Prognostic factors associated with extubation failure in acutely brain-injured patients: a systematic review and meta-analysis

Supplemental Digital Content

Shaurya Taran, Natalia Angeloni, Ruxandra Pinto, Shawn Lee, Victoria A McCredie, Marcus J Schultz, Chiara Robba, Fabio Taccone, Neill KJ Adhikari

Additional outcomes

eTable 12: Indications for reintubation by study
eTable 13: Additional outcomes

PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	4
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	6, 7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	6, 7
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	eFigure 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7, 8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	8, eAppendix 1
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	8, 9
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	9
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	9
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	eAppendix 2
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	9
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	9, 10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	9, 10
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	10
Reporting bias	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not

PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			undertaken
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	10
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	11
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	None identified
Study characteristics	17	Cite each included study and present its characteristics.	11, 12
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	eTable 11
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Figure 2, Figure 3
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 2
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	12, 13
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	eFigures 2-5
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	eFigures 3-5
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	None undertaken
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Table 2
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	14, 15
	23b	Discuss any limitations of the evidence included in the review.	16, 17
	23c	Discuss any limitations of the review processes used.	16, 17
	23d	Discuss implications of the results for practice, policy, and future research.	17
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	11
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	1

PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Competing interests	26	Declare any competing interests of review authors.	1
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	19

Page numbers refer to the MS Word version of the originally submitted manuscript.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

eFigure 1: Electronic search strategies

Database: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other

Search Strategy:

---

1 ((extubat* or ex-tubat*) adj3 (fail* or success* or succeed* or predict* or evidence-based or early or delay* or soon or late or timing or time or strateg* or approach* or ready or readiness or schedul* or plan* or practice* or decide* or decision* or determine* or factor*)).mp. (5250)
2 (reintubat* or re-intubat*).mp. (2864)
3 (liberat* adj3 (fail* or success* or succeed* or predict* or evidence-based or early or delay* or soon or late or timing or time or strateg* or approach* or ready or readiness or schedul* or plan* or practice* or decide* or decision* or determine* or factor*)).mp. (882)
4 or/1-3 (8064)
5 exp Nervous System Diseases/ (2562746)
6 (brain or cerebr* or cranio* or spinal or intracranial or intra-cranial or neuro* or nervous).mp. (3768902)
7 exp Brain Injuries/ (71118)
8 exp Brain Injuries, Traumatic/ (16178)
9 exp Subarachnoid Hemorrhage/ (21736)
10 (subarachnoid hemorrhage* or subarachnoid haemorrhage*).mp. (30424)
11 exp Intracranial Hemorrhages/ (72836)
12 exp Hematoma, Subdural/ (9247)
13 (subdural hematoma* or sub-dural hematoma*).mp. (7476)
14 exp Hematoma, Epidural, Cranial/ (3454)
15 epidural hematoma*.mp. (3327)
16 exp Ischemic Stroke/ (1274)
17 stroke*.mp. (314344)
18 exp Status Epilepticus/ (8468)
19 status epilepticus.mp. (14048)
20 exp Meningitis/ (56133)
21 meningitis.mp. (66332)
22 exp Encephalitis/ (49314)
23 encephalitis.mp. (55425)
24 global cerebral ischemia.mp. (1742)
25 post cardiac arrest*.mp. (1000)
26 or/5-25 (5004950)
27 4 and 26 (1946)
28 limit 27 to english language (1747)

Database: Embase Classic and Embase

Search Strategy:
---
1 ((extubat* or ex-tubat*) adj3 (fail* or success* or succeed* or predict* or evidence-based or early or delay* or soon or late or timing or time or strateg* or approach* or ready or readiness or schedul* or plan* or practice* or decide* or decision* or determine* or factor*)).mp. (9053)
2 (reintubat* or re-intubat*).mp. (5241)
3 (liberat* adj3 (fail* or success* or succeed* or predict* or evidence-based or early or delay* or soon or late or timing or time or strateg* or approach* or ready or readiness or schedul* or plan* or practice* or decide* or decision* or determine* or factor*)).mp. (1389)
4 or/1-3 (13943)
5 exp neurologic disease/ (3957047)
6 (brain or cerebr* or cranio* or spinal or intracranial or intra-cranial or neuro* or nervous).mp. (5585371)
7 exp brain injury/ (198815)
8 exp traumatic brain injury/ (53976)
9 exp subarachnoid hemorrhage/ (47850)
10 (subarachnoid hemorrhage* or subarachnoid haemorrhage*).mp. (52207)
11 exp brain hemorrhage/ or (intracranial hemorrhage* or intracranial haemorrhage*).mp. (158099)
12 exp subdural hematoma/ (19989)
13 (subdural hematoma* or sub-dural hematoma*).mp. (21252)
14 exp epidural hematoma/ (8433)
15 epidural hematoma*.mp. (9660)
16 exp brain ischemia/ (198651)
17 stroke*.mp. (485447)
18 exp epileptic state/ (24681)
19 status epilepticus.mp. (20969)
20 exp meningitis/ (110140)
21 meningitis.mp. (110487)
22 exp encephalitis/ (120900)
23 encephalitis.mp. (85635)
24 global cerebral ischemia.mp. (2273)
25 post cardiac arrest*.mp. (2298)
26 or/5-25 (6941616)
27 4 and 26 (3991)
28 limit 27 to english language (3726)

****

Database: EBM Reviews - Cochrane Central Register of Controlled Trials

Search Strategy:
---
1 ((extubat* or ex-tubat*) adj3 (fail* or success* or succeed* or predict* or evidence-based or early or delay* or soon or late or timing or time or strateg* or approach* or ready or readiness or schedul* or plan* or practice* or decide* or decision* or determine* or factor*)).mp. (3163)
2 (reintubat* or re-intubat*).mp. (840)
3 (liberat* adj3 (fail* or success* or succeed* or predict* or evidence-based or early or delay* or soon or late or timing or time or strateg* or approach* or ready or readiness or schedul* or plan* or practice* or decide* or decision* or determine* or factor*)).mp. (78)
4 or/1-3 (3637)
5 exp Nervous System Diseases/ (102095)
6 (brain or cerebr* or cranio* or spinal or intracranial or intra-cranial or neuro* or nervous).mp. (224744)
7 exp Brain Injuries/ (2190)
8 exp Brain Injuries, Traumatic/ (2190)
9 exp Subarachnoid Hemorrhage/ (583)
10 (subarachnoid hemorrhage* or subarachnoid haemorrhage*).mp. (1933)
11 exp Intracranial Hemorrhages/ (1936)
12 exp Hematoma, Subdural/ (122)
13 (subdural hematoma* or sub-dural hematoma*).mp. (527)
14 exp Hematoma, Epidural, Cranial/ (12)
15 epidural hematoma*.mp. (172)
16 exp Ischemic Stroke/ (0)
17 stroke*.mp. (59911)
18 exp Status Epilepticus/ (105)
19 status epilepticus.mp. (513)
20 exp Meningitis/ (680)
21 meningitis.mp. (2123)
22 exp Encephalitis/ (325)
23 encephalitis.mp. (893)
24 global cerebral ischemia.mp. (17)
25 post cardiac arrest*.mp. (198)
26 or/5-25 (311304)
27 4 and 26 (886)
28 limit 27 to english language (525)

****

eTable 1: Study exclusions at full-text stage

Reason for exclusion	Number	Study
Duplicate publication	32	Abbas (2013), Alsherbini (2017), Anderson (2011), Asehnoune (2017), Bowry (2019), Castro (2012), Chen (2021), Collazos (2021), dos Reis (2013), Godet (2017), Greer (2009), Kingbeil (1988), Koh (1997), Kutchak (2015), Kutchak (2017), Lioutas (2015), Maier (2021), Manno (2008), McCredie (2017), Mullaguri (2016), Rishi (2014), Roquilly (2013), Sachin (2021), Shalev (2015), Singh (2014), Steidl (2017), Suntrup-Krueger (2019), Suntrup-Krueger (2019), Tanwar (2019), Vidotto (2008), Vidotto (2012), Wendell (2010)
Wrong outcomes	16	Alsherbini (2019), Al-Dhuhli (2019), Coplin (2000), Fandler-Hofler (2020), Flexman (2014), Ghali (2021) Jenkins (2019), Koh (1997), Lioutas (2016), Maier (2021), Manno (2008), Popat (2018), Reis (2013), Roquilly (2013), Sachin (2020), Schonenberger (2016)
Abstract only	11	Fan (2018), George (2015), Johal (2019), Kahn (2014), Katyshev (2017), Mayer (2018), Nashawi (2019), Shi (2019), Wendell (2010), Yonaty (2012), Yun (2019)
Mechanical ventilation < 24 hours	9	Alansary (2020), Anderson (2010), Cai (2016), Hayashi (2013), Navalesi (2008), Shalev (2014), Vidotto (2008), Vidotto (2011), Vidotto (2012)
No prognostic factors	9	Abbas (2013), Asehnoune (2017), Brogan (2015), Cai (2013), Karanjia (2011), Klingbeil (1988), Mullaguri (2018), Tanwar (2019), Yekefallah (2019)
Letter/commentary	6	Ayubi (2017), Bowry (2019), Chowdhury (2013), Elmer (2014), Godet (2017), Liu (2017)
Wrong patient group	4	Baptistella (2021), Mohammad (2016), Said (2016), Salam (2004)
Review article	2	Cinotti (2018), Mahanes (2004)

eTable 2: Citation searching results

Author (year)	Number screened	Full texts reviewed	Article screened	Included/ Excluded	Justification
Asehnoune (2017)	49	1	Predictors of Extubation Failure in Neuro-Critically Ill Patients in KNH ICUs	Included	Meets all inclusion criteria
Castro (2012)	18	0			
Dos Reis (2013)	15	1	A Reassessment of Weaning Parameters in Patients with Spontaneous Intracerebral Hemorrhage	Excluded	No prognostic factors
Dos Reis (2017)	19	1	Development of a risk score to predict extubation failure in patients with traumatic brain injury: Methodological issues	Excluded	Letter/ commentary
Gitonga (2020)	0	0			
Godet (2017)	53	0			
Guru (2016)	22	0			
Ibrahim (2018)	3	1	The Cough reflex intensity score in critically ill patients' airway management: study protocol for a multicenter, prospective, observational trial.	Excluded	Wrong patient group
Ko (2009)	117	0			
Kutchak (2013)	38	0			
Kutchak (2017)	7	0			
McCredie (2017)	33	0			
Namen (2001)	389	0			
Qureshi (2000)	119	1	The impact of tracheostomy timing on clinical outcomes and adverse events in intubated patients with infratentorial lesions: early versus late tracheostomy.	Excluded	Wrong outcomes
Rishi (2016)	15	0			
Shi (2021)	1	0			
Steidl (2017)	31	0			
Suntrup-Krueger (2019)	16	1	Development and validation of a machine learning model for prediction of extubation failure in intensive care units	Excluded	Wrong patient group
Videtta (2021)	1	0			
Wendell (2011)	33	0			
Wojak (2018)	2	0			

