator provides highly accurate
37 calculations for individual patients. Panelists were also asked their opinions on a nihilism
38 guard¹¹. With respect to a nihilism guard, panelists were told that:
39
40
41
42
43
44
45
46

47 *“Prognostic calculators could be used to create a ‘nihilism guard’ which reduces*
48 *the impact of inappropriate therapeutic nihilism in severe traumatic brain injury.*
49 *This would mean that care of a patient could not be withdrawn immediately or*
50 *unilaterally when a sufficiently positive outcome is predicted. Because of the*
51 *importance of such a medical decision, involvement of a second physician or*
52
53
54
55
56
57
58
59
60

perhaps a panel would be required prior to proceeding with withdrawal of care.

This would help ensure that such a decision is being made carefully – similar to the need for two physicians to declare brain death.

Survey results were graphed using Microsoft Excel. Excel was also used to perform Chi Square analyses comparing observed responses to those expected with indiscriminate responses. For questions 21-24, ANOVA was used to assess for differences between the four groups (Microsoft Excel).

Results:

The SIBICC panelists consisted of a diverse group of 42 physicians and surgeons recognized for their expertise in the care of TBI^{18,19}. Panelists were from disciplines including neurosurgery, critical care, trauma surgery, emergency medicine and anaesthesia. The group exhibited ethnic and gender diversity and hailed from 6 continents. 41 of the 42 SIBICC panelists completed the survey (97.6%). **Chi Square analysis performed for questions 1-20 uniformly demonstrated that the answers differed from indiscriminate responses ($p < 0.01$ in all cases).**

Respondents indicated that they rarely perform prognostic calculations for severe TBI patients in routine patient care (**Figure 1A, $p < 0.01$**); only 7.3% of respondents indicated that they perform prognostic calculations for most or all severe TBI patients. Inaccuracy of current calculators for predicting outcome in individual patients was cited as a reason for this lack of use in the provided comments. Respondents were most likely to use the IMPACT prognostic calculator²⁰ (71.8% of responses, **$p < 0.01$**) if they were to perform such calculations (**Figure 1B**). Over half of respondents (51.4%, **Figure 1C, $p < 0.01$**) indicated that they very rarely share the results of prognostic calculations with patients' legally authorized representatives or substitute decision makers.

A number of questions focused on therapeutic nihilism. Over half of respondents (53.7%, **Figure 2A**) indicated that they had some concern with inappropriate therapeutic

1
2
3 nihilism in their medical center while 31.7% reported a high level of concern ($p<0.01$). In
4 comparison, two thirds of respondents (65.9%, **Figure 2B**, $p<0.01$) reported a high level of
5 concern with therapeutic nihilism at other medical centers around the world. 95.1% of
6 respondents (**Figure 2C**, $p<0.01$) reported being somewhat or strongly troubled by variability in
7 physician judgements about whether a given patient can or should be saved and which
8 resources should be expended in their care. 78.1% of respondents felt that physicians
9 markedly influence the decisions of substitute decision makers when communicating their
10 perception of patient prognosis (**Figure 2D**, $p<0.01$). Overall panelists did not report a high
11 level of concern with having different opinions than other care team members related to
12 prognosis and aggressiveness of care for severe TBI patients (**Figure 2E**, $p<0.01$).

13
14
15
16
17
18
19
20
21
22
23
24 SIBICC panelists' views were also sought on neurologic outcomes. 92.7% of
25 respondents somewhat or strongly agreed that there is a lack of consensus amongst physicians
26 as to what constitutes a good or bad neurologic outcome (**Figure 3A**, $p<0.01$). Similarly 95.1%
27 of respondents somewhat or strongly agreed that there is a lack of consensus amongst
28 physicians as to what constitutes an acceptable chance of achieving a good neurologic outcome
29 (**Figure 3C**, $p<0.01$). At least half of respondents felt strongly that efforts to improve consensus
30 on these points would be beneficial (**Figure 3B, 3D**, both $p>0.01$). Panelist felt strongly that the
31 general public should be involved in efforts to better define what constitutes an acceptable
32 outcome (**Figure 3E**, $p<0.01$) and expressed disappointment that prognostic calculators have not
33 been accompanied by more advance related to their use (**Figure 3F**, $p<0.01$).

34
35
36
37
38
39
40
41
42
43
44
45 The SIBICC panelists also opined on how decisions related to the aggressiveness of
46 care could be improved. 68.3% somewhat or strongly agreed that greater consistency in
47 withdrawal of care decisions around the world would be preferable (**Figure 4A**, $p<0.01$) but
48 95.12% strongly or somewhat agreed that withdrawal of care decisions should be influenced by
49 the patient's culture and local care environment (**Figure 4B**, $p<0.01$). Respondents somewhat
50 agreed that a nihilism guard would be desirable to reduce inappropriate therapeutic nihilism and
51
52
53
54
55
56
57
58
59
60

1
2
3 that they would implement one if convenient to do so (**Figure 4C and 4D**, both $p < 0.01$). SIBICC
4
5 panelists provided diverse responses regarding the utility of a nihilism guard when considering a
6
7 patient's legally authorized representative's decision-making autonomy. (**Figure 4E**, $p < 0.01$).
8

9
10 SIBICC authors also provided their own opinions on what constitutes an acceptable
11
12 neurological outcome and what chance of an unacceptable outcome would lead them to agree
13
14 to a withdrawal of care decision. Over 60% of the authors felt that certain and enduring
15
16 outcomes of death, vegetative state or lower severe disability would justify withdrawal of care
17
18 decisions (**Figure 5A**, $p < 0.01$). Only 15.0% of respondents felt that upper severe disability
19
20 would be a justification for withdrawal of care. Whether an ideal or existing prognostic calculator
21
22 was considered and whether the predicted outcome was death or an unacceptable outcome,
23
24 respondents were consistent in selecting predictions between 64 and 69% on average as a
25
26 threshold at which they would support withdrawal of care decisions (**Figure 5B**, ANOVA
27
28 $p = 0.98$). Responses for all four conditions were highly variable, however.
29

30 31 **Discussion:**

32
33 Decision making in patients with devastating TBI falls at the intersection of medicine,
34
35 culture, religion and philosophy. Despite the importance of decision making for these patients,
36
37 medicine currently provides little relevant guidance to clinicians. To help address this gap we
38
39 sought the opinions of SIBICC's eminent and diverse TBI experts^{18,19} on important issues of
40
41 care which have been insufficiently studied despite their importance: decisions related to
42
43 prognostication, aggressiveness/withdrawal of care and perspectives on nihilism. In this context
44
45 this survey data provides a highly novel contribution to the literature. Our results provides a
46
47 starting point for needed future research and discussion on these topics.
48

49 50 *Prognostic Calculators:*

51
52 Some consider a vegetative outcome as being less desirable than death. If poor
53
54 outcomes could be predicted with high accuracy it would help patient's legally authorized
55
56 representatives to make more informed decisions about whether or not to proceed with
57
58
59
60

1
2
3 aggressive care and can help to ensure that medical resources are expended on those who will
4 ultimately benefit from them¹¹. Several prognostic calculators for TBI have been developed^{14,20-}
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

aggressive care and can help to ensure that medical resources are expended on those who will ultimately benefit from them¹¹. Several prognostic calculators for TBI have been developed^{14,20-22} reflecting a significant advance for the field. Although some have been highly validated they still lack precision and accuracy for individual patients. Many respondents commented that the inaccuracy of current calculators is a key reason for not using them. It is anticipated that the accuracy of these calculators will improve over time and, with this in mind, it is helpful to consider how more accurate prognostic information could be used to benefit patient care in the future.

What is a Bad Outcome?

A key first step in improving withdrawal of care decisions is deciding what would constitute an undesirable outcome if it was accurately predicted^{9,11}. We surveyed SIBICC panelists with respect to extended Glasgow Outcome Scale^{23,24} scores as this is an entrenched and commonly used outcome measure in TBI patients. Although approximately two thirds of the panel felt that an outcome of lower severe disability or worse justified withdrawal of care decisions, it is important that this was not unanimous. Similarly, an approximately two thirds chance of death or an undesirable outcome was consistently identified as mean value at which our panelists felt care could be withdrawn. While this is a helpful finding that can be further explored in future studies, the marked variability in opinions was perhaps the most important finding. These findings would seem to confirm the panelists' opinion that a lack of consensus currently exists and that efforts to reduce this variability may be beneficial.

It is very important in considering the results of this study that the survey assessed only the opinions of physicians. Even though our physician panelists were highly diverse with respect to location and specialty of practice (neurosurgery, critical care, emergency medicine, neurology and anaesthesia) as well as years of experience, other stakeholders may provide different responses to these questions. Future research is needed to better understand these important additional perspectives.

Responsibility for Withdrawal of Care Decisions:

Although many would report that decision making following devastating TBI is the responsibility of well-informed substitute decision makers familiar with the wishes of a patient^{12,25}, our survey confirms that the relationship between clinicians and decision makers is complex. As our panelists recognize the marked influence that physicians have on aggressiveness of care, it would seem that in many cases physicians are actually the decision makers and that substitute decision makers are limited by the perceptions communicated to them. The inter-relationships of clinicians and substitute decision makers are complex and will require careful consideration in conjunction with any effort to improve or modify decision making^{12,16}. Indeed, the notion of therapeutic nihilism and guards against nihilism imply that a significant amount of the responsibility for these critical care decisions lies with clinicians¹⁷. Better delineation of the roles and responsibilities of clinicians and substitute decision makers will be an important part of improving relevant processes¹⁰. In addition, cultural, religious, socioeconomic, resource availability, and regional differences in access to trauma care influence the decision for aggressive management versus care withdrawal.

At first it may seem a paradox that our panelists felt that both consistency of care and individualization of care are important. Both are, however, key tenets of modern care that must be balanced. Standardization of best practices has been at the heart of the guidelines movement; guideline implementation for TBI has been repeatedly associated with a 50% reduction in mortality^{7,8} and reduced cost of care^{26,27}. More recently personalized medicine has sought to individualize care in hopes of further improving patient outcomes with tailored therapies. Practically this may mean that guidelines serve to provided a common base of high-quality care but that care may be further refined based on specific patient characteristics. These tenets are also harmonized when processes of care are standardized but but the decisions made are patient-specific.

