Supplementary appendix

The following are supplemental materials and will be published online only

Epidemiological characteristics, ventilator management and clinical outcome in patients receiving invasive ventilation in intensive care units from 10 Asian middle–income countries (PRoVENT–iMiC) – an international, multicentre, prospective study

Table of Contents

ADDITIONAL METHODS 2

eTable 1. List of participating ICUs 2
eTable 2. Participating centres characteristics, aggregated by country 3
eTable 3. Definitions of pulmonary complications used in study 5
eTable 4. Modifications from the original analysis plan 6
eTable 5. Missing data summary for analysed variables 7

ADDITIONAL RESULTS 8

eTable 6. Patients recruited per country 8
eTable 7a. Ventilatory characteristics day 1 9
eTable 7b. Ventilatory characteristics day 2 10
eTable 7c. Ventilatory characteristics day 3 11
eTable 8. Number of pulmonary complications per patient in the three study groups 12
eTable 9. Day of occurrence of pulmonary complications per patient in the three study groups 13
eTable 10. Pulmonary complications reported on day of start of mechanical ventilation (day 0) 14
eTable 11. Sensitivity analysis of factors associated with ICU mortality using driving pressure (excluding PEEP, Pplat and Ppeak) in patients receiving mechanical ventilation 15
eTable 12. Analysis of factors associated with pulmonary complications in patients receiving mechanical ventilation 16
eTable 13. Ventilation characteristics in day 0 with comparative analysis considering clustering of observations in participating centres. 17
eTable 14. Pulmonary complications observed in first 7 days of mechanical ventilation and clinical outcomes with comparative analysis taking into account clustering of observations in participating centres 18
eFigure 1. Variation across countries of tidal volume and PEEP reported on day 0 19
eFigure 2. Distribution of ventilator parameters on the first day of invasive ventilation 20
eFigure 3. Number of patients mechanically ventilated and ventilator modes used during the first 4 days 21
eFigure 4. Receiver operating characteristics curve for LIPS in predicting development of ARDS 22
eFigure 5. Linearity check (logit x predictor) for multivariable model exploring risk factors for death in ICU 23
eFigure 6. Linearity check (logit x predictor) for multivariable model exploring risk factors for pulmonary complications 23

CASE REPORT FORMS 24

ADDITIONAL METHODS

eTable 1. List of participating ICUs

Country	City	Institution name	Nº of patients
Bangladesh	Chittagong	Chittagong Medical College Hospital	29
	Dhaka	Bangabandhu Sheikh Mujib Medical University	9
	Dhaka	Birdem General Hospital	29
	Dhaka	Dhaka Medical College Hospital	19
	Rajshahi	Rajshahi Medical College Hospital	33
	Sylhet	Sylhet MAG Osmani Medical College Hospital	12
India	Bangalore	St John's Medical College, Bangalore	76
	Pune	Bharati Vidyapeeth Medical College, Pune	32
	Rourkela	Ispat General Hospital, Rourkela	11
Iran	Tehran	Modarres Hospital	3
	Tehran	Masih Daneshvari Hospital	5
	Tehran	Pars Hospital	8
Malaysia	Johor Bahru	Hospital Sultanah Aminah Johor Bahru	96
Malaysia	Kuala Lumpur	Hospital Kuala Lumpur	102
Malaysia	Kuala Lumpur	International Islamic University Medical Center	9
Malaysia	Kuala Lumpur	UMMC University of Malaya Medical Center	54
Maldives	Malè	Indira Gandhi Memorial Hospital	3
Nepal	Kathmandu	Patan Academy of Health Sciences	19
Pakistan	Faisalabad	Allied Hospital	9
Pakistan	Islamabad	Shifa surgical ICU International Hospital	49
Pakistan	Islamabad	Shifa medical ICU International Hospital	39
Pakistan	Islamabad	Pakistan Institute of Medical Sciences (PIMS)	7
Pakistan	Karachi	Aga Khan University surgical ICU	45
Pakistan	Karachi	Patel Hospital	26
Pakistan	Lahore	National Hospital and Medical Center (NHMC)	15
Pakistan	Lahore	Doctor's Hospital and Medical Center	13
Pakistan	Nawabshah	Peoples Medical College Hospital,	23
Pakistan	Peshawar	North West General Hospital	18
Sri Lanka	Batticoloa	Batticoloa Base Hospital	8
Sri Lanka	Colombo	Colombo South Teaching Hospital surgical ICU	17
Sri Lanka	Colombo	Colombo South Teaching Hospital medical ICU	14
Sri Lanka	Colombo	Sri Jayawardenapura CTICU	45
Sri Lanka	Colombo	Sri Jayawardenapura GICU	22
Sri Lanka	Colombo	Lanka Hospital Colombo	7
Sri Lanka	Colombo	National Hospital Sri Lanka surgical ICU	17
Sri Lanka	Colombo	National Hospital Sri Lanka medical ICU	29
Sri Lanka	Jaffna	Jaffna Teaching Hospital	4
Sri Lanka	Karapitiya	Karapitiya Teaching Hospital	11
Sri Lanka	Puttalam	Puttlam Hospital	0
Thailand	Bangkok	Chulalongkorn University	30
Thailand	Bangkok	Mahidol HTD	2
Thailand	Bangkok	Ramathibodi Hospital	36
Thailand	Bangkok	Srinakharinwirot University	40
Thailand	Bangkok	Sriraj Hospital	19
Thailand	Bangkok	Vajira Hospital	18
Thailand	Chiang Mai	Chiang Mai Surgical ICU	27
Thailand	Chiang Mai	Chiang Mai Medical ICU