Total articles screened: 981
Full texts reviewed: 6
Articles included: 1

eTable 3: Expanded Characteristics of included studies

Author (year) Country	No. of centres / patients	Population	Main selection criteria	Failed extubation n (%) [a]	ICU mortality n (%)
Asehnoune et al. (2017) France	3 / 437	TBI, SAH, ICH, stroke, CNS infection	Inclusion: Age >18 y, GCS ≤12, MV >48 h Exclusion: WDLST, pregnancy, SCI above T4	99 (22.6%)	15 (3.4%)
Castro et al. (2012) Brazil	1 / 20	Brainstem infarction	Inclusion: MV ≥10 d, GCS ≥7 Exclusion: Arrhythmia, MAP >150 or <60 mm Hg, recurrent stroke	8 (40.0%)	NR
dos Reis et al. (2013) Brazil	1 / 119	TBI	Inclusion: Age ≥ 18, GCS ≥ 8 at extubation, MV ≥48 h, successful SBT Exclusion: SCI, unplanned extubation	15 (12.6%)	NR
dos Reis et al. (2017) Brazil	1 / 311	TBI	Inclusion: Age >1 y8, MV >48 h, successful SBT, GCS ≥8 at extubation Exclusion: SCI, accidental extubation, primary tracheostomy	43 (13.8%)	NR
Gitonga (2020) Kenya	1 / 80	TBI, ICH, ischemic stroke, status epilepticus, infection, brain tumour	Inclusion: Age ≥14 y, GCS ≤14, MV > 24 h Exclusion: SCI above T4, GBS, post-cardiac arrest, eclampsia	34 (42.5%)	NR
Godet et al. (2017) France	1 / 140	TBI, SAH, ICH, ischemic stroke, HIE	SCI, status epilepticus, intoxication, CNS infection, self-extubation, primary tracheostomy	31 (24.2%)	9 (6.4%)
Guru et al. (2016) USA	1 / 150	Acute posterior fossa stroke (ischemic or hemorrhagic)	Inclusion: Age ≥18 y Exclusion: SAH, chronic strokes, primary IVH, extubated in operating room	18 (12.0%)[b]	NR
Ibrahim et al. (2018) Egypt	1 / 80	TBI	Inclusion: Ages 18–65 y, MV >24 h, successful SBT Exclusion: GCS <9, chest trauma, chronic respiratory diseases	37 (46.3%)	NR

Author (year) Country	No. of centres / patients	Population	Main selection criteria	Failed extubation n (%) [a]	ICU mortality n (%)
Ko et al. (2009) USA	1 / 62	TBI, SAH, ICH, ischemic stroke, brain tumour, SDH	Inclusion: Adult Exclusion: SCI, intubation for procedure, primary tracheostomy, WDLST, brain death	11 (17.5%)	NR
Kutchak et al. (2015) Brazil	1 / 135	TBI, SAH, ICH, brain tumour	Inclusion: MV> 24 hours, neurologic indication for MV, candidate for weaning Exclusion: NR	45 (33.3%)	7 (5.2%)
Kutchak et al. (2017) Brazil	1 / 132	TBI, SAH, ICH, brain tumour	Inclusion: Age ≥18 y, MV ≥24 h, brain injury, candidate for weaning Exclusion: SCI, thoracic or abdominal trauma, neuromuscular disorder	42 (31.8%)	6 (4.5%)
McCredie et al. (2017) Canada	3 / 192	TBI, SAH, ICH, ischemic stroke, subdural/epidural hematoma, post-craniotomy, HIE, status epilepticus, infection	Inclusion: Age >16 y, MV >24 h, acute brain injury new on hospital admission Exclusion: Unplanned extubation, death prior to extubation, extubation due to withdrawal of life-sustaining treatment	21.0%	5 (3.3%)
Namen et al. (2001) USA	1 /100	TBI, SAH, ICH, brain tumour, spinal trauma (<10% of patients)	Inclusion: NR Exclusion: NR	44 (38%)[c]	NR
Qureshi et al. (2000) USA	1 /69	ICH, ischemic stroke, brain tumour	Inclusion: Primary infratentorial lesion Exclusion: Elective intubation for neurosurgical procedures with extubation in the OR or recovery room	46 (66%)	27 (39%)
Rishi et al. (2016) USA	1 / 949	TBI, SAH, ICH, ischemic stroke, subdural hematoma, infection, brain tumour	Inclusion: Age ≥ 18, MV ≥ 24 hours Exclusion: Age < 18, no MV	108 (11.4%)	126 (13.3%)
Steidl (2017) Germany	2 / 185	ICH, ischemic stroke	Inclusion: Age > 18, presence of ICH or acute ischemic stroke Exclusion: Do-not-resuscitate order, extubation due to WDLST	36 (36.7%)	NR

Author (year) Country	No. of centres / patients	Population	Main selection criteria	Failed extubation n (%) [a]	ICU mortality n (%)
Shi et al. (2020) China	1 / 46	Tumor, intracranial vascular malformation or aneurysm, ICH, SAH	Inclusion: Age ≥ 18, MV > 48 hours, brain injury Exclusion: Brain dead, spinal cord injury, tracheostomized before or within 48h after SBT	17 (37%)	2 (4.3%)
Suntrup-Krueger et al. (2019) Germany	1 / 133	ICH, ischemic stroke	Inclusion: Adult patients (age not specified), ready for extubation Exclusion: Primary tracheostomy, extubation due to WDLST	32 (24.1%)[c]	NR
Videtta et al. (2021) Argentina	1 / 34	TBI, ischemic stroke, SAH, infection, status epilepticus, brain tumour	Inclusion: Age ≥ 18, required MV for ≥ 48 hours, neurocritical care patients Exclusion: Tracheostomy performed before first extubation attempt	9 (26.5%)	NR
Wendell et al. (2011) USA	1 / 71	Ischemic stroke	Inclusion: Stroke in MCA territory only, onset of stroke symptoms < 24 hours from admission Exclusion: Additional strokes outside MCA, primary ICH	10 (21.3%)	NR
Wojak et al. (2018) Germany	1 / 107	SAH	Inclusion: Hunt/Hess Grade 1-3 SAH, prior requirement for general anesthesia Exclusion: Death in the first 3 days of admission	13 (12.1%)	NR

CNS Central nervous system, *COPD* Chronic obstructive pulmonary disease, *CRS*-R Coma recovery scale revised, *GBS* Guillain barre syndrome, *GCS* Glasgow coma scale, *HIE* Hypoxic ischemic encephalopathy, *ICH* Intracranial hemorrhage, *IVH* Intraventricular hemorrhage, *MAP* mean arterial pressure, *MCA* Middle cerebral artery, *MV* Mechanical ventilation, *NIHSS* National Institute of Health Stroke Scale, *NR* Not reported, *SAH* Subarachnoid hemorrhage, *SBT* Spontaneous breathing trial, *SCI* Spinal cord injury, *SDH* Subdural hematoma, *TBI* Traumatic brain injury, *USA* United States of America, *WDLST*, withdrawal of life-sustaining treatent

All studies were cohort studies except Namen et al. (2001), which was a randomized trial.

[a] Not requiring reintubation within up to 72 hours of extubation, unless otherwise specified
[b] Not requiring reintubation at up to 7 days after extubation
[c] Not requiring reintubation at any point during ICU admission

eTable 4: Baseline characteristics by study and extubation outcome

Variable	Study														
	Asehnoune			Castro			dos Reis (2013)			dos Reis (2017)			Gitonga		
	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort
Patients, n	338	99	437	12	8	20	104	15	119	268	43	311	46	34	80
Age (yr), Mean (SD)	48±18	54±18	50±18	56±5	58±5	56.4±4.9	34.5±11.9	38.5±18.7	35±12.9	35.5±13.6	36.7±15	35.7±13.8			
Male, n (%)	206 (60.9)	61 (61.6)	267 (61.1)	8 (66.6)	5 (62.5)	12 (60)	100 (96.2)	11 (77.3)	111 (93.3)	253 (94.4)	34 (79.1)	287 (92.3)	31 (67.4)	30 (88.2)	61 (76.3)
Comorbidities, n															
Hypertension															25
Diabetes	21	12	33												10
Smoking	87	25	112												
Chronic kidney disease															2
COPD	22	8	30												
Coronary artery disease															
Illness Severity Score, mean (SD)															
SAPS II	41±12	44±14	42±12												
APACHE II															
APACHE III															
SOFA															
Cause of ABI, n (%)															
Traumatic brain injury	151 (44.7)	35 (35.3)	186 (42.6)				104 (100)	15 (100)	119 (100)	268 (100)	43 (100)	311 (100)	24 (52.2)	27 (79.4)	51 (63.8)
Subarachnoid Hemorrhage	97 (28.7)	29 (29.3)	126 (28.8)												
Intracranial Hemorrhage	39 (11.5)	15 (15.1)	54 (12.4)												8 (10)
Epidural Hematoma															
Acute Subdural Hematoma															
Acute Ischemic Stroke	16 (4.7)	6 (6)	22 (5)	12 (100)	8 (100)	20 (100)									4 (5)
Status Epilepticus															1 (1.3)
Meningitis/Encephalitis															6 (7.5)
Post craniotomy															
Global Cerebral Ischemia															
Other	35 (10.4)	14 (14.3)	49 (11.2)												10 (12.5)
MV Characteristics															
Days of MV before SBT															
Days of MV before extubation												7.6±3.4			
Total duration of MV	11 (5-17)	22(13-29)	12 (6-20)	301 ±34 (h)	317 ±35 (h)	302.8 ±35.4 (h)	7.8±3.3	9.8±5.1	8.1±3.6						
SBT technique	T-tube trial OR Ventilatory Support level <= 7 cm H_2O									PSV 7cm H_2O or T-tube					

Variable	Study														
	Godet			Guru			Ibrahim			Ko			Kutchak (2015)		
	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort
Patients, n	97	43	140	52	18	69	43	37	80	51	11	62	90	45	135
Age (yr), Mean (SD) *or* Median (IQR)	56±16	58±17		65 (53-74.8)	64.5 (43.5-76.8)		35.8±14.5	44.3±16.3	40.56 ±16.14	53.3	54.9	52 (17-87)	48.17 ±17.50	49.82 ±16.93	47.80 ±17.01
Male, n (%)	62 (64)	26 (78)	88 (63)	26 (50)	12 (66.7)	38 (55)	25 (58)	23 (62)	53 (66)			34 (55)	66 (73.30)	30 (66.70)	96 (71.10)
Comorbidities, n															
Hypertension				33	12		6	5	11	32	8	40			
Diabetes	17	8		12	5		4	2	6	9	3	12			
Smoking	29	14								23	2	25			
Chronic kidney disease				7	2										
COPD	12	8		4	1		1	2	3						
Coronary artery disease															
Illness Severity, Mean (SD) *or* Median (IQR)															
SAPS II	49±15	52±16													
APACHE II							7.38±3.2	8.39±4.09	7.9±3.7				18.20 ±5.70	20.40 ±4.40	18.87 ±5.41
APACHE III				57 (39.8-69.8)	52 (37.3-97.3)										
SOFA	6±3	6±3		4 (2-7)	5 (3.5-8.3)										
Cause of ABI, n (%)															
Traumatic brain injury	43 (44)	19 (44)					43 (100)	37 (100)	80 (100)			11 (17.7)			62 (47)
Subarachnoid hemorrhage	20 (21)	8 (19)										16 (25.8)			48 (35.6)
Intracranial hemorrhage	23 (22)	7 (16)		26 (50)	8 (44.4)							20 (32.3)			15 (11.4)
Epidural hematoma															
Acute subdural hematoma												5 (8.06)			
Acute ischemic stroke	5 (5)	7 (16)		26 (50)	10 (55.6)							2 (3.22)			
Status epilepticus															
Meningitis/encephalitis															
Post craniotomy															
Global cerebral ischemia	6 (6)	2 (5)													
Other												8 (12.9)			8 (6.1)
MV Characteristics															
Days of MV before SBT	17 (10-25)	16 (11-22)													
Days of MV before extubation															
Total duration of MV	17 (10-25)	25 (19-35)		2 (1-3.8)	3.5 (2-6.3)		5.26±2.7	7.79±4.66	6.46±3.96	8.78	8.36		7.21±4.85	11.46 ±6.26	8.62±5.70
SBT technique	PSV			T-Piece Trial			T Tube with oxygen			T-piece or CPAP			T-Tube and supplemental oxygen		