1
2
3 In similar spirit, though our panelists disagreed that “withdrawal of care decisions should
4 be handled more consistently around the world” as their comments indicated that they felt there
5 would be important benefits to increased standardization. They felt, though, that such
6 standardization was unlikely to be achieved due to great diversity in beliefs, values, religions
7 and financial resources in different parts of the world. As articulated above, panelists felt that an
8 effort to standardize processes and principles was desirable but that specific actions and
9 decisions will undoubtedly vary tremendously.
10
11
12
13
14
15
16
17

18 *Nihilism Guards and Improving Withdrawal of Care Decision Making:*
19

20 The SIBICC panelists feel that there is need to build consensus related to key aspects of
21 decision making for patients with devastating brain injuries. Although prognostic calculators
22 could ultimately help to increase the objectivity of relevant decisions¹¹ the panelists felt that they
23 require refinement before they play a substantial role in withdrawal of care decisions. An early
24 application of prognostic calculators could be the development of nihilism guards which would
25 aim to safeguard patients with a reasonable chance of an acceptable outcome from clinicians
26 with inappropriately poor predictions of their outcome who do not wish to provide the aggressive
27 care needed to achieve the best possible outcome¹¹.
28
29
30
31
32
33
34
35
36

37 Given the importance of the determination of brain death^{28,29}, the significance of an
38 inaccurate determination and the complexity of the assessment, two independent clinicians are
39 required to independently adjudicate the patient. It seems a paradox that withdrawal of care
40 decisions are subject to much less rigor despite their similarity. As they become more accurate,
41 prognostic calculators could help to make this decision making more objective and could help to
42 guard against inappropriate therapeutic nihilism. A patient who is predicted to have a
43 sufficiently good outcome might require two physicians to sign off on a decision to withdraw care
44 to help ensure that appropriate and accurate information has been communicated to decision
45 makers. It could also help to identify and guard against concerning motives behind withdrawal
46 of care decisions by substitute decision makers such as financial gain from an inheritance or life
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 insurance policy, as well as avoidance of the stress and costs of inherent to new debility. This
4 concept is at odds with the autonomy of patient's substitute decision makers, however. Notably,
5 the SIBICC panelists did not report strong enthusiasm for this concept.
6
7
8

9
10 It is noteworthy that tools can be built into modern electronic medical records which
11 could can make prognostic calculations facile and which can provide a platform for a nihilism
12 guard¹¹. The senior author recently reported the development and implementation of a
13 'dotphrase' within EPIC electronic medical record software which allows users to easily and
14 rapidly perform IMPACT prognostic calculations with relevant patient information that is
15 automatically populated in a heads up display¹¹. A nihilism guard could also be implemented
16 whereby withdrawal of care orders would require signoff by two physicians before they could be
17 executed. Efforts to define a bad outcome and what constitutes an acceptable chance of
18 achieving a good outcome would of course be fundamental to such a construct.
19
20
21
22
23
24
25
26
27

28
29 Ultimately, it is our view that the operational threshold for a nihilism guard should reflect
30 the precision of the prediction model that informs it. In the context of current, imprecise models
31 we feel that nihilism guards would most sensibly be employed initially where they are most likely
32 to achieve their intended purpose of protecting a patient likely to achieve an acceptable
33 outcome. More precise prediction models could eventually be applied to patients predicted to
34 have less good outcomes. Very importantly, a nihilism guard should serve to mandate caution
35 in making a critical decision. We would not support the converse approach of using outcome
36 predictions to trigger a care limiting decision if such discussion was not otherwise judged to be
37 appropriate.
38
39
40
41
42
43
44
45
46

47
48 Although prognostic calculators could ultimately help to increase the objectivity of
49 relevant decisions, the panelists felt that they would require refinement before they play a
50 substantial role in withdrawal of care decisions. Indeed, the current infrequent use of prognostic
51 models reported in our survey is at odds with the implementation of nihilism guards which would
52 require more routine use.
53
54
55
56
57
58
59
60

Conclusion:

Despite their critical importance to the care of severe TBI patients, the use of prognostic information, therapeutic nihilism and withdrawal of care processes remain insufficiently informed and subject to marked variability between practitioners. Our survey of the SIBICC panelists who are a diverse group of TBI experts suggests that advancement is needed in these areas. The consensus view of SIBICC panelists on what constitute an acceptable neurologic outcome and chance of achieving such an outcome are particularly valuable findings. While panelist responses demonstrated marked variability, they provide a starting point for future study, advancement and consensus building.

Conflict of Interest: No author has disclosed a conflict of interest relevant to this manuscript.

References

1. Maas AI, Stocchetti N, Bullock R. Moderate and severe traumatic brain injury in adults. *Lancet Neurol* 2008;7(8):728-41, doi:10.1016/S1474-4422(08)70164-9
2. Hawryluk GW, Bullock MR. Past, Present, and Future of Traumatic Brain Injury Research. *Neurosurg Clin N Am* 2016;27(4):375-96, doi:10.1016/j.nec.2016.05.002
3. Carney N, Totten AM, O'Reilly C, et al. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. *Neurosurgery* 2017;80(1):6-15, doi:10.1227/NEU.0000000000001432
4. Brain Trauma F, American Association of Neurological S, Congress of Neurological S, et al. Guidelines for the management of severe traumatic brain injury. Introduction. *J Neurotrauma* 2007;24 Suppl 1(S1-2), doi:10.1089/neu.2007.9997
5. The Brain Trauma Foundation. The American Association of Neurological Surgeons. The Joint Section on Neurotrauma and Critical Care. Methodology. *J Neurotrauma* 2000;17(6-7):561-2, doi:10.1089/neu.2000.17.561
6. Bullock R, Chesnut RM, Clifton G, et al. Guidelines for the management of severe head injury. Brain Trauma Foundation. *Eur J Emerg Med* 1996;3(2):109-27, doi:10.1097/00063110-199606000-00010
7. Gerber LM, Chiu YL, Carney N, et al. Marked reduction in mortality in patients with severe traumatic brain injury. *J Neurosurg* 2013;119(6):1583-90, doi:10.3171/2013.8.JNS13276
8. Hawryluk GWJ, Ghajar J. Evolution and Impact of the Brain Trauma Foundation Guidelines. *Neurosurgery* 2021;89(6):1148-1156, doi:10.1093/neuros/nyab357
9. Letsinger J, Rommel C, Hirschi R, et al. The aggressiveness of neurotrauma practitioners and the influence of the IMPACT prognostic calculator. *PLoS One* 2017;12(8):e0183552, doi:10.1371/journal.pone.0183552
10. Geocadin RG, Callaway CW, Fink EL, et al. Standards for Studies of Neurological Prognostication in Comatose Survivors of Cardiac Arrest: A Scientific Statement From the American Heart Association. *Circulation* 2019;140(9):e517-e542, doi:10.1161/CIR.0000000000000702
11. Hirschi R, Rommel C, Hawryluk GWJ. Should we have a guard against therapeutic nihilism for patients with severe traumatic brain injury? *Neural Regen Res* 2017;12(11):1801-1803, doi:10.4103/1673-5374.219037
12. Landry JT. Is shared decision-making to blame for the provision of ethically inappropriate treatment? Results of a multi-site study exploring physician understanding of the "shared" model of decision making. *J Eval Clin Pract* 2021;27(4):826-835, doi:10.1111/jep.13481
13. Berkowitz J, Martinez-Cambor P, Stevens G, et al. The development of incorpoRATE: A measure of physicians' willingness to incorporate shared decision making into practice. *Patient Educ Couns* 2021;104(9):2327-2337, doi:10.1016/j.pec.2021.02.040
14. Dijkland SA, Foks KA, Polinder S, et al. Prognosis in Moderate and Severe Traumatic Brain Injury: A Systematic Review of Contemporary Models and Validation Studies. *J Neurotrauma* 2020;37(1):1-13, doi:10.1089/neu.2019.6401
15. Roozenbeek B, Lingsma HF, Lecky FE, et al. Prediction of outcome after moderate and severe traumatic brain injury: external validation of the International Mission on Prognosis and Analysis of Clinical Trials (IMPACT) and Corticoid Randomisation After Significant Head injury (CRASH) prognostic models. *Crit Care Med* 2012;40(5):1609-17, doi:10.1097/CCM.0b013e31824519ce
16. Izzy S, Compton R, Carandang R, et al. Self-fulfilling prophecies through withdrawal of care: do they exist in traumatic brain injury, too? *Neurocrit Care* 2013;19(3):347-63, doi:10.1007/s12028-013-9925-z
17. Hemphill JC, 3rd, White DB. Clinical nihilism in neuroemergencies. *Emerg Med Clin North Am* 2009;27(1):27-37, vii-viii, doi:10.1016/j.emc.2008.08.009

18. Hawryluk GWJ, Aguilera S, Buki A, et al. A management algorithm for patients with intracranial pressure monitoring: the Seattle International Severe Traumatic Brain Injury Consensus Conference (SIBICC). *Intensive Care Med* 2019;45(12):1783-1794, doi:10.1007/s00134-019-05805-9
19. Chesnut R, Aguilera S, Buki A, et al. A management algorithm for adult patients with both brain oxygen and intracranial pressure monitoring: the Seattle International Severe Traumatic Brain Injury Consensus Conference (SIBICC). *Intensive Care Med* 2020, doi:10.1007/s00134-019-05900-x
20. Maas AI, Marmarou A, Murray GD, et al. Prognosis and clinical trial design in traumatic brain injury: the IMPACT study. *J Neurotrauma* 2007;24(2):232-8, doi:10.1089/neu.2006.0024
21. Collaborators MCT, Perel P, Arango M, et al. Predicting outcome after traumatic brain injury: practical prognostic models based on large cohort of international patients. *BMJ* 2008;336(7641):425-9, doi:10.1136/bmj.39461.643438.25
22. Champion HR, Sacco WJ, Carnazzo AJ, et al. Trauma score. *Crit Care Med* 1981;9(9):672-6, doi:10.1097/00003246-198109000-00015
23. Jennett B, Bond M. Assessment of outcome after severe brain damage. *Lancet* 1975;1(7905):480-4, doi:10.1016/s0140-6736(75)92830-5
24. Wilson JT, Pettigrew LE, Teasdale GM. Structured interviews for the Glasgow Outcome Scale and the extended Glasgow Outcome Scale: guidelines for their use. *J Neurotrauma* 1998;15(8):573-85, doi:10.1089/neu.1998.15.573
25. Rubenfeld GD. Principles and practice of withdrawing life-sustaining treatments. *Crit Care Clin* 2004;20(3):435-51, ix, doi:10.1016/j.ccc.2004.03.005
26. Fakhry SM, Trask AL, Waller MA, et al. Management of brain-injured patients by an evidence-based medicine protocol improves outcomes and decreases hospital charges. *J Trauma* 2004;56(3):492-9; discussion 499-500, doi:10.1097/01.ta.0000115650.07193.66
27. Faul M, Wald MM, Rutland-Brown W, et al. Using a cost-benefit analysis to estimate outcomes of a clinical treatment guideline: testing the Brain Trauma Foundation guidelines for the treatment of severe traumatic brain injury. *J Trauma* 2007;63(6):1271-8, doi:10.1097/TA.0b013e3181493080
28. Zamperetti N, Bellomo R, Defanti CA, et al. Irreversible apnoeic coma 35 years later. Towards a more rigorous definition of brain death? *Intensive Care Med* 2004;30(9):1715-22, doi:10.1007/s00134-003-2106-3
29. Sundin-Huard D, Fahy K. The problems with the validity of the diagnosis of brain death. *Nurs Crit Care* 2004;9(2):64-71, doi:10.1111/j.1478-5153.2003.0057.x

Figure 1: SIBICC Panelists' Use of Prognostic Calculators

Legend: Blinded survey responses from 41 SIBICC panelists are provided related to the use of prognostic calculators in their practices. The panelists indicated that they infrequently perform prognostic calculations or report the results of prognostic calculations to patients' substitute decision makers. Most investigators indicated they would use the IMPACT prognostic calculator if they were to use one.