Variable	Study														
	Kutchak (2017)			McCredie			Namen			Qureshi			Rishi		
	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort
Patients, n	90	42	132	120	32	152			100	23	46	69	841	108	949
Age (yr), Mean (SD)	47.7±17.2	48.2±16.7	47.8 ±17.01	48±18	59±16	50±19			59 (18-91)	54.6±13.4	54.8±16.5	54.8±15.4	57 (25.0)	58.5 (23.0)	57.0 (26.0)
Male, n (%)	66 (73.3)	28 (66.7)	94 (72.6)	79(66)	24 (75)	103 (68)			55 (55)	10 (43)	26(57)	36 (52)	498 (59.2)	76 (70.4)	574 (60.5)
Comorbidities, n															
Hypertension															
Diabetes															
Smoking															
Chronic kidney disease															
COPD															
Coronary artery disease															
Illness Severity, mean (SD)															
SAPS II															
APACHE II	18.2±5.7	20.4±4.4	18.87 ±5.41	14±6	15±7	14±6			14.5 (5-21)						
APACHE III													51.0 (42.0)	56.0 (42.0)	51.0 (43.0)
SOFA															
Cause of ABI, n (%)															
Traumatic brain injury	43 (47.8)	19 (45.2)	62 (47)	37 (31)	9 (28)	46 (30)			23 (23)						146 (15.4)
Subarachnoid hemorrhage	7 (7.8)	8 (19)	15 (11.4)	29 (24)	10 (31)	39 (26)			19 (19)						129 (13.6)
Intracranial hemorrhage	32 (35.6)	15 (35.7)	47 (35.6)	19 (16)	5 (16)	24 (16)			34 (34)	10 (43)	19 (41)	29 (42)			101 (10.6)
Epidural hematoma															
Acute subdural hematoma				28 (23)	8 (25)	36 (24)									35 (3.7)
Acute ischemic stroke										7 (30)	20 (44)	27 (39)			106 (11.2)
Status epilepticus															
Meningitis/encephalitis															25 (2.6)
Post craniotomy				11 (9.2)	3 (9.4)	14 (9)									
Global cerebral ischemia															
Other	8 (8.9)	0 (0)	8 (6.1)	34 (28)	7 (22)	41 (26)			22 (22)	6 (26)	7 (15)	13 (18.8)			
MV Characteristics															
Days of MV before SBT															
Days of MV before extubation															
Total duration of MV	6 (3-10)	11 (6-14)	8.0 (3-11.75)	5 (3-8)	4 (3-8)	5 (3-8)									
SBT technique	T-Piece and supplemental oxygen			SBT or tolerates pressure support <= 7cm H_2O			T-piece or Flow-by						T-piece or pressure support		

Variable	Study																	
	Shi			Steidl			Suntrup-Krueger			Videtta			Wendell			Wojak		
	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort	Successful Extubation	Failed Extubation	Entire Cohort
Patients, n	29	17	46	62	36	98	101	32	133	25	9	34	37	10	47	94	13	107
Age (yr), Mean (SD)	54.3±11.7	47.8±11.7	51.9±13.2	65.9±15.0	64.6±16.2	65.4±15.4	68.2±12.9	70.7±11.7		39.72±16.43	51.67±11.74		62 (52-71)	51.5 (45-72)		51.5	63	
Male, n (%)	18 (62)	13 (76)	31 (67)	29 (46.8)	19 (52.8)	48 (49.0)	51 (50.5)	19 (59.4)					21 (57)	7 (70)	28 (60)	29 (30.9)	4 (30.8)	33 (30.8)
Comorbidities, n																		
Hypertension						58							26	6	32			
Diabetes						18							11	2	13			
Smoking						19							22	7/9	29 /46			
Chronic kidney disease																		
COPD						5							6	1	7			
Coronary artery disease													10	4	14			
Illness Severity, mean (SD)																		
SAPS II																		
APACHE II	15.7±4.4	17.2±3.3	16.2±4.1							19.32±7.62	20.22±4.74							
APACHE III																		
SOFA										6.20±2.55	6.11±3.41							
Cause of ABI, n (%)																		
Traumatic brain injury												21(61.8)						
Subarachnoid hemorrhage												2 (5.9)				94 (100)	13 (100)	107 (100)
Intracranial hemorrhage				6 (9.7)	7 (19.4)	13 (13.3)	5 (5)	4 (12.5)	9 (7)									
Epidural hematoma																		
Acute subdural hematoma																		
Acute ischemic stroke				56 (90.3)	29 (80.6)	85 (86.7)	96 (95)	28 (87.5)	124 (93)			7 (20.6)	37 (100)	10 (100)	47 (100)			
Status epilepticus												1 (2.9)						
Meningitis/encephalitis												2 (5.9)						
Post craniotomy																		
Global cerebral ischemia																		
Other	22 (76)	14(82)	36 (78)									1 (2.9)						
MV Characteristics																		
Days of MV before SBT	4.9±2.2	4.2±1.5	4.6±2.0															
Days of MV prior to extubation				44.3±54.3 (h)	37.7±35.7 (h)		28.7±51.4 (h)	85.6±77.7 (h)					2 (1-4)	2 (1.5-3.5)		1	2	
Total duration of MV				46.0±59.4 (h)	210.4±154.5 (h)					9.08±4.42	17.33±20.16		3 (2-5)	4 (3-7)		23 (h)	551 (h)	
SBT technique	CPAP of 5cm H_2O												Weaned to minimal PSV			PSV or CPAP with PEEP		

ABI Acute brain injury, *APACHE* Acute physiologic assessment and chronic health evaluation, *CPAP* Continuous positive airway pressure, *COPD* Chronic obstructive pulmonary disease, *MV* Mechanical ventilation, *PEEP* Positive end expiratory pressure, *PSV* Pressure support ventilation, *SAPS* Simplified acute physiology score, *SBT* Spontaneous breathing trial, *SOFA* Sequential organ failure assessment

eTable 5: Prognostic factors by study and extubation outcome

Variable			Study											
	Asehnoune		Castro		dos Reis (2013)		dos Reis (2017)		Gitonga		Godet		Guru	
	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed
Neurologic factors														
GCS total on admission	7 (5-10)	7 (3-10)			8.8±3.5	9.3±3.7			9 (7-11)	7 (4-8)	8 (5-11)	6 (4-9)		
GCS total on Intubation													9 (7-13)	10 (9.5-11.5)
GCS total on extubation day	11 (10-14)	11 (9-13)	10±2	9±1			10.7±0.6	10.1±1.0	8 (7-10)	7 (5-9)	9 (8-10)	9 (7-10)		
GCS motor on extubation day	6 (6-6)	6 (5-6)							4 (3-5)	4 (2-4)	5.1±1.4	4.8±1.6		
GCS eye on extubation day	4 (4-4)	4 (3-4)									3.7±0.6	3.5±0.8		
SAS on extubation day														
RASS on extubation day											0 (-1 - 0)	-1 (-1 - 0)		
BPS on extubation day											3 (3-3)	3 (3-3)		
FOUR score on extubation day									12 (10-15)	10 (6-12)	12 (11-13)	11 (10-13)		
FOUR item "eye"											3.6±0.8	3.1±1.1		
FOUR item "motor"											3.2±1.1	3.0±1.2		
FOUR item "brainstem"											4.0±0.1	3.8±0.6		
CRS-R on extubation day											15 (10-19)	11 (8-15)		
CRS-R item "auditory"											2.6±1.4	2.2±1.5		
CRS-R item "visual"											3.1±1.4	2.2±1.3		
CRS-R item "oromotor/verbal"											1.3±0.7	1.1±0.7		
CRS-R item "communication"											0.9±0.9	0.7±0.8		
CRS-R item "arousal"											2.5±0.7	1.8±0.9		
CRS-R item "motor"											3.7±1.6	3.3±1.4		
CAM-ICU on extubation day											54 (56)	34 (79)		
Admission NIHSS														
Airway factors on extubation day, n (%)														
Gag reflex present											83 (86)	27 (63)	15 (79)	5 (83.3)
Cough (stimulated or spontaneous)	283 (87)	80 (84.2)					247 (92.2)	35 (81.40)			75 (77)	23 (53)	48 (97.9)	10 (100.0)
ETT cuff leak present	52 (16.2)	8 (8.42)					263 (98.1)	43 (100)						
New positive sputum culture														
24-hr suction count													4 (2-6)	5 (2.8-8)
Secretion volume nil/small							201 (75)	21 (48.8)						
Secretion volume moderate/high							67 (25)	22 (51.2)						
Ventilator factors on extubation day														
Mean Inspiratory Pressure														
Maximal Inspiratory Pressure			45.3±10.3	41.6±7.5			76.7±28.5	76.3±26.1						
Mean Expiratory Pressure														
Maximal Expiratory Pressure							55.0±29.5	50.3±30.2						
Rapid Shallow Breathing Index			96±12	149±28	73.5±33.1	83.8±21.3	67.0±31.9	71.7±25.9			39±19	38±17	43.3 (32.9-51)	38 (28-48.9)
PEEP													5 (5-5)	5 (4.5-5.5)
Minute ventilation							10.9346±3.7452	11.3787±4.2734						
Hemodynamic/gas exchange factors on extubation day, Mean (SD) *or* Median (IQR)														
Systolic BP			147.5±13	141.3±15.9			149.1±96.3	145.9±23.7						
Diastolic BP			90.8±8	96.3±12.4			83.2±13.9	84.5±15.6						
Mean Arterial Pressure							105.2±35.0	105.0±16.6						
Heart Rate			89.2±24.6	94.5±16.9			91.2±21.1	93.3±17.8			88.4±16.3	84.0±15.1		
$PaCO_2$							38.1±7.1	37.7±4.7			38.9±5.6	38.8±6.5	35 (31-38)	35 (31-39)
PaO_2							124.2±40.0	119.6±31.9					89 (64-128)	85 (65-126)
SaO_2														
P/F ratio			216±27	175±34			365.2±122.4	352.1±101.8			335±82	334±94		
ABG pH							7.44±0.04	7.43±0.04			7.45±0.04	7.45±0.04		
24-hr fluid balance														