CRASH = Corticosteroid Randomization After Significant Head Injury Trial; IMPACT = International Mission for Prognosis and Analysis of Clinical Trials in Traumatic Brain Injury; SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury; TRISS = trauma injury severity score

Figure 2: SIBICC Panelists' Views on Nihilism and Withdrawal of Care Decisions

Legend: Blinded survey responses from 41 SIBICC panelists are provided related to their experiences with and views on nihilism and withdrawal of care decisions. The majority of respondents indicated that they have some concern with inappropriate therapeutic nihilism at their hospitals (**A**) and a higher level of concern with nihilism at other centers (**B**). Many reported concern with practice variability related to aggressiveness of care (**C, E**), and that physicians markedly influence the opinions of substitute decision makers (**D**). More than half of respondents indicated that their views on a patient's prognosis differ from other members of the care team at least occasionally.

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury

Figure 3: SIBICC Panelists' Views on Neurological Outcomes

Legend: Blinded survey responses from 41 SIBICC panelists are provided related to improving withdrawal of care decisions and processes. Most respondents indicated that improving consensus amongst physicians as to what constitutes an acceptable neurological outcome and an acceptable chance of achieving such an outcome would be desirable (**A-D**). They felt it would be beneficial for physicians to work with the general public to better understand what should be viewed as an acceptable neurological outcome and that use of prognostic calculators would benefit from refinement.

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury

Figure 4: SIBICC Panelists' Views on How Withdrawal of Care Processes Could Be Improved

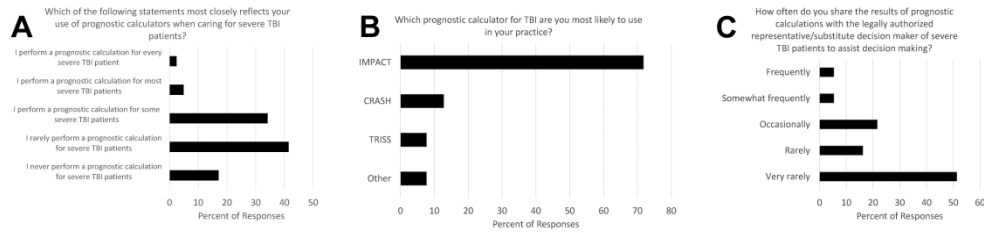
Legend: Blinded survey responses from 41 SIBICC panelists are provided related to improving withdrawal of care decisions and processes. Respondents favored greater consistency in withdrawal of care decisions around the world (A), but felt that it was appropriate for these decisions to be influenced by the patient's culture and local care environment (B). The panelists had some but not strong interest in the notion of a nihilism guard (C,D). There were mixed views on the autonomy of a patient's legally authorized representative to make withdrawal of care decisions independently (E).

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury

Figure 5: SIBICC Panelists' Views on Acceptable Outcomes and Chances of Those Outcomes

Legend: For (A), SIBICC panelists selected all Extended Glasgow Coma Scale Scores which they felt were sufficiently poor to justify withdrawal of care decisions. For (B) panelists considered predictions computed with ideal or existing prognostic calculators and the lowest chance of death or unacceptable outcome at which they would agree to a withdrawal of care decision. Responses were highly variable and presented via box and whisker plots. Values ranged from 64-69% depending on the scenario and were not statistically different on ANOVA testing.

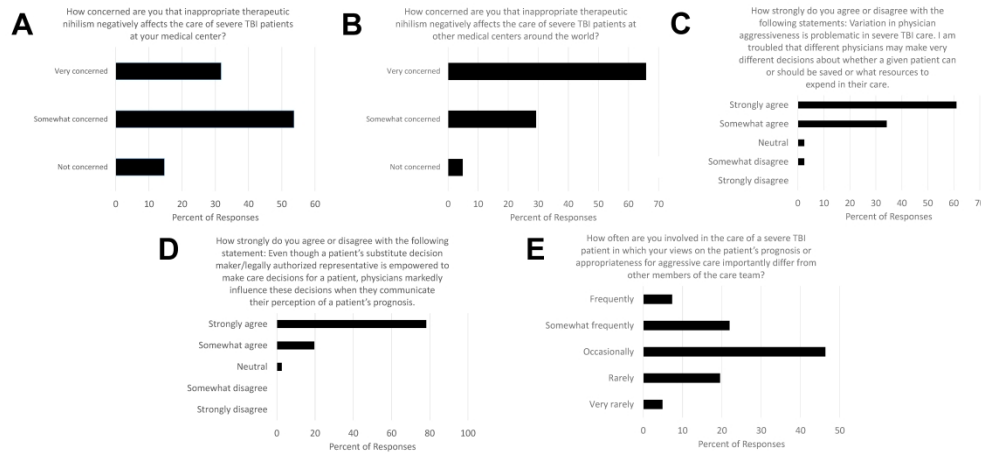
SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; UO = unacceptable outcome



Blinded survey responses from 41 SIBICC panelists are provided related to the use of prognostic calculators in their practices. The panelists indicated that they infrequently perform prognostic calculations or report the results of prognostic calculations to patients' substitute decision makers. Most investigators indicated they would use the IMPACT prognostic calculator if they were to use one.

CRASH = Corticosteroid Randomization After Significant Head Injury Trial; IMPACT = International Mission for Prognosis and Analysis of Clinical Trials in Traumatic Brain Injury; SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury; TRISS = trauma injury severity score

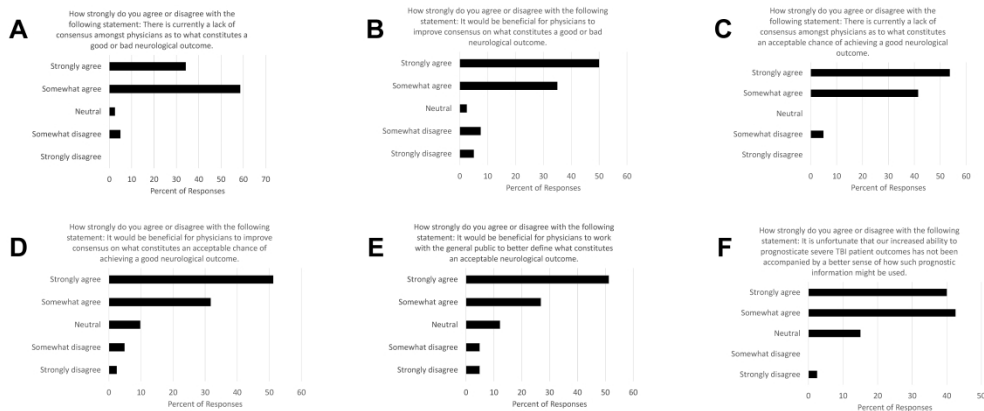
845x205mm (200 x 200 DPI)



Blinded survey responses from 41 SIBICC panelists are provided related to their experiences with and views on nihilism and withdrawal of care decisions. The majority of respondents indicated that they have some concern with inappropriate therapeutic nihilism at their hospitals (A) and a higher level of concern with nihilism at other centers (B). Many reported concern with practice variability related to aggressiveness of care (C, E), and that physicians markedly influence the opinions of substitute decision makers (D). More than half of respondents indicated that their views on a patient's prognosis differ from other members of the care team at least occasionally.

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury

842x381mm (200 x 200 DPI)

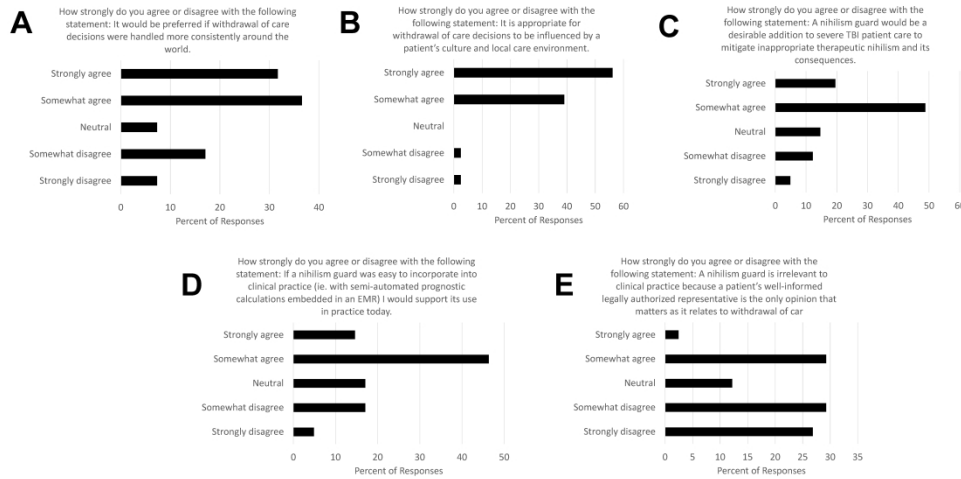


Blinded survey responses from 41 SIBICC panelists are provided related to improving withdrawal of care decisions and processes. Most respondents indicated that improving consensus amongst physicians as to what constitutes an acceptable neurological outcome and an acceptable chance of achieving such an outcome would be desirable (A-D). They felt it would be beneficial for physicians to work with the general public to better understand what should be viewed as an acceptable neurological outcome and that use of prognostic calculators would benefit from refinement.

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury

978x413mm (200 x 200 DPI)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

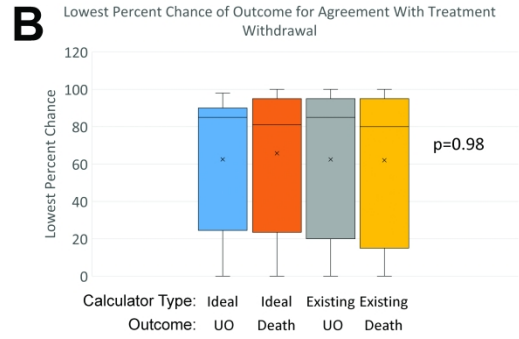
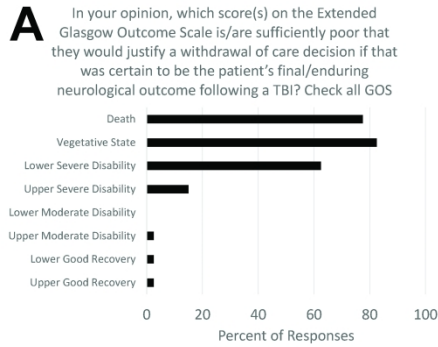


Blinded survey responses from 41 SIBICC panelists are provided related to improving withdrawal of care decisions and processes. Respondents favored greater consistency in withdrawal of care decisions around the world (A), but felt that it was appropriate for these decisions to be influenced by the patient's culture and local care environment (B). The panelists had some but not strong interest in the notion of a nihilism guard (C,D). There were mixed views on the autonomy of a patient's legally authorized representative to make withdrawal of care decisions independently (E).

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; TBI = traumatic brain injury

825x412mm (200 x 200 DPI)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



For (A), SIBICC panelists selected all Extended Glasgow Coma Scale Scores which they felt were sufficiently poor to justify withdrawal of care decisions. For (B) panelists considered predictions computed with ideal or existing prognostic calculators and the lowest chance of death or unacceptable outcome at which they would agree to a withdrawal of care decision. Responses were highly variable and presented via box and whisker plots. Values ranged from 64-69% depending on the scenario and were not statistically different on ANOVA testing.

SIBICC = Seattle International severe traumatic Brain Injury Consensus Conference; UO = unacceptable outcome

536x190mm (300 x 300 DPI)

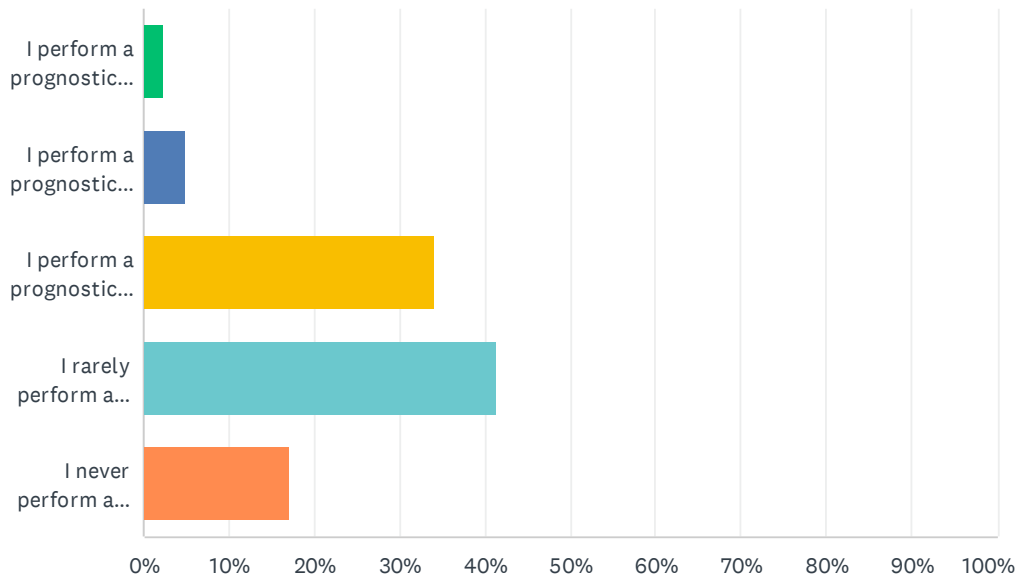
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Q1 Over the last decade prognostic calculators have been developed which have been derived from very large databases of TBI patients and which have undergone extensive validation. Although our ability to prognosticate outcomes from severe TBI has improved through these efforts, it could be argued that the uses and utility of these calculations have been insufficiently studied. With this background, please respond to the following questions. An optional opportunity to comment on each question is provided. What is your name? [Note your name will not be associated with your responses – it will simply be used to affirm that you responded to the survey in order to provide authorship].

Answered: 40 Skipped: 1

Q2 Which of the following statements most closely reflects your use of prognostic calculators when caring for severe TBI patients?

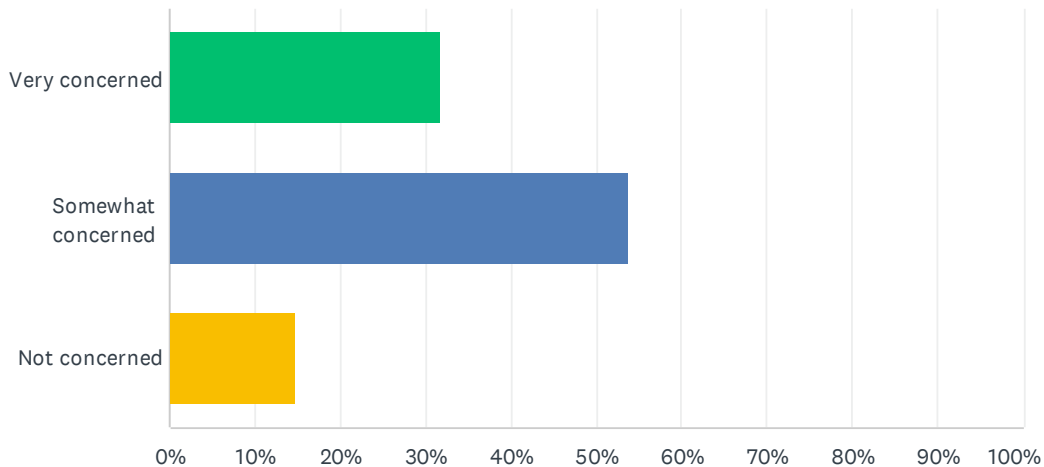
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
I perform a prognostic calculation for every severe TBI patient I care for	2.44%	1
I perform a prognostic calculation for most severe TBI patients I care for	4.88%	2
I perform a prognostic calculation for some severe TBI patients I care for	34.15%	14
I rarely perform a prognostic calculation for severe TBI patients I care for	41.46%	17
I never perform a prognostic calculation for severe TBI patients I care for	17.07%	7
TOTAL		41

Q3 How concerned are you that inappropriate therapeutic nihilism negatively affects the care of severe TBI patients at your medical center?

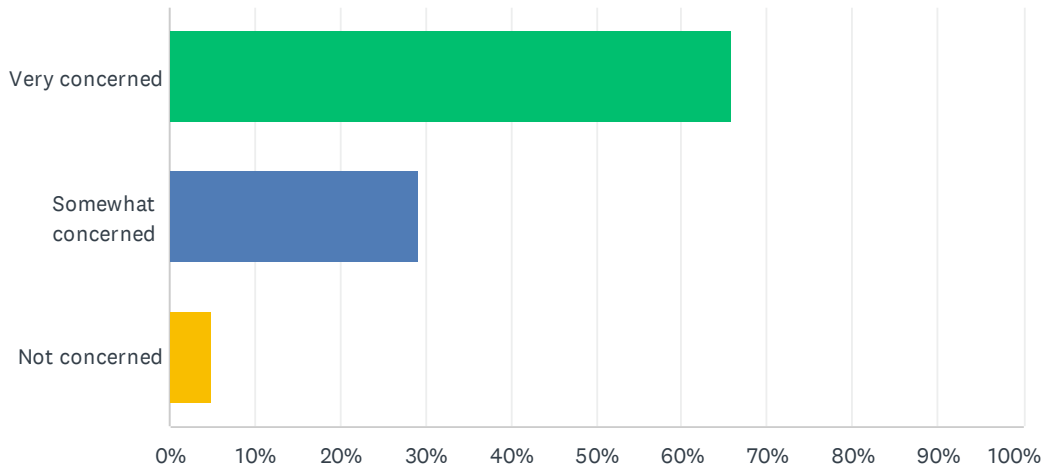
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very concerned	31.71%	13
Somewhat concerned	53.66%	22
Not concerned	14.63%	6
TOTAL		41

Q4 How concerned are you that inappropriate therapeutic nihilism negatively affects the care of severe TBI patients at other medical centers around the world?

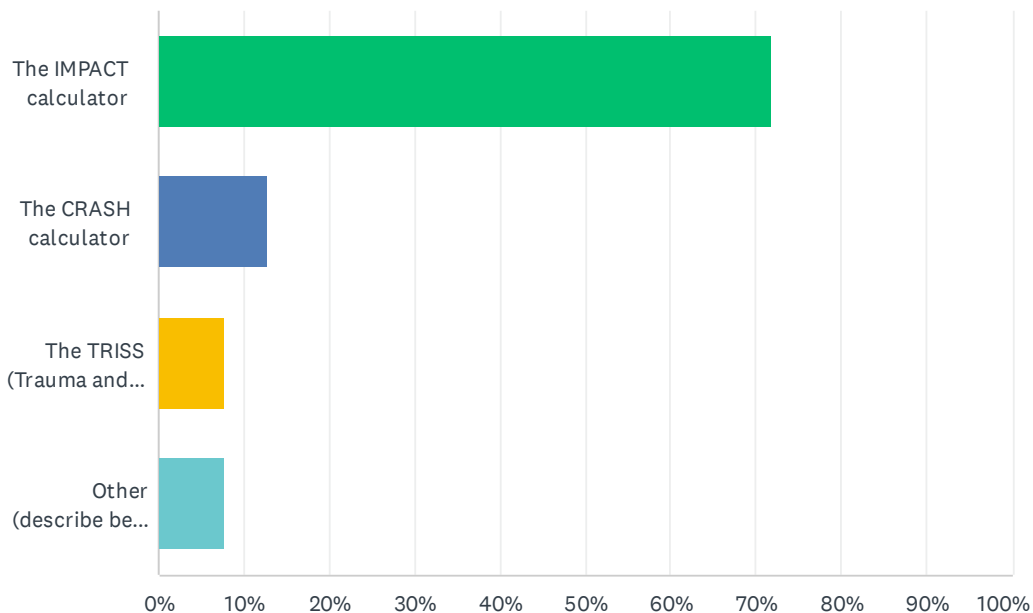
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very concerned	65.85%	27
Somewhat concerned	29.27%	12
Not concerned	4.88%	2
TOTAL		41

Q5 Which prognostic calculator for TBI are you most likely to use in your practice?

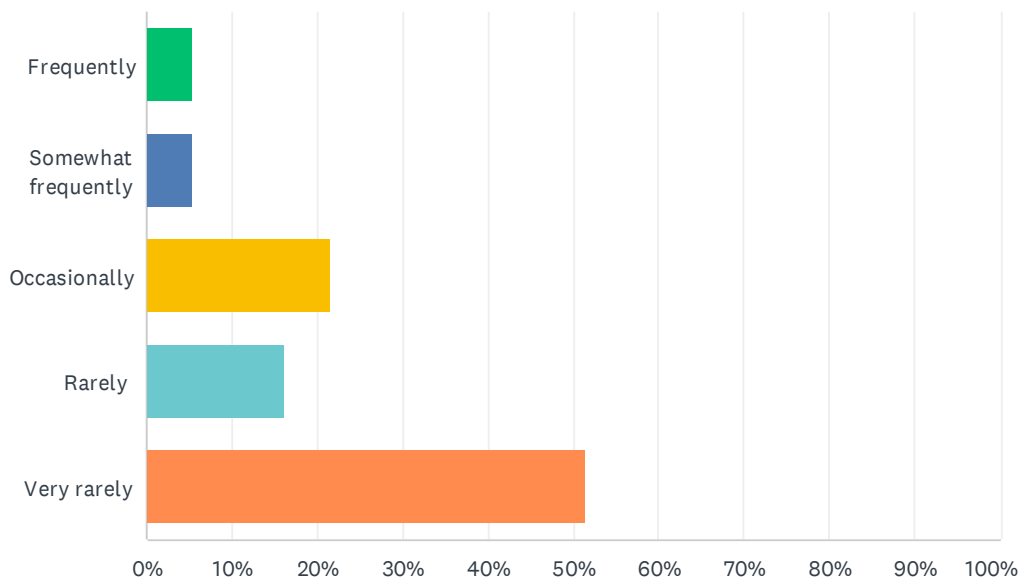
Answered: 39 Skipped: 2



ANSWER CHOICES	RESPONSES	
The IMPACT calculator	71.79%	28
The CRASH calculator	12.82%	5
The TRISS (Trauma and Injury Severity Score)	7.69%	3
Other (describe below please)	7.69%	3
TOTAL		39

Q6 How often do you share the results of prognostic calculations with the legally authorized representative/substitute decision maker of severe TBI patients to assist decision making?