Variable	Study													
	Ibrahim		Ko		Kutchak (2015)		Kutchak (2017)		McCredie		Namen		Qureshi	
	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed
Neurologic factors														
GCS total on admission	8 (7)	9 (7)			7.94±2.12	7.20±2.16	7.94±2.13	7.40±2.16	7(4-9)	7 (6-9)				
GCS total on Intubation														
GCS total on extubation day	13 (6)	12 (6)			10.07±0.93	8.90±0.51	10.1±0.95	8.81±0.52	9 (8-10)	9 (8-10)				
GCS motor on extubation day														
GCS eye on extubation day														
SAS on extubation day														
RASS on extubation day														
BPS on extubation day														
FOUR score on extubation day			12.11	12.54										
FOUR item "eye"														
FOUR item "motor"														
FOUR item "brainstem"														
CRS-R on extubation day														
CRS-R item "auditory"														
CRS-R item "visual"														
CRS-R item "oromotor/verbal"														
CRS-R item "communication"														
CRS-R item "arousal"														
CRS-R item "motor"														
CAM-ICU on extubation day														
Admission NIHSS														
Airway factors on extubation day, n (%)														
Gag reflex present														
Cough (stimulated or spontaneous)														
ETT cuff leak present														
New positive sputum culture														
24-hr suction count														
Secretion volume nil/small														
Secretion volume moderate/high	6 (14)	8 (22)												
Ventilator factors on extubation day														
Mean Inspiratory Pressure														
Maximal Inspiratory Pressure			23.21	21.81	70.43±22.30	54.80±23.53	70 (52-87)	48 (37-67)						
Mean Expiratory Pressure														
Maximal Expiratory Pressure					75.65±48.80	55.73±27.59	63 (48-83)	50 (41-65)						
Rapid Shallow Breathing Index	58.9±22.3	57.8±23.3	59.91	74.81	43.86±16.76	51.30±18.92	43 (31-53)	52.5(38.8-58)						
PEEP					5.25±0.45	5.31±0.47	5.25±0.45	5.31±0.47						
Minute ventilation			9.76	9.96										
Hemodynamic/gas exchange factors on extubation day, Mean (SD) *or* Median (IQR)														
Systolic blood pressure					138±22	140±16								
Diastolic blood pressure					80±11	81±8.9								
Mean arterial pressure														
Heart rate					89±12	88±12								
$PaCO_2$					40±6.20	39±5.47								
PaO_2					117±35	125±31								
SaO_2					98±1.51	98±1.75								
P/F ratio	300.9±128.7	306.4±140.8	421	452	346±116	356±112								
ABG pH					7.40±0.31	7.40±0.03								
24-hr fluid balance														

Variable	Study													
	Rishi		Shi		Steidl		Suntrup-Krueger		Videtta		Wendell		Wojak	
	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed	Successful	Failed
Neurologic Factors														
GCS total on admission	8.0 (6.0)	9.0 (5.0)			12.0 (4.3)	11.0 (5.8)					11 (8-14)	11.5 (7-14)		
GCS total on Intubation														
GCS total on extubation day			9.0 (8.0-10.0)	8.0 (5.5-10.0)	13.0 (2.0)	12.0 (2.0)	12.7±2.0	10.9±2.2			10 (9-11)	9.5 (8-10)		
GCS motor on extubation day									5.64±0.49	5.56±0.53	6 (5-6)	6 (5-6)		
GCS eye on extubation day											4 (3-4)	3 (1-3)		
SAS on extubation day														
RASS on extubation day							0.1±1.2	-0.2±1.6						
BPS on extubation day														
FOUR score on extubation day	9.0 (6.0)	11.0 (5.0)												
FOUR item "eye"														
FOUR item "motor"														
FOUR item "brainstem"														
CRS-R on extubation day														
CRS-R item "auditory"														
CRS-R item "visual"														
CRS-R item "oromotor/verbal"														
CRS-R item "communication"														
CRS-R item "arousal"														
CRS-R item "motor"														
CAM-ICU on extubation day														
Admission NIHSS					15.0 (7.0)	13.5 (11.0)	15.5±7.9	17.5±10.8			17 (12-22)	19 (14-21)		
Airway Factors on extubation day, n (%)														
Gag reflex present														
Cough (stimulated or spontaneous)											37 (100)	10 (100)		
ETT cuff leak present														
New positive sputum culture														
24-hr suction count														
Secretion volume nil/small														
Secretion volume moderate/high														
Ventilator Factors on extubation day														
Mean Inspiratory Pressure														
Maximal Inspiratory Pressure														
Mean Expiratory Pressure														
Maximal Expiratory Pressure														
Rapid Shallow Breathing Index			48(32.0-75.0)	48.0(29.0-69.0)										
PEEP														
Minute ventilation			8.4(7.8-10.1)	9.5(7.7-11.3)										
Hemodynamic/Gas exchange factors on extubation day, Mean (SD) *or* Median (IQR)														
Systolic blood pressure														
Diastolic blood pressure														
Mean arterial pressure			99.1±13.0	98.4±8.8										
Heart rate			94.3±15.5	91.4±13.1										
$PaCO_2$			37.2±5.2	34.5±5.9										
PaO_2			98.6±30.9	96±34.4										
SaO_2														
P/F ratio			246.5±77.3	240±86.0										
ABG pH			7.49±0.03	7.48±0.04										
24-hr fluid balance														

ABG Arterial blood gas, *BPS* Behavioural pain scale, *CAM*-ICU Confusion assessment method – Intensive care unit, *COPD* chronic obstructive pulmonary disease, *CRS-R* Coma recovery scale - revised, *ETT* Endotracheal tube, *FOUR* Full outline of unresponsiveness, *GCS* Glasgow coma score, $PaCO_2$ Partial pressure of carbon dioxide, PaO_2 Partial pressure of oxygen, *PEEP* Positive end expiratory pressure, *P/F* Ratio of the partial pressure of oxygen to the fraction of inspired oxygen, *RASS* Richmond agitation and sedation scale, *SAS* Sedation agitation score

eTable 6: CHARMS-PF checklist of key items (adapted from Riley et al. (1))

Source of data	**N (%)**
Cohort study	20 (95.2%)
Randomized clinical trial	1 (4.8%)
Participant recruitment	
Participant recruitment and eligibility described	15 (71.4%)
Participants adequately described	16 (76.2%)
Study dates provided	17 (81.0%)
Outcomes to be predicted	
Outcomes clearly defined	18 (85.7%)
Same outcome definition used in all participants	21 (100%)
Outcomes assessed blinded to prognostic factors	7 (33.3%)
Time of outcome occurrence described	19 (90.5%)
Prognostic factors (index and comparator factors)	
Number and type of prognostic factors described	21 (100%)
Definition and method of measurement of each prognostic factor described	18 (85.7%)
Timing of each prognostic factor measurement described (e.g., on admission, on extubation day)	16 (76.2%)
Prognostic factors assessed blinded for outcome	8 (38.1%)
Handling of prognostic factors described (e.g., continuous, categorized)	19 (90.5%)
Sample size	
Sample size calculation conducted	5 (23.8%)
Indicated number of participants and number of outcomes/events	5 (23.8%)
Number of outcomes considered in relation to number of prognostic factors	3 (14.3%)
Missing data	
Number of participants with any missing data reported	3 (14.3%)
Reported missing data for each prognostic factor of interest	0 (0%)
Details of attrition described (e.g., number of patients lost to follow-up)	2 (9.5%)

Handling of missing data described (e.g., complete case analysis, imputation methods, other)	3 (14.3%)
Analysis	
Modeling method described (e.g., linear, logistic, Cox)	19 (90.5%)
Reports how modeling assumptions were checked	2 (9.5%)
Method for selection of prognostic factors (e.g., all factors considered, only significant factors)	11 (5.2%)
Method for handling continuous prognostic factors (e.g., dichotomisation, categorization)	17 (81.0%)
Results	
Unadjusted and adjusted prognostic effects estimate provided	16 (76.2%)
For each adjusted prognostic effects estimate, the set of adjustment factors used was described	13 (61.9%)
Interpretation and Discussion	
Interpretation of presented results	21 (100%)
Comparison with other studies, discussion of generalizability, strengths, and limitations	21 (100%)

eAppendix 1: Domains of extracted factors

1) Demographic factors: age, sex, body mass index (BMI), medical comorbidities, and ABI diagnosis at admission.
2) Neurologic factors: GCS (Glasgow Coma Scale) score at admission or on day of extubation, motor component of the GCS, eye component of the GCS, and Full Outline of Unresponsiveness (FOUR) score at admission or on day of extubation.
3) Airway and respiratory factors: cough, gag, swallow, secretion burden, maximal expiratory pressure (MEP), maximal inspiratory pressure (MIP), rapid shallow breathing index (RSBI), minute ventilation, spontaneous breathing trial (SBT) technique, respiratory rate, and positive end expiratory pressure (PEEP), each on day of extubation.
4) Hemodynamic and gas exchange factors: Mean arterial pressure, mean heart rate, partial pressure of oxygen, partial pressure of carbon dioxide, and ratio of partial pressure of oxygen to fraction of inspired oxygen concentration (PaO_2/FiO_2), each on day of extubation.

eTable 7: Neurologic prognostic factors by study

Author (Year)	GCS[a]	RASS	BPS	FOUR score	CRS-R	CAM-ICU	NIHSS	ICP
Asehnoune et al. (2017)	X							
Castro et al. (2012)	X							
dos Reis et al. (2013)	X							
dos Reis et al. (2017)	X							
Gitonga (2020)	X			X				
Godet et al. (2017)	X	X	X	X	X	X		
Guru et al. (2016)	X							
Ibrahim et al. (2018)	X							
Ko et al. (2009)				X				
Kutchak et al. (2015)	X							
Kutchak et al. (2017)	X							
McCredie et al. (2017)	X							X
Namen et al. (2001)	X							
Qureshi et al. (2000)	X							
Rishi et al. (2016)	X			X				
Shi et al. (2020)	X							
Steidl et al. (2017)	X						X	
Suntrup-Krueger et al. (2019)	X	X					X	
Videtta et al. (2021)								
Wendell et al. (2011)	X						X	
Wojak et al. (2018)								

[a] On admission or extubation day

BPS Behavioural pain scale, *CAM-ICU* Confusion assessment method for the intensive care unit, *CRS-R* Coma recovery scale revised, *FOUR* Full outline of unresponsiveness, *GCS* Glasgow coma scale, *ICP* Intracranial pressure, *NIHSS* National institutes of health stroke scale, *RASS* Richmond-agitation sedation scale, *SAS* Sedation agitation scale

eTable 8: Airway and respiratory prognostic factors by study

Author (Year)	Cough	Gag	ETT Cuff Leak	Secretions/ Suctioning	MIP	MEP	RSBI	PEEP	Minute ventilation
Asehnoune et al. (2017)	X		X	X					
Castro et al. (2012)					X		X		
dos Reis et al. (2013)							X		
dos Reis et al. (2017)	X		X	X	X	X	X		X
Gitonga (2020)									
Godet et al. (2017)	X	X					X		
Guru et al. (2016)	X	X		X			X	X	
Ibrahim et al. (2018)	X			X			X		
Ko et al. (2009)					X		X		X
Kutchak et al. (2015)	X				X	X	X	X	
Kutchak et al. (2017)					X	X	X	X	
McCredie et al. (2017)	X	X	X	X			X	X	X
Namen et al. (2001)							X		X
Qureshi et al. (2000)									
Rishi et al. (2016)									
Shi et al. (2020)							X		X
Steidl et al. (2017)	X	X		X			X		X
Suntrup-Krueger et al. (2019)	X			X					
Videtta et al (2021)									
Wendell et al. (2011)									
Wojak et al. (2018)									