Answered: 37 Skipped: 4

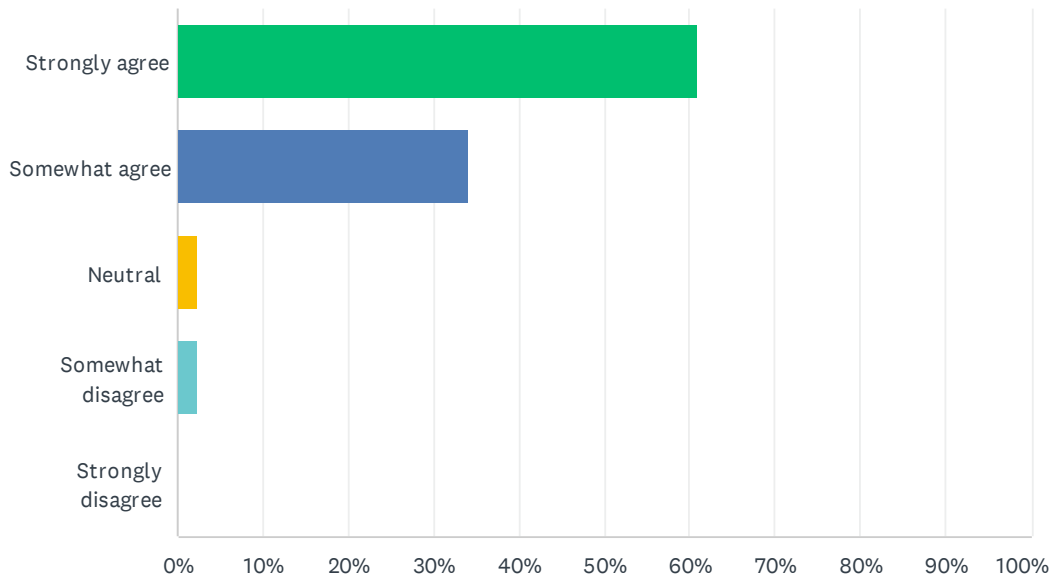


ANSWER CHOICES	RESPONSES
Frequently	5.41% 2
Somewhat frequently	5.41% 2
Occasionally	21.62% 8
Rarely	16.22% 6
Very rarely	51.35% 19
TOTAL	37

1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24
 25
 26
 27
 28
 29
 30
 31
 32
 33
 34

**Q7 How strongly do you agree or disagree with the following statements:
 Variation in physician aggressiveness is problematic in severe TBI care. I
 am troubled that different physicians may make very different decisions
 about whether a given patient can or should be saved or what resources to
 expend in their care.**

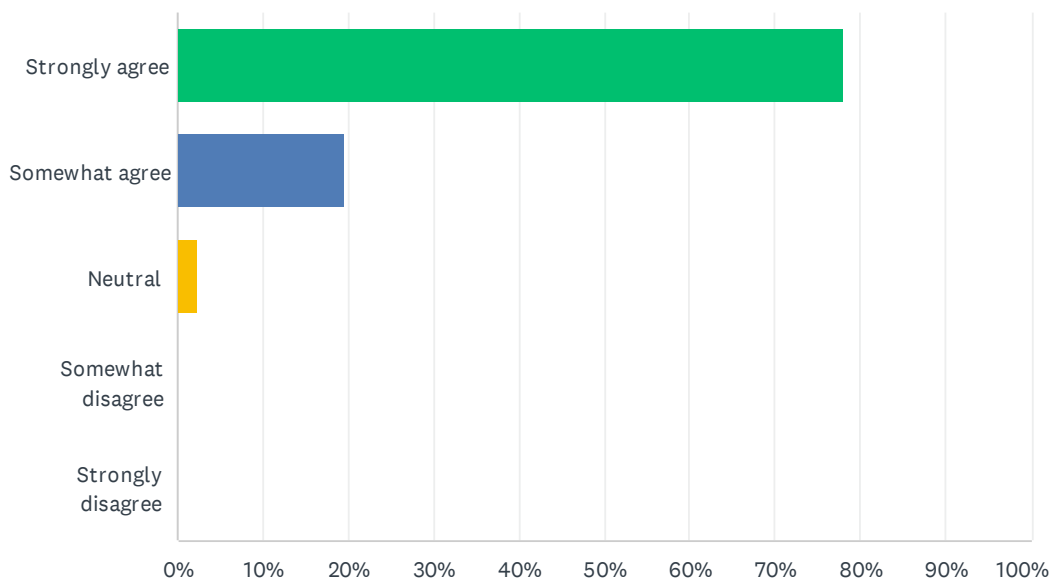
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	60.98%	25
Somewhat agree	34.15%	14
Neutral	2.44%	1
Somewhat disagree	2.44%	1
Strongly disagree	0.00%	0
TOTAL		41

Q8 How strongly do you agree or disagree with the following statement:
 Even though a patient's substitute decision maker/legally authorized
 representative is empowered to make care decisions for a patient,
 physicians markedly influence these decisions when they communicate
 their perception of a patient's prognosis.

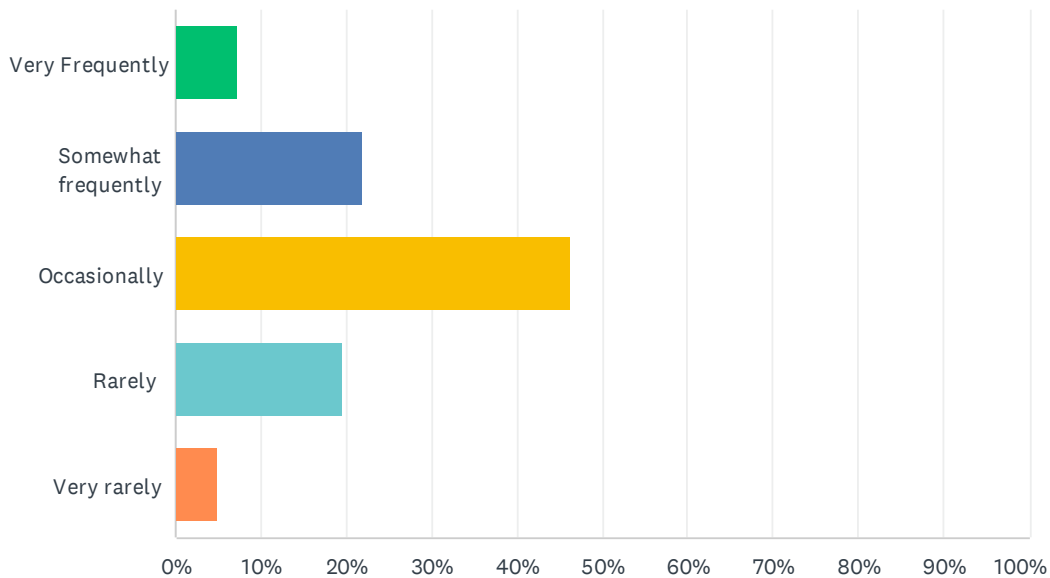
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	78.05%	32
Somewhat agree	19.51%	8
Neutral	2.44%	1
Somewhat disagree	0.00%	0
Strongly disagree	0.00%	0
TOTAL		41

Q9 How often are you involved in the care of a severe TBI patient in which your views on the patient's prognosis or appropriateness for aggressive care importantly differ from other members of the care team?

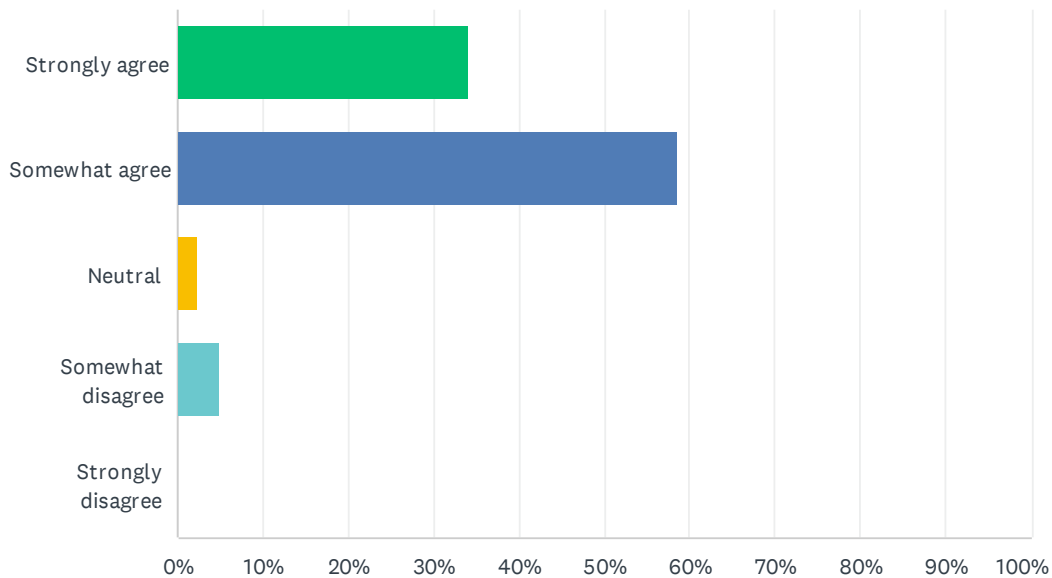
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Very Frequently	7.32%	3
Somewhat frequently	21.95%	9
Occasionally	46.34%	19
Rarely	19.51%	8
Very rarely	4.88%	2
TOTAL		41

Q10 How strongly do you agree or disagree with the following statement:
 There is currently a lack of consensus amongst physicians as to what
 constitutes a good or bad neurological outcome.

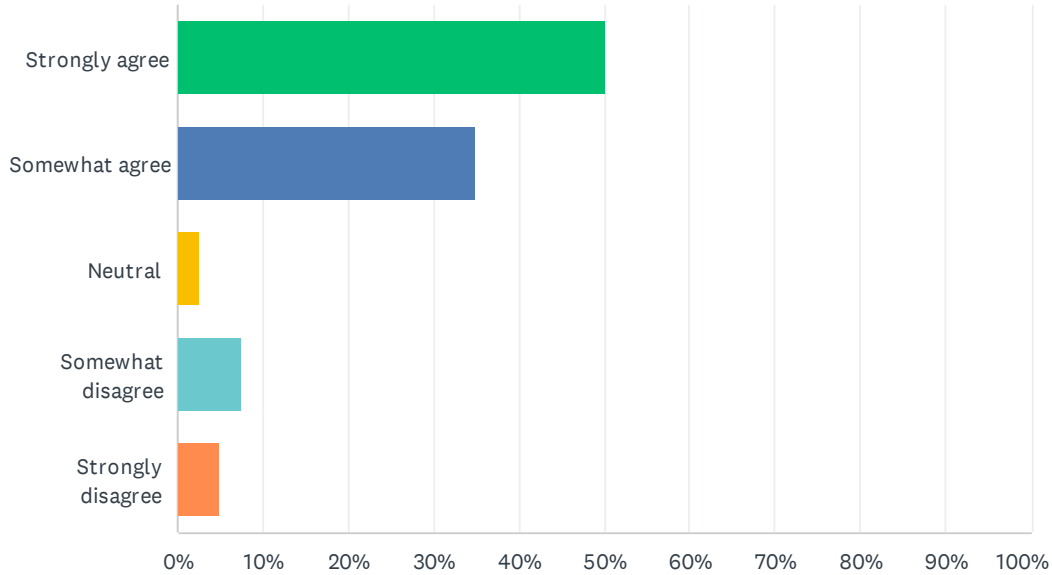
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	34.15%	14
Somewhat agree	58.54%	24
Neutral	2.44%	1
Somewhat disagree	4.88%	2
Strongly disagree	0.00%	0
TOTAL		41

Q11 How strongly do you agree or disagree with the following statement: It would be beneficial for physicians to improve consensus on what constitutes a good or bad neurological outcome.

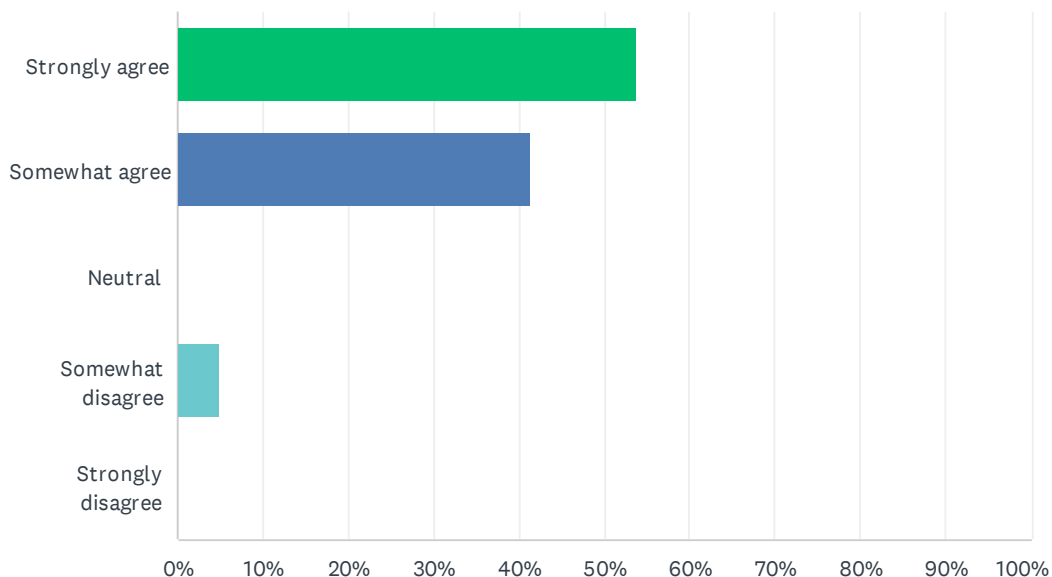
Answered: 40 Skipped: 1



ANSWER CHOICES	RESPONSES
Strongly agree	50.00% 20
Somewhat agree	35.00% 14
Neutral	2.50% 1
Somewhat disagree	7.50% 3
Strongly disagree	5.00% 2
TOTAL	40

Q12 How strongly do you agree or disagree with the following statement:
 There is currently a lack of consensus amongst physicians as to what
 constitutes an acceptable chance of achieving a good neurological
 outcome.

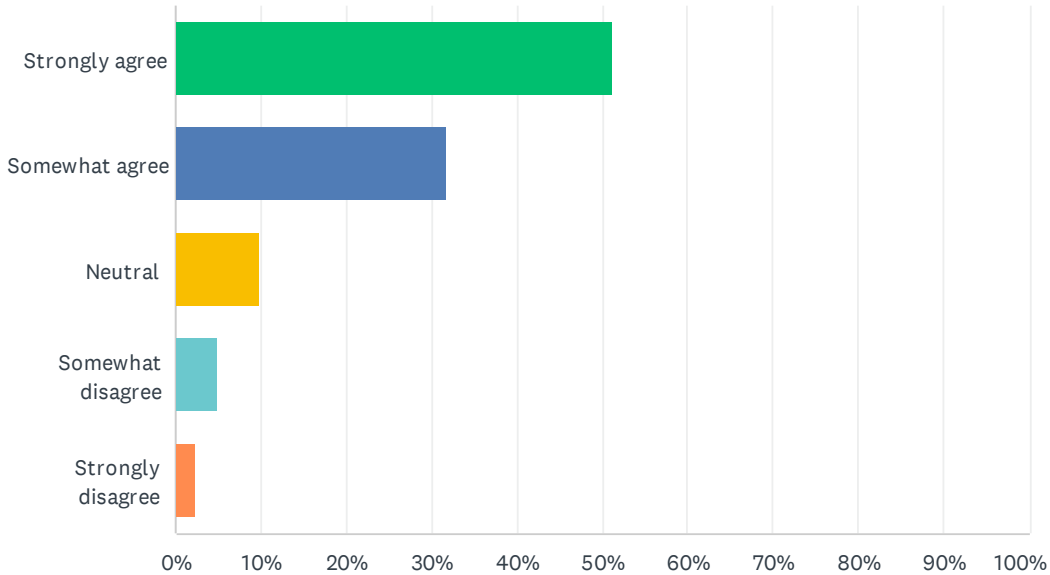
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	53.66%	22
Somewhat agree	41.46%	17
Neutral	0.00%	0
Somewhat disagree	4.88%	2
Strongly disagree	0.00%	0
TOTAL		41

Q13 How strongly do you agree or disagree with the following statement: It would be beneficial for physicians to improve consensus on what constitutes an acceptable chance of achieving a good neurological outcome.

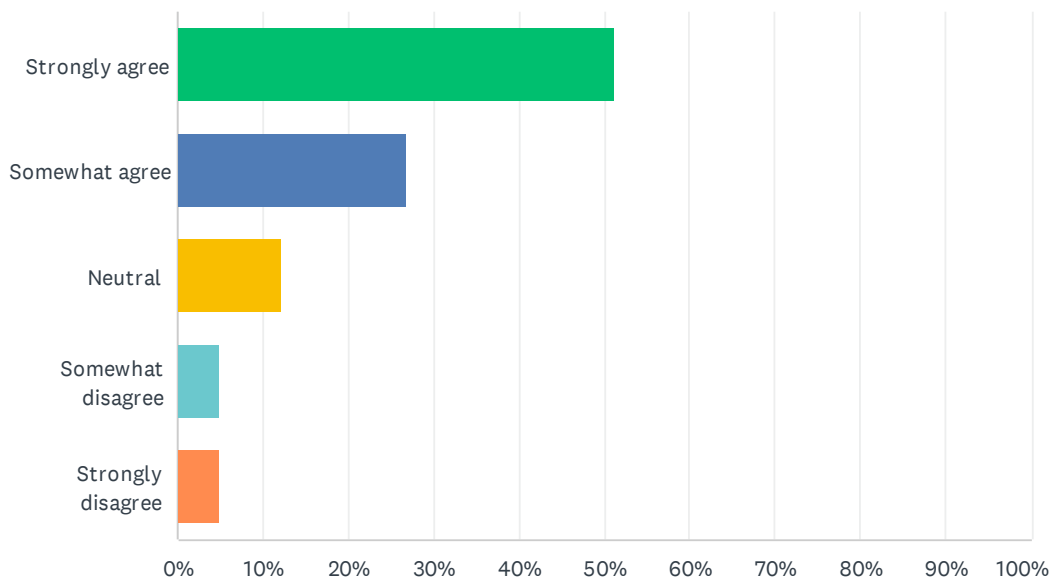
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	51.22%	21
Somewhat agree	31.71%	13
Neutral	9.76%	4
Somewhat disagree	4.88%	2
Strongly disagree	2.44%	1
TOTAL		41

Q14 How strongly do you agree or disagree with the following statement: It would be beneficial for physicians to work with the general public to better define what constitutes an acceptable neurological outcome.

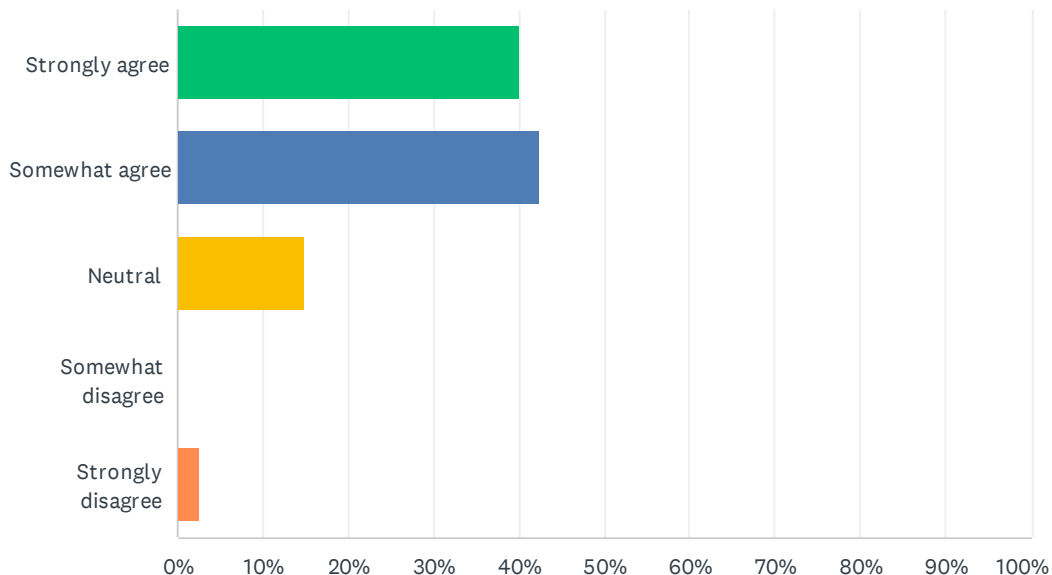
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	51.22%	21
Somewhat agree	26.83%	11
Neutral	12.20%	5
Somewhat disagree	4.88%	2
Strongly disagree	4.88%	2
TOTAL		41

Q15 How strongly do you agree or disagree with the following statement: It is unfortunate that our increased ability to prognosticate severe TBI patient outcomes has not been accompanied by a better sense of how such prognostic information might be used.