ETT Endotracheal tube, *MEP* Maximal expiratory pressure, *MIP* Maximal inspiratory pressure, *PEEP* Positive end expiratory pressure, *RSBI* Rapid shallow breathing index

eTable 9: Hemodynamic and gas exchange prognostic factors by study

Author (Year)	Systolic BP	Diastolic BP	MAP	Heart Rate	$PaCO_2$	PaO_2	P/F Ratio	ABG pH	24-hr Fluid Balance
Asehnoune et al. (2017)									
Castro et al. (2012)	X	X		X			X		
dos Reis et al. (2013)									
dos Reis et al. (2017)	X	X	X	X	X	X	X	X	
Gitonga (2020)									
Godet et al. (2017)				X	X		X	X	
Guru et al. (2016)					X	X			
Ibrahim et al. (2018)							X		
Ko et al. (2009)							X		
Kutchak et al. (2015)	X	X		X	X	X	X	X	
Kutchak et al. (2017)									
McCredie et al. (2017)					X		X		X
Namen et al. (2001)							X		
Qureshi et al. (2000)									
Rishi et al. (2016)									
Shi et al. (2020)			X	X	X	X	X	X	
Steidl et al. (2017)							X		
Suntrup-Krueger et al. (2019)									
Videtta et al. (2021)									
Wendell et al. (2011)									
Wojak et al. (2018)									

ABG arterial blood gas, *BP* blood pressure, *MAP* mean arterial pressure

eTable 10: Adjusted prognostic factors included from multivariable models

Author (year)	Prognostic factors								
	Age	Sex	GCS	Cough	Swallowing	RSBI	P/F ratio	Duration of MV	Other
Asehnoune (2017)	X (<40 vs > 40)		X		X (attempt)				Visual pursuit
Castro (2012)						X (>80)	X (>199)		Airway resistance, BMI, Pdi, Pdi/Pdi max, Ti/Ti tot
dos Reis (2017)		X		X				X	Secretion volume, GCS motor score
Gitonga (2020)			X					X	TBI diagnosis, operative intervention, FOUR score
Godet (2017)				X	X				Gag, coma recovery score revised "visual" item
Guru (2016)								X (< 7 days)	Surgical evacuation
Ibrahim (2018)	X	X	X			X	X	X	APACHE II, semi-quantitative cough score
Kutchak (2017)									GCS motor score, tongue protrusion test
McCredie (2017)	X		X	X					24-hour fluid balance
Namen (2001)			X			X (<105)	X (>200)		Minute ventilation
Qureshi (2000)			X						Absence of brainstem deficits, surgical evacuation
Suntrup-Krueger (2019)			X		X			X	NIHSS, infratentorial location of stroke, semi-quantitative airway score, following commands
Wendell (2011)	X		X						NIHSS, laterality of stroke
Wojak (2018)	X							X	Hunt/Hess grade, intraventricular hemorrhage, intracerebral hemorrhage

APACHE Acute physiology and chronic health evaluation, *BMI* Body mass index, *FOUR* Full outline of unresponsiveness, *GCS* Glasgow coma scale, *MV* Mechanical ventilation, *NIHSS* National Institute of Health stroke scale, *P/F* Ratio of the partial pressure of oxygen to fraction of inspired oxygen concentration, *RSBI* Rapid shallow breathing index, *TBI* Traumatic brain injury

eTable 11: Risk of bias by QUIPS domain

Study	Study participation		Study attrition		Prognostic factor measurement		Outcome measurement		Study confounding		Statistical analysis and reporting		Overall risk of bias	
	Risk of bias	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*
Asehnoune (2017)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Full description of baseline characteristics.	Moderate	Limited description of loss to follow-up patients. No loss to follow-up reasons provided.	Low	Adequate description and measurement of prognostic factors. Imputations and sensitivity analysis used to treat missing data.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Low	Overall low due to low risk of bias in prognostic factor measurement, confounding, and statistical reporting.
Castro (2012)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Full description of baseline characteristics.	Low	No loss to follow-up. Measurements done and primary outcome presented in all 20 included patients.	Low	Adequate description and measurement of the prognostic factor. No missing data in measured prognostic factors.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Moderate	The multivariable model does not include factors such as age, that can be associated with muscle strength and severity of illness.	Low	Adequate statistical model. Sample size calculation described. No evidence of selective reporting of results.	Moderate	Overall moderate due to low risk of bias in prognostic factor measurement and statistical reporting, and moderate for study confounding.
dos Reis (2013)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Full description of baseline characteristics.	Low	No loss to follow-up. Primary outcome and predictor data presented for all 119 included patients.	Low	Adequate description and measurement of the prognostic factor. Cut-off point well defined. No missing data in measured prognostic factors.	Low	Extubation failure clearly defined and appropriately measured for all patients.	High	Only one predictor studied. No confounders described or included in the analysis.	Moderate	Insufficient presentation of data, limited description of model building strategy.	Moderate	Overall moderate due to low risk of bias for prognostic factor measurement, high for confounding, and moderate for statistical report and analysis.
dos Reis (2017)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Full description of baseline characteristics.	Low	No loss to follow-up. Primary outcome presented for all 311included patients.	Moderate	Not defined when the prognostic factors were measured. No report of missing data.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Moderate	Overall moderate due to moderate risk of bias for prognostic factor measurement, and low for confounding and statistical reporting.
Gitonga (2020)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Full description of baseline characteristics.	Low	No loss to follow-up. Primary outcome presented for all 80 included patients	Low	Strong description of all considered prognostic factors, including timing of measurement for the most important	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Low	Overall low due to low risk of bias for prognostic factor measurement, confounding, and statistical reporting.

Study	Study participation		Study attrition		Prognostic factor measurement		Outcome measurement		Study confounding		Statistical analysis and reporting		Overall risk of bias	
	Risk of bias	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*
						factors in adjusted model								
Godet (2017)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Good description of baseline characteristics.	Low	No loss to follow-up. Primary outcome presented for all 140 included patients.	Low	Adequate description and measurement of prognostic factors. Sensitivity analysis used to treat missing data.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Low	Overall low due to low risk of bias for prognostic factor measurement, confounding, and statistical reporting.
Guru (2016)	Moderate	Source population not adequately described. No information about required time on mechanical ventilation before extubation attempt.	Moderate	47 out of 197 eligible patients were excluded due to missing data. No information or attempts to collect information about these excluded patients.	Low	Adequate description and measurement of prognostic factors. No missing data in included patients.	Moderate	Extubation failure not adequately defined: no time point specified.	Moderate	Relevant confounders were measured but not fully described. Residual confounding therefore likely to be present.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Moderate	Overall low due to low risk of bias for prognostic factor measurement and statistical reporting, and moderate for study confounding
Ibrahim (2018)	Moderate	Limited description of sampling technique	Low	No loss to follow-up. Primary outcome data presented for all 80 included patients.	High	No consistency in the measurement of the prognostic factor: the validated scale was modified according to the result. The scale and the modified scale are not necessarily comparable.	Low	Extubation failure clearly defined and appropriately measured for all patients.	High	Only one predictor studied. No confounders described or included in the analysis.	Moderate	Limited description of model building strategy.	High	Overall high due to high risk of bias for prognostic factor measurements and study confounders, and moderate risk of bias for study population and statistical report.
Qureshi (2000)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Good description of baseline characteristics.	Low	A total of 7 patients (of 76 eligible) were excluded. This small proportion is unlikely to significantly affect study findings	Low	Adequate description and measurement (including time points) of prognostic factors. No missing data evident.	Moderate	Failed extubation criteria not explicitly defined and needed to be inferred from results.	Moderate	Selection of independent predictors not clinically sensible (e.g., GCS measured both at admission and before intubation, without elaboration)	Moderate	Incomplete description of an important independent predictor (absence of brainstem deficits) with unclear methods of how these were elicited	Moderate	Overall moderate due to low risk of bias for study participation, and moderate for study confounding and outcome reporting.
Ko (2009)	Moderate	Sampling period reported as 8 months without start or end dates. Limited description of	Moderate	Limited description of loss to follow-up patients.	Moderate	Incomplete descriptions of each prognostic factor. Measurement	Low	Extubation failure clearly defined and appropriately measured for all patients.	Moderate	Confounders not reliably measured. No description of adjustment methods for	Moderate	Limited description of data. No use of multivariable models. However, there	Moderate	Overall moderate due to moderate risk of bias for prognostic factor

Study	Study participation		Study attrition		Prognostic factor measurement		Outcome measurement		Study confounding		Statistical analysis and reporting		Overall risk of bias	
	Risk of bias	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*
		inclusion and exclusion criteria. Full description of baseline characteristics.				of each factor not robustly defined.				co-variates. All analyses were univariate.		is no evidence of selective reporting in the described results.		measurement, confounding, and statistical reporting.
Kutchak (2015)	High	Study design not adequately described. No description of exclusion criteria.	Low	No loss to follow-up. Primary outcome data presented for all 135 included patients.	Moderate	Prognostic factors well defined but no cut-off points provided. No report of missing data.	Low	Extubation failure clearly defined and appropriately measured for all patients.	High	Relevant confounders not measured. No adjustment for measured confounders.	High	A multivariable model is reported but the results are not shown.	High	Overall high due to high risk of bias for study confounding, and statistical reporting, and moderate for prognostic factor measurement
Kutchak (2017)	Moderate	Limited description of sampling technique.	Moderate	18 patients did not participate for being extubated outside the protocol, but description of these patients is not given.	Moderate	Prognostic factors well defined but no cut-off points provided. No report of missing data.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Moderate	Overall moderate due to moderate risk of bias for prognostic factor measurement, and low for confounding and statistical reporting.
McCredie (2017)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Good description of baseline characteristics.	Low	Loss to follow-up patients adequately described. Primary outcome data presented for all 152 electively extubated patients.	Low	Adequate description and measurement of prognostic factors. No missing data in included patients.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Low	Overall low due to low risk of bias for prognostic factor measurement, confounding, and statistical reporting.
Namen (2001)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Good description of baseline characteristics.	Low	No loss to follow-up. Primary outcome data presented for all 100 included patients.	Low	Prognostic factors well defined. Measurements appropriate for study and similar for both groups. No missing data in measured prognostic factors.	Moderate	Failed extubation criteria not explicitly defined and needed to be inferred from results.	Moderate	Adjusted analysis performed but limited presentation of data and not all adjusted factors necessarily relevant.	High	Results between text and tables not in agreement for all factors. Details of modeling strategy not fully explained.	Moderate	Overall moderate due to low risk of bias for prognostic factor measurement, moderate for study confounding, and high for statistical reporting.
Rishi (2016)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion/exclusion criteria. Good description of	Low	No loss to follow-up. Primary outcome data presented for all 949 included patients.	Low	Adequate description and measurement of prognostic factors. No missing data in measured prognostic factors.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Moderate	Residual confounding likely present as there was no adjustment. All analyses described were univariate.	Moderate	Full description of data between successful and failed extubation groups. However, there was no multivariable model.	Moderate	Overall moderate due to low risk of bias for prognostic factor measurement and moderate for study confounding