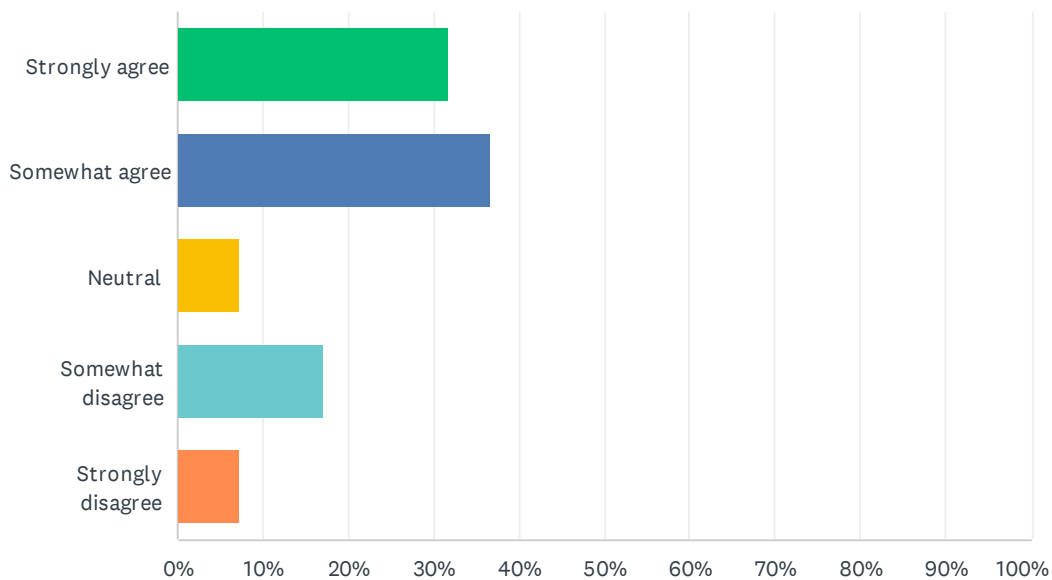
Answered: 40 Skipped: 1



ANSWER CHOICES	RESPONSES	
Strongly agree	40.00%	16
Somewhat agree	42.50%	17
Neutral	15.00%	6
Somewhat disagree	0.00%	0
Strongly disagree	2.50%	1
TOTAL		40

Q16 How strongly do you agree or disagree with the following statement: It would be preferred if withdrawal of care decisions were handled more consistently around the world.

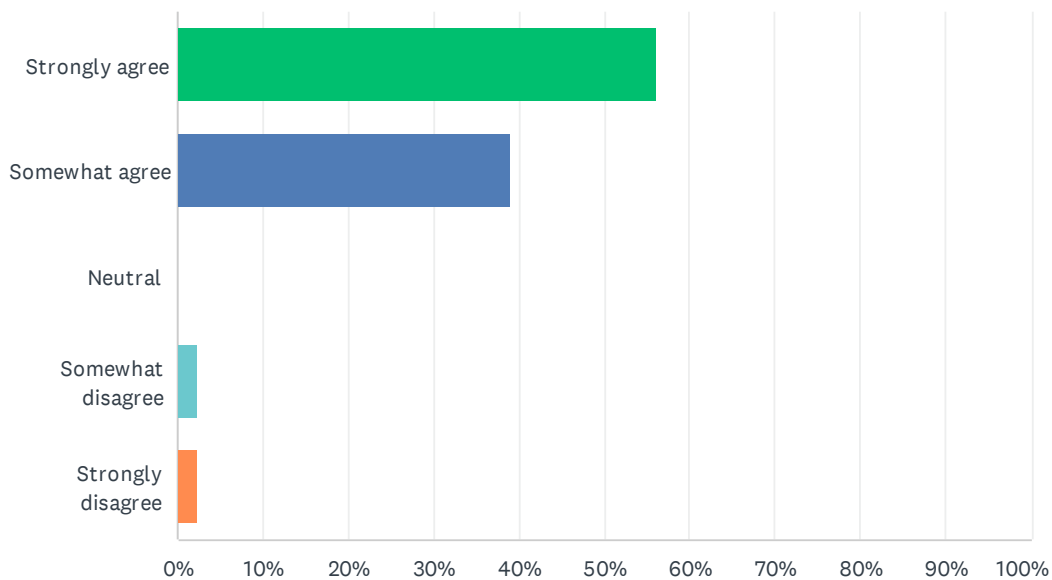
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	31.71%	13
Somewhat agree	36.59%	15
Neutral	7.32%	3
Somewhat disagree	17.07%	7
Strongly disagree	7.32%	3
TOTAL		41

Q17 How strongly do you agree or disagree with the following statement: It is appropriate for withdrawal of care decisions to be influenced by a patient's culture and local care environment.

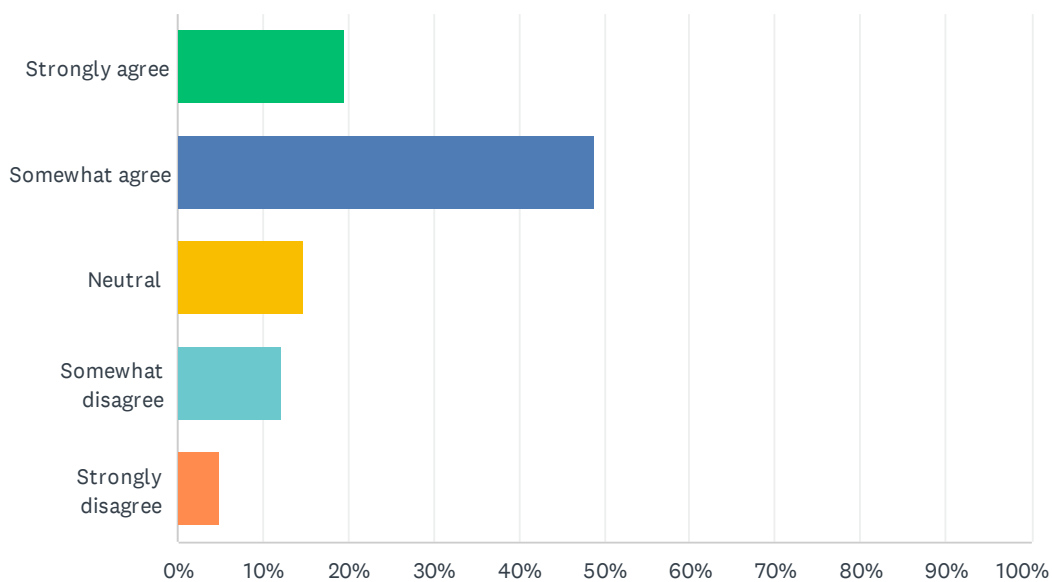
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES
Strongly agree	56.10% 23
Somewhat agree	39.02% 16
Neutral	0.00% 0
Somewhat disagree	2.44% 1
Strongly disagree	2.44% 1
TOTAL	41

Q18 Prognostic calculators could be used to create a ‘nihilism guard’ which reduces the impact of inappropriate therapeutic nihilism in severe traumatic brain injury. This would mean that care of a patient could not be withdrawn immediately or unilaterally when a sufficiently positive outcome is predicted. Because of the importance of such a medical decision, involvement of a second physician or perhaps a panel would be required prior to proceeding with withdrawal of care. This would help ensure that such a decision is being made carefully – similar to the need for two physicians to declare brain death. Please answer the following questions related to a nihilism guard. How strongly do you agree or disagree with the following statement: A nihilism guard would be a desirable addition to severe TBI patient care to mitigate inappropriate therapeutic nihilism and its consequences.

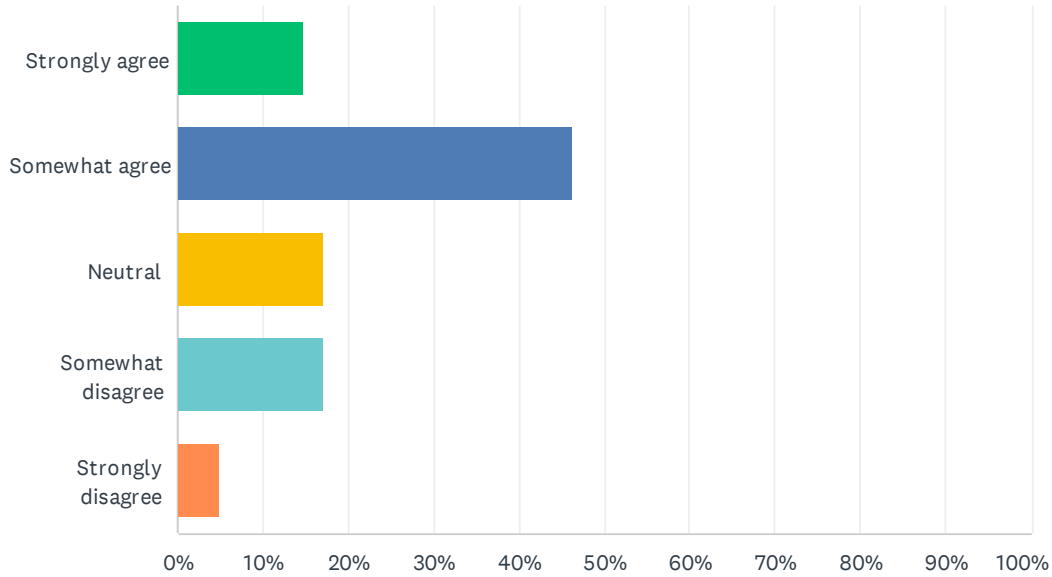
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES
Strongly agree	19.51% 8
Somewhat agree	48.78% 20
Neutral	14.63% 6
Somewhat disagree	12.20% 5
Strongly disagree	4.88% 2
TOTAL	41

Q19 How strongly do you agree or disagree with the following statement: If a nihilism guard was easy to incorporate into clinical practice (ie. with semi-automated prognostic calculations embedded in an EMR) I would support its use in practice today.

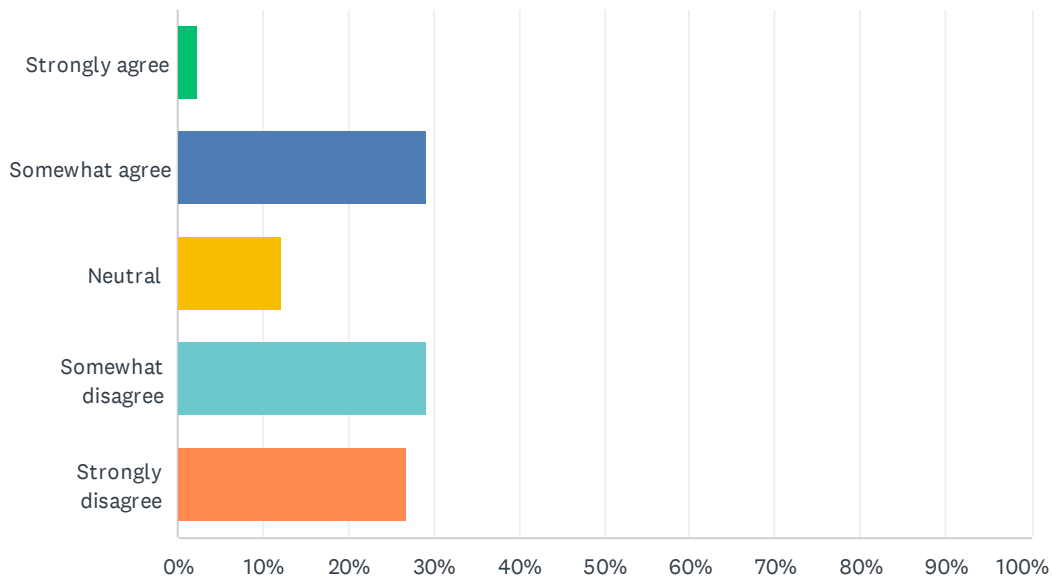
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	14.63%	6
Somewhat agree	46.34%	19
Neutral	17.07%	7
Somewhat disagree	17.07%	7
Strongly disagree	4.88%	2
TOTAL		41

Q20 How strongly do you agree or disagree with the following statement: A nihilism guard is irrelevant to clinical practice because a patient’s well-informed legally authorized representative is the only opinion that matters as it relates to withdrawal of care decisions.

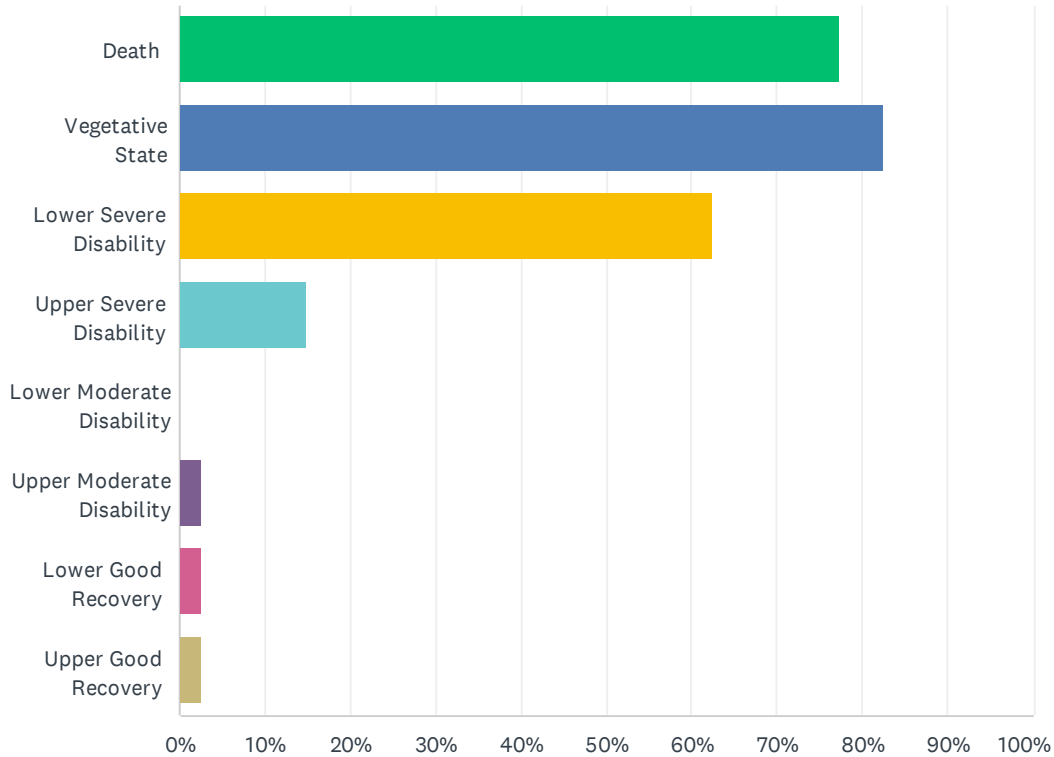
Answered: 41 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	2.44%	1
Somewhat agree	29.27%	12
Neutral	12.20%	5
Somewhat disagree	29.27%	12
Strongly disagree	26.83%	11
TOTAL		41

Q21 In your opinion, which score(s) on the Extended Glasgow Outcome Scale is/are sufficiently poor that they would justify a withdrawal of care decision if that was certain to be the patient's final/enduring neurological outcome following a TBI? Check all GOSE scores that apply.

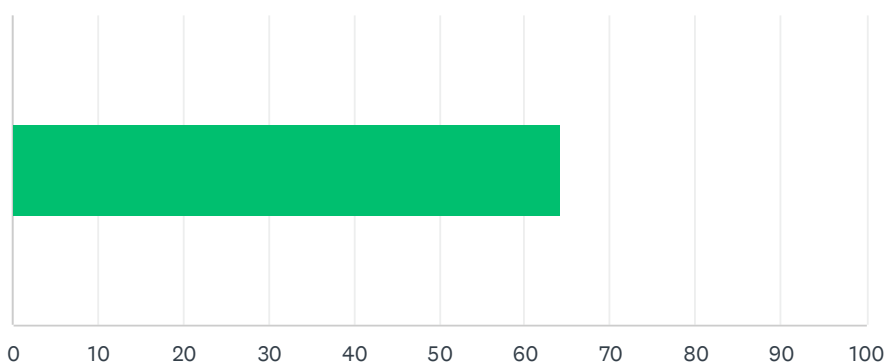
Answered: 40 Skipped: 1



ANSWER CHOICES	RESPONSES
Death	77.50% 31
Vegetative State	82.50% 33
Lower Severe Disability	62.50% 25
Upper Severe Disability	15.00% 6
Lower Moderate Disability	0.00% 0
Upper Moderate Disability	2.50% 1
Lower Good Recovery	2.50% 1
Upper Good Recovery	2.50% 1
Total Respondents: 40	

1
2
3 Q22 For the following questions please consider a theoretical, ideal severe
4 TBI prognostic calculator which was constructed from an extremely large
5 population and which performed extremely well in repeated large external
6 validation studies. Assume the ideal prognostic calculator provides highly
7 accurate calculations for individual patients. If calculated with an IDEAL
8 severe TBI prognostic calculator, what is the lowest percent of chance of
9 an unacceptable outcome at which would you agree with treatment
10 withdrawal? Please move the slider to provide your answer.
11
12
13
14

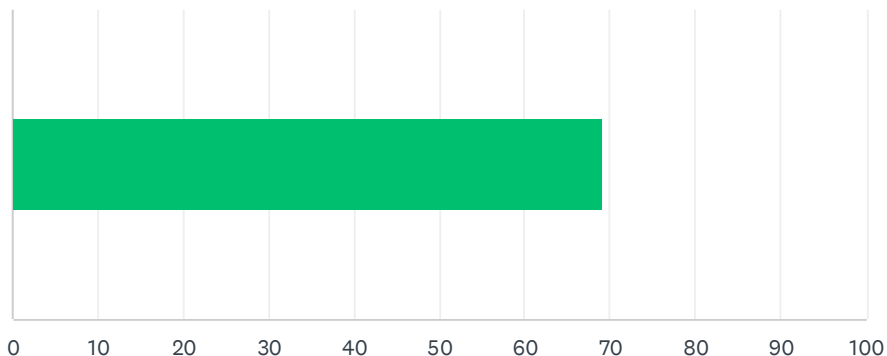
15 Answered: 40 Skipped: 1



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	64	2,563	40
Total Respondents: 40			

Q23 If calculated with an IDEAL severe TBI prognostic calculator, what is the lowest percent of chance of mortality at which would you agree with treatment withdrawal? Please move the slider to provide your answer.

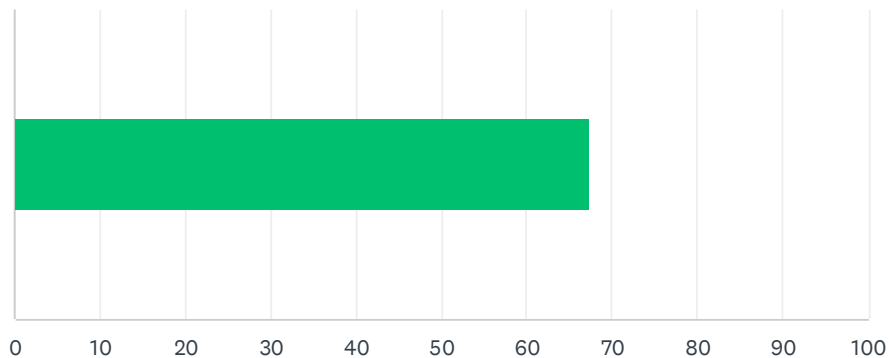
Answered: 39 Skipped: 2



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	69	2,697	39
Total Respondents: 39			

1
2
3
4 Q24 If calculated with an EXISTING severe TBI prognostic calculator,
5 what is the lowest percent chance of an unacceptable outcome at which
6 would you agree with treatment withdrawal? Please move the slider to
7 provide your answer.
8

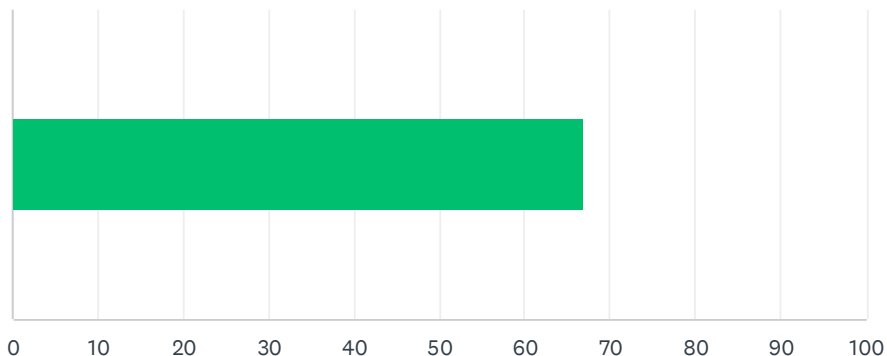
9 Answered: 38 Skipped: 3



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	67	2,561	38
Total Respondents: 38			

Q25 If calculated with an EXISTING severe TBI prognostic calculator, what is the lowest percent of chance of mortality at which would you agree with treatment withdrawal? Please move the slider to provide your answer.

Answered: 38 Skipped: 3



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
	67	2,544	38
Total Respondents: 38			