Study	Study participation		Study attrition		Prognostic factor measurement		Outcome measurement		Study confounding		Statistical analysis and reporting		Overall risk of bias	
	Risk of bias	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*
		baseline characteristics.												and statistical reporting.
Shi (2021)	Moderate	Place of recruitment described but period reported only as 12 months without start and stop dates. Limited description of sampling technique.	Low	No evidence of loss to follow-up. Primary outcome data was presented for all 46 patients.	Low	Adequate description and measurement (including time points) of prognostic factors. No missing data evident.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Moderate	No description of adjustment for clinically relevant covariates. Residual confounding likely to be present.	Moderate	Full description of data between successful and failed extubation groups. However, there was no multivariable model.	Moderate	Overall moderate due to low risk of bias for prognostic factor measurement and moderate for study confounding and statistical reporting.
Steidl (2017)	Moderate	Limited description of sampling technique. Limited description of inclusion criteria.	Low	No loss to follow-up. Primary outcome data presented for all 185 included patients.	Low	Adequate description and measurement of prognostic factors. No missing data in measured prognostic factors.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Moderate	Adjusted analysis performed but little data presented to verify findings, and only 2 factors presented in adjusted analysis.	Moderate	Selective reporting evident as only the factors independently associated with extubation failure were described.	Moderate	Overall moderate due to low risk of bias for prognostic factor measurement and moderate for study confounding and statistical reporting.
Suntrup-Krueger (2019)	Low	Place and period of recruitment, and sampling, clearly defined. Full description of inclusion criteria. Good description of baseline characteristics.	Low	No loss to follow-up. Primary outcome data presented for all 133 included patients.	Moderate	Prognostic factors well described but assessment of cough and gag subjective and non-standardized.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Low	Relevant confounders were measured and adjusted with multivariable models. Modeling technique described.	Low	Adequate statistical model. The strategy for model building is appropriate. No evidence of selective reporting of results.	Moderate	Overall moderate due to moderate risk of bias for prognostic factor measurement and low for study confounding and statistical reporting.
Videtta (2021)	Moderate	Place of recruitment described but period reported only as 30 months without start and stop dates. Limited description of sampling technique.	Low	Patients with missing follow-up data were excluded. Primary outcome reported for all 34 included patients.	Moderate	Limited evaluation of prognostic factors with unclear documentation of when measured.	Moderate	Extubation failure defined as weaning and absence of ventilatory support for ≥ 7 days but unclear if NIV/HFNC were used	Moderate	Adjusted analysis performed, but results presented only for age, with no odds ratio reported	Moderate	Selective reporting evident as only the factors independently associated with extubation failure were described.	Moderate	Overall moderate due to moderate risk of bias for prognostic factor measurement, study confounding and statistical reporting.
Wendell (2011)	Moderate	Limited description of sampling technique.	Low	Primary outcome data presented for all 47 patients.	Low	Adequate description and measurement of prognostic factors. No missing data in measured prognostic factors.	Low	Extubation failure clearly defined and appropriately measured for all patients.	Moderate	Adjusted analysis performed but with very little data to verify findings. Residual confounding likely present.	Moderate	No description of modeling strategy despite presentation of an adjusted analysis. Odds ratios for non-significant factors not presented.	Moderate	Overall moderate due to low risk of bias for prognostic factor measurement and moderate for study confounding and statistical reporting.
Wojak (2018)	High	No sampling technique	Low	No loss to follow-up.	Moderate	Unclear how to interpret odds	Low	Extubation failure clearly	Moderate	Adjusted analysis is not	Moderate	Limited description of	Moderate	Overall moderate due to moderate risk

Study	Study participation		Study attrition		Prognostic factor measurement		Outcome measurement		Study confounding		Statistical analysis and reporting		Overall risk of bias	
	Risk of bias	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*	*Risk of bias*	*Support*
		described. No sampling period described. Limited description of inclusion criteria. Limited description of baseline characteristics.		Primary outcome data reported for all 107 patients who underwent extubation trial.		ratios for a given change in each prognostic factor, as cut-off points are not clearly defined.		defined and appropriately measured for all patients.		comprehensively defined. Residual confounding by relevant covariates likely to be present.		modeling methods. No description of how model assumptions were checked. Data sparsely presented.		of bias for prognostic factor measurement, study confounding, and statistical reporting.

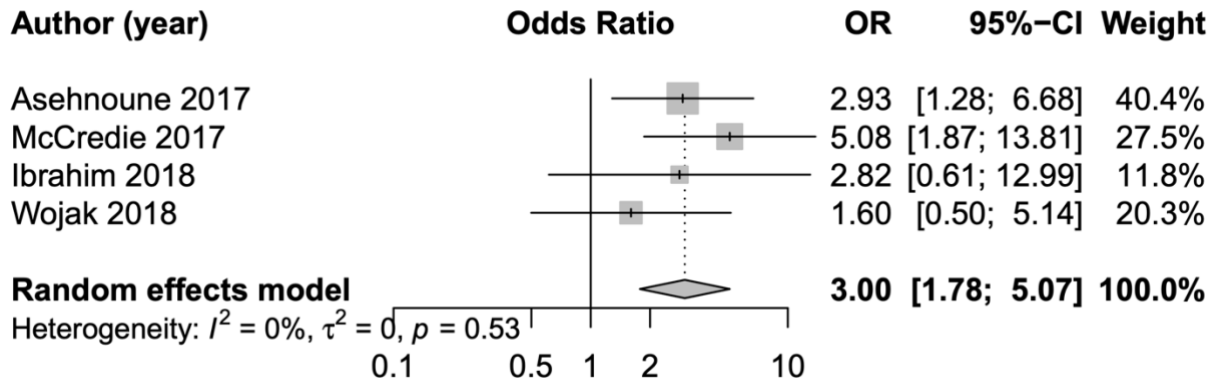
GCS Glasgow coma scale

eAppendix 2: Additional statistical methods

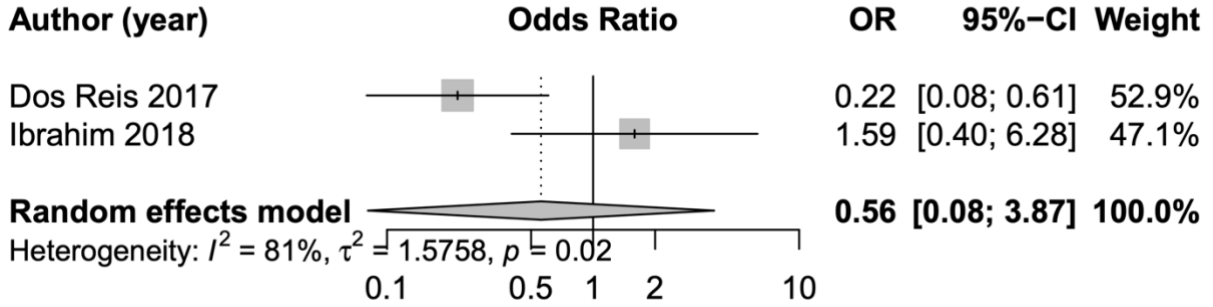
For continuous prognostic factors, we reported the odds ratio (OR) for the highest third versus the lowest third of each prognostic factor. This is equivalent to an increase in the prognostic factor by 2.18 standard deviation (SD) units (2). We assumed that prognostic factors had a normal distribution. Studies reported OR either for continuous prognostic factors, where the association with extubation failure was reported per unit change of the given factor, or in a dichotomized fashion, where the association with extubation failure was reported at a given threshold. For studies that reported OR of the prognostic factor as a continuous variable, we first transformed the OR to correspond to a one unit increase and then multiplied the log-OR by 2.18*SD. If OR were reported for dichotomized prognostic factors, we estimated the lower and upper mean and multiplied the log-OR by 2.18*SD divided by the difference between upper and lower mean. To apply this method, we required the means and standard deviations for each prognostic factor. If data was reported as median and interquartile range (IQR) or median and range, we used the formulas described by Wan et al. to transform to means and standard deviations (3). If means and standard deviations were reported per group we combined as the data as reported in the Cochrane Handbook (https://handbook-5-1.cochrane.org/chapter_7/table_7_7_a_formulae_for_combining_groups.htm). If the median was reported without a measurement of spread, data for the study was not used. One study reported the adjusted OR for duration of mechanical ventilation, but the mean and standard deviations were not available (4). We therefore imputed this value by pooling the means and standard deviations from two other studies that reported on similar types of patients (5, 6).

eFigure 2: Forest plots for individual prognostic factors in primary adjusted meta-analysis

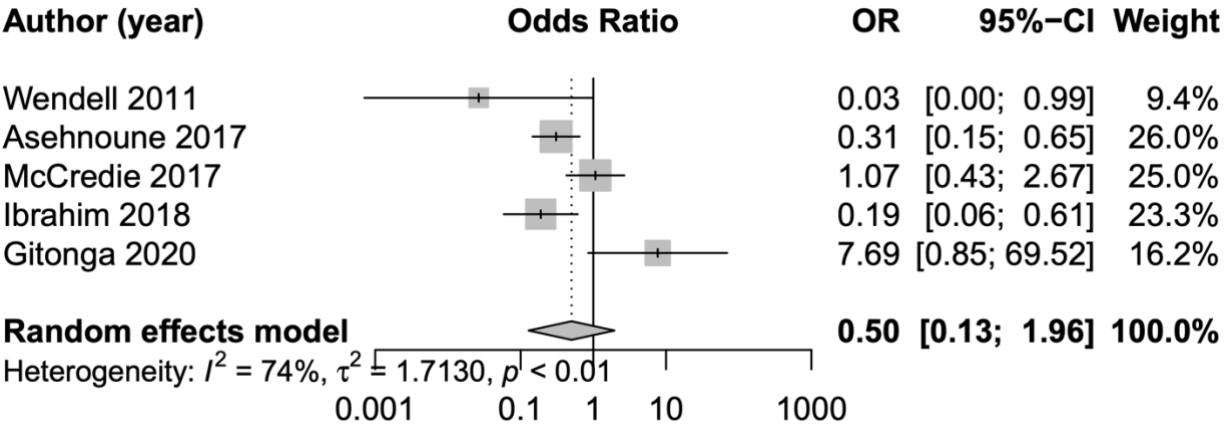
AGE



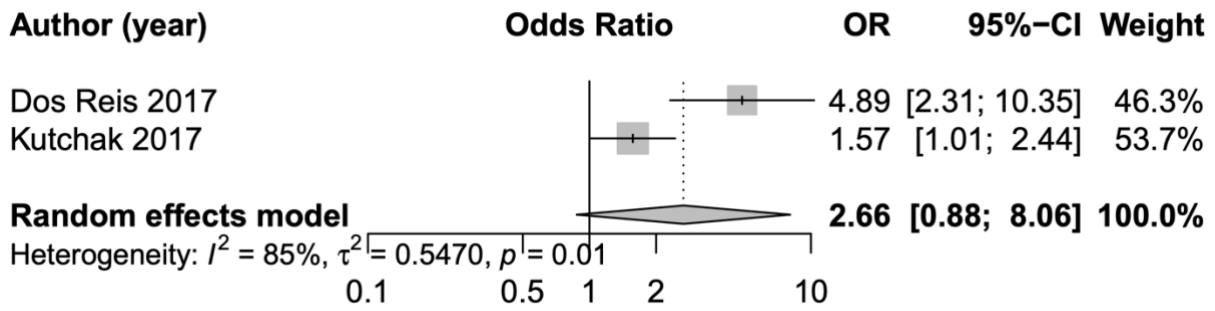
SEX



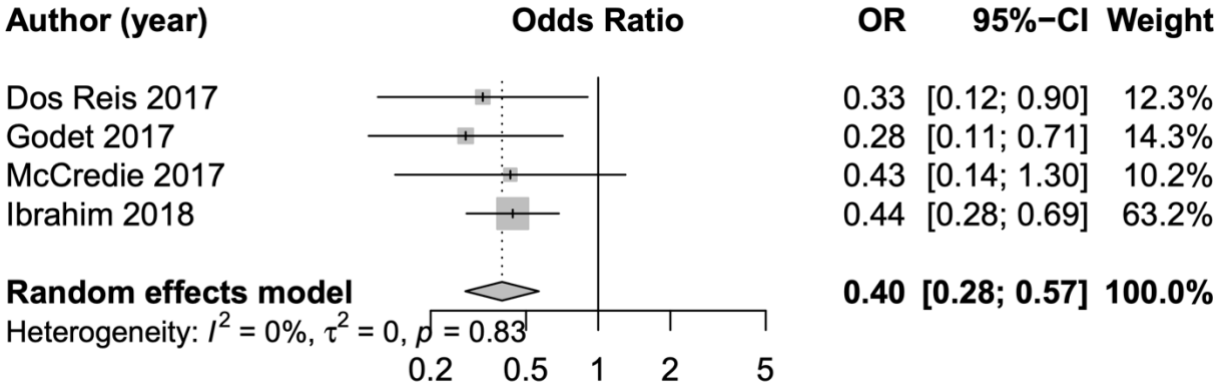
GCS AT EXTUBATION



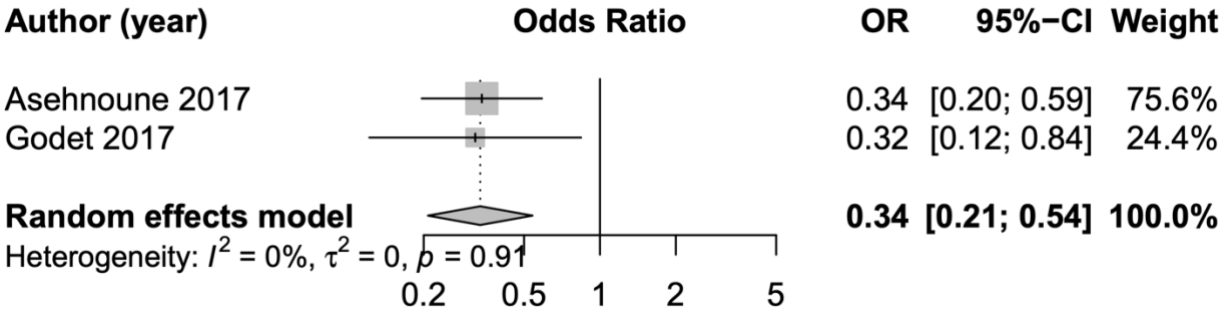
GCS MOTOR < 5



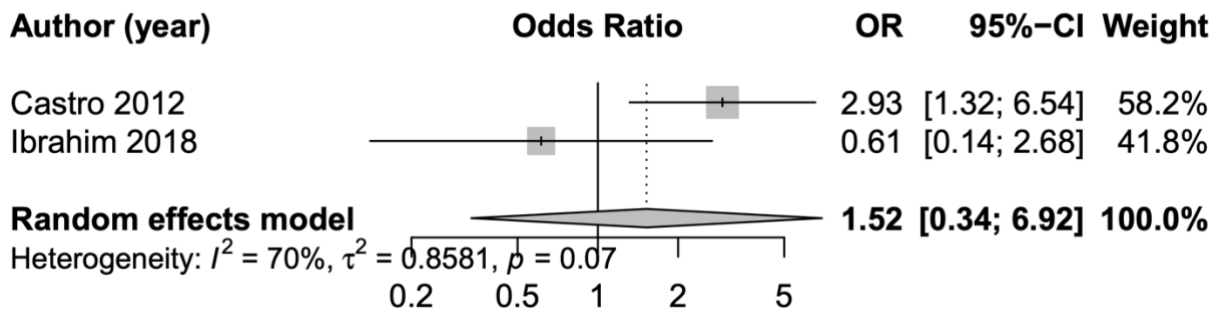
COUGH



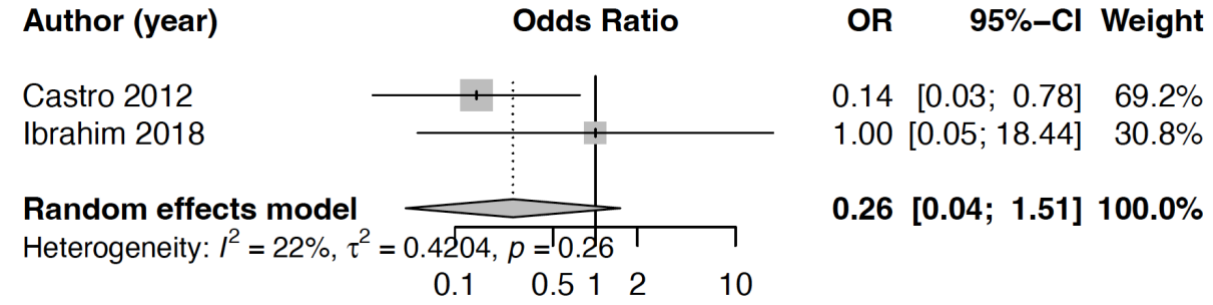
SWALLOW



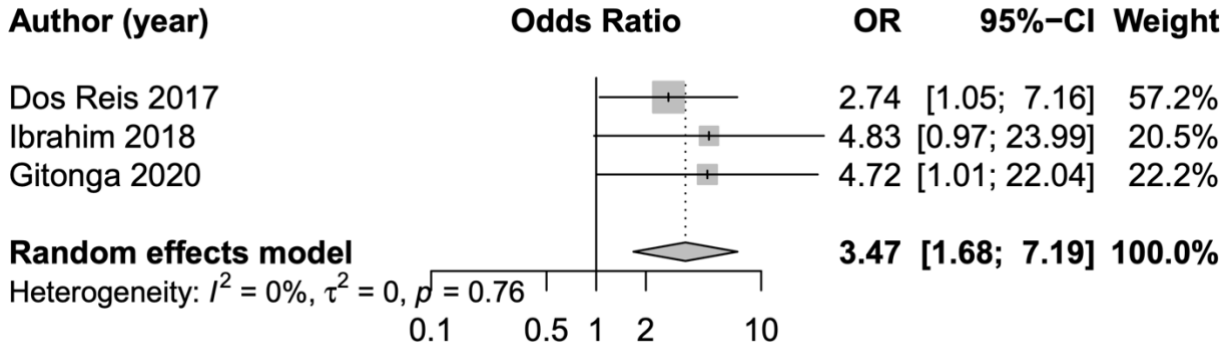
RSBI



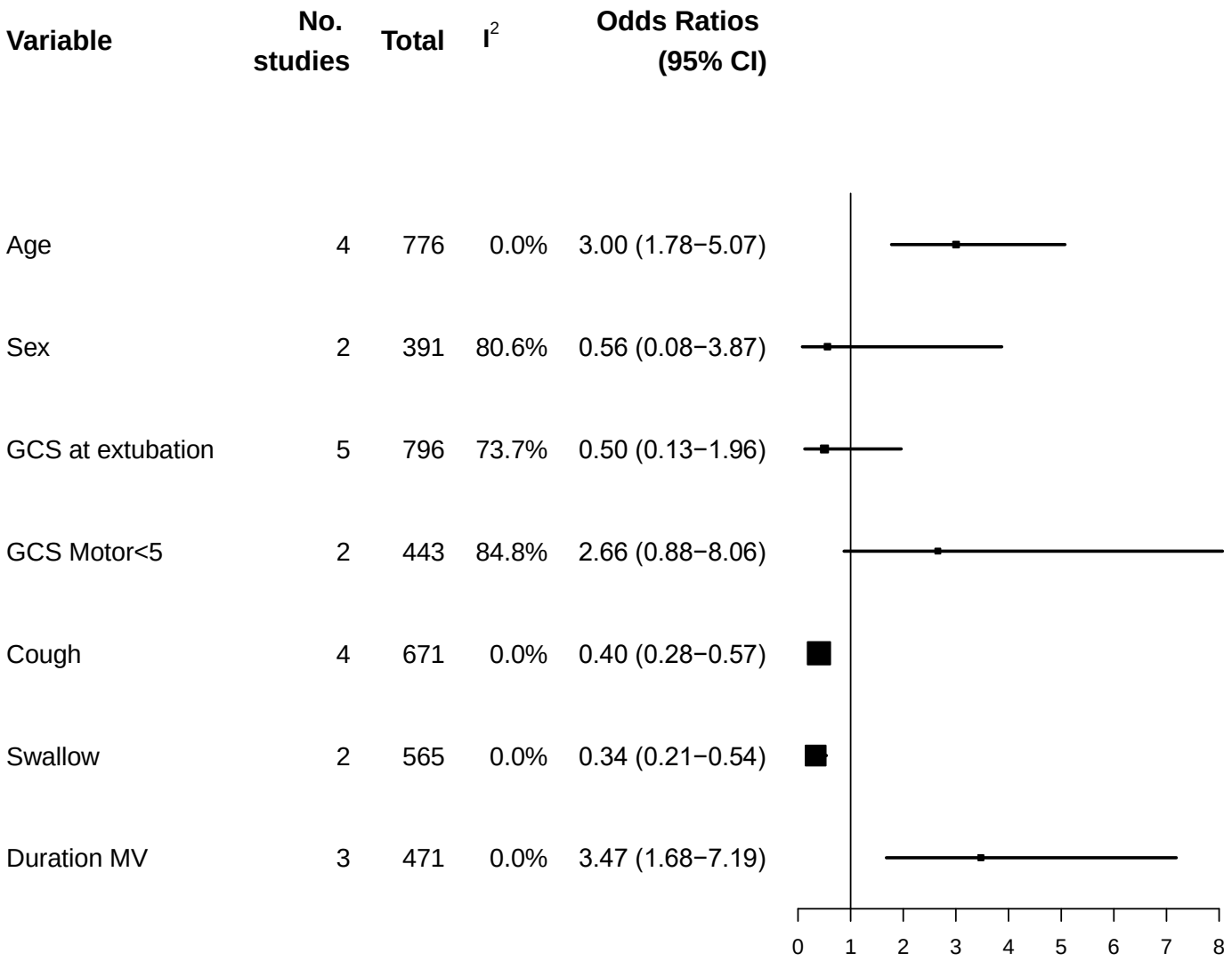
PaO_2/FiO_2



DURATION OF MECHANICAL VENTILATION

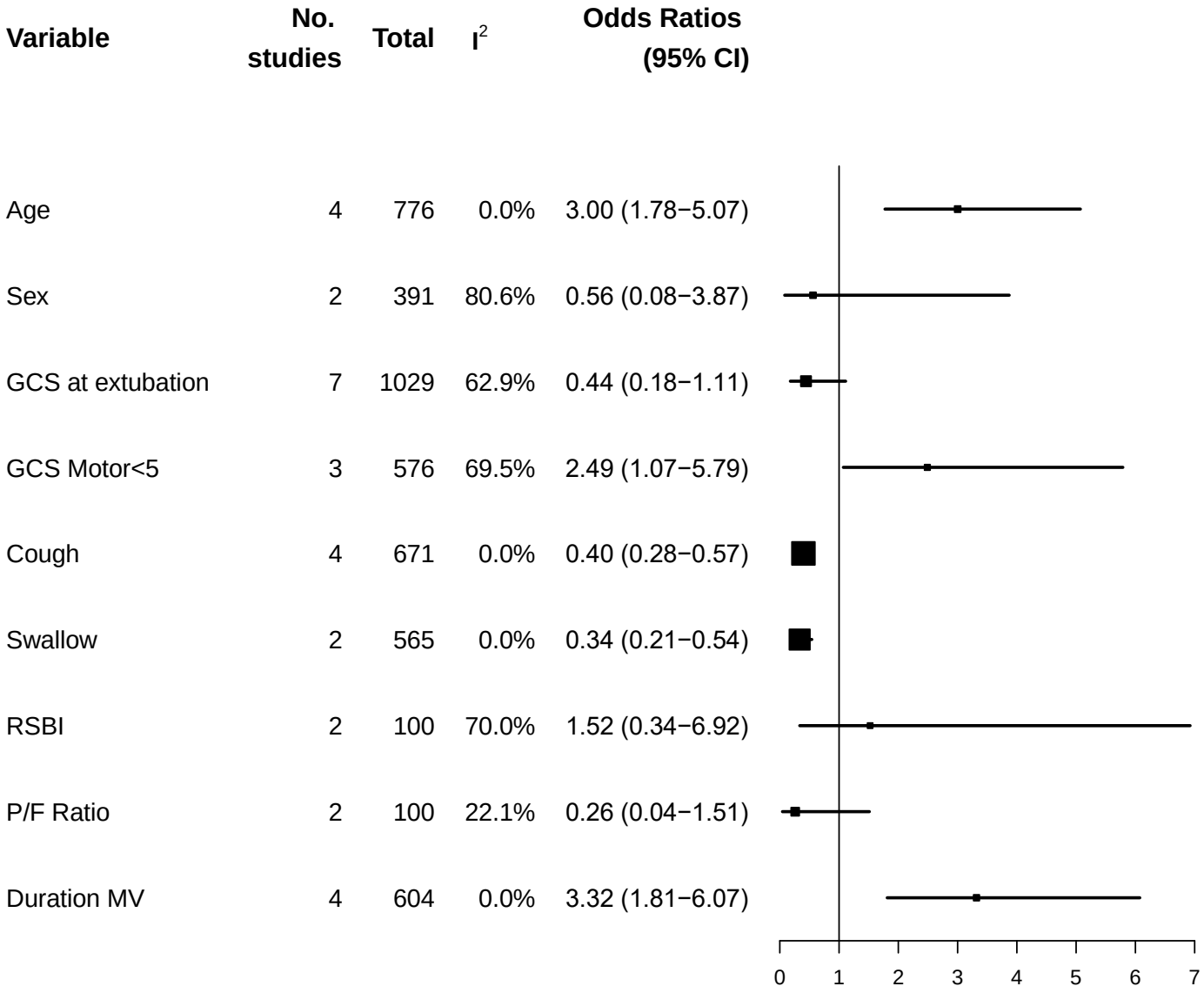


eFigure 3: Sensitivity analysis restricted to studies with extubation after a successful SBT *

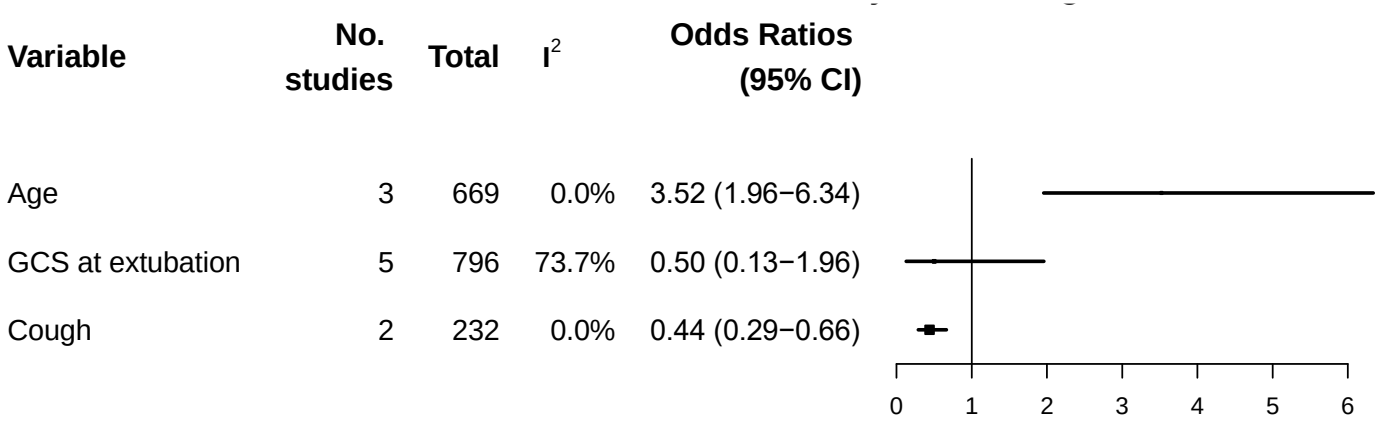


* All SBTs across primary studies were performed on pressure support $\leq$ 8 cm H_2O, CPAP, or T-piece with a duration of 30-120 min

eFigure 4: Sensitivity analysis including studies measuring reintubation at any point in ICU



eFigure 5: Sensitivity analysis restricted to studies that adjusted for age and GCS



eTable 12: Indications for reintubation by study

Author (Year)	Excessive secretions n (%)	Decreased LOC n (%)	Respiratory failure n (%)	Laryngospasm /Stridor n (%)	Airway protection failure n (%)	Other n (%)
Asehnoune et al. (2017)	50 (50.5%)		17 (17.1%)	19 (19.2%)		Neurologic impairment: 36 (36.3%) Hypoxemia: 33 (33.3%) Cardiovascular failure: 1 (1%)
Castro et al. (2012)						
dos Reis et al. (2013)	1 (6.7%)	2 (13.3%)	7 (46.7%)	4 (26.7%)		Sepsis: 1 (6.7%)
dos Reis et al. (2017)	4 (9.3%)	7 (16.3%)	18 (41.9%)	11 (25.6%)		Bronchospasm: 1 (2.3%) Other causes: 2 (4.7%)
Gitonga et al. (2020)						
Godet et al. (2017)	29 (67.4%)			6 (14.0%)	2 (4.6%)	Atelectasis: 3 (7.0%) Pneumonia: 2 (4.6%) Cardiac causes: 1 (2.3%)
Guru et al. (2016)	4 (22.2%)	5 (27.8%)		3 (16.7%)	3 (16.7%)	Apnea/hypoventilation: 3 (16.7%)
Ibrahim et al. (2018)						
Ko et al. (2009)						
Kutchak et al. (2015)*	7%	7%			62%	
Kutchak et al. (2017)*	7%	7%			62%	
McCredie et al. (2017)			10 (31%)			Secretions, decreased LOC, or upper airway obstruction: 18 (56%) Other causes: 4 (13%)
Namen et al. (2001)						
Qureshi et al. (2000)					3 (27.3%)	Secretions, airway spasm, or hypoventilation: 7 (63.6%) Pulmonary embolus: 1 (9.1%)
Rishi et al. (2016)*					58.7%	Non-airway related problems: 30.3%
Shi et al. (2021)				4 (24%)		Neurologic factors (not specified): 8 (47%)
Steidl et al. (2017)		9 (25%)	4 (11.1%)		13 (36%)	Elevated ICP: 8 (22.2%) Hemodynamic instability: 2 (5.6%)
Suntrup-Krueger et al. (2019)		5 (15.6%)				Severe dysphagia: 16 (50%) Respiratory complications: 9 (28.1%) Need for surgery: 2 (6.3%)
Videtta et al. (2021)						
Wendell et al. (2011)						
Wojak et al. (2018)		5 (38.5%)	7 (53.8%)			Seizure: 1 (7.7%)

* *n* not provided
ICP Intracranial pressure, *LOC* Level of consciousness

eTable 13: Additional outcomes

Author (Year)	Primary tracheostomy n (%)	ICU LOS, median days (IQR)		Mortality at longest follow-up, n (%)	
		Successful extubation	Failed extubation	Successful extubation	Failed extubation
Asehnoune et al. (2017)	40 (9.2%)	15 (9-23)	27 (21-36)	4 (1.2%)	11 (11.1%)
Castro et al. (2012)					
dos Reis et al. (2013)					
dos Reis et al. (2017)	112 (17.8%)				
Gitonga et al (2020).					
Godet et al. (2017)		23 (14-36)	30 (22-48)	1 (1.0%)	8 (18.6%)
Guru et al. (2016)	17 (11.3%)	6 (4-9)	14 (11-18)	1 (1.9%)	5 (27.8%)
Ibrahim et al. (2018)					
Ko et al. (2009)					
Kutchak et al. (2015)		12 (7-17)	17 (14-23)	1 (1.1%)	6 (13.6%)
Kutchak et al. (2017)	56 (22.8%)	12 (7-17)	17 (14-23)	4 (4.4%)	8 (19.0%)
McCredie et al. (2017)	40 (20.8%)	7 (4-14)	14 (8-18)	1 (0.8%)	4 (12.5%)
Namen et al. (2001)	29 (29%)				
Qureshi et al. (2000)	23 (33%)				
Rishi et al. (2016)				201 (23.9%)	15 (13.9%)
Shi et al. (2021)	11 (21.7%)	14 (11-18)	13 (10-20)		
Steidl et al. (2017)	87 (47.0%)	5.5 (4.8) *	15.4 (18.7) *		
Suntrup-Krueger et al. (2019)		7.2 (6.0)	32.8 (19.1) *	3 (3.0%)	7 (21.9%)
Videtta et al. (2021)					
Wendell et al. (2011)	2 (2.8%)	10 (6-13)	12 (6-13)	3 (8.1%)	2 (20.0%)
Wojak et al. (2018)	34 (24.1%)	18 **	25 **		

* Data reported as mean (SD)
** IQR not provided
ICU intensive care unit, *IQR* interquartile range

References for Supplemental Digital Content

1. Riley RD, Moons KGM, Snell KIE, et al: A guide to systematic review and meta-analysis of prognostic factor studies. *BMJ* 2019; 364:k4597

2. Hemingway H, Philipson P, Chen R, et al: Evaluating the quality of research into a single prognostic biomarker: a systematic review and meta-analysis of 83 studies of C-reactive protein in stable coronary artery disease. *PLoS medicine* 2010; 7(6):e1000286-e1000286

3. Wan X, Wang W, Liu J, et al: Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. *BMC Medical Research Methodology* 2014; 14(1):135

4. Gitonga F: Predictors of extubation failure in Neuro-critically ill patients in KNH ICUs. University of Nairobi, 2020.

5. Dos Reis HFC, Gomes-Neto M, Almeida MLO, et al: Development of a risk score to predict extubation failure in patients with traumatic brain injury. *J Crit Care* 2017; 42:218-222

6. Ibrahim AS, Aly MG, Abdel-Rahman KA, et al: Semi-quantitative Cough Strength Score as a Predictor for Extubation Outcome in Traumatic Brain Injury: A Prospective Observational Study. *Neurocrit Care* 2018; 29(2):273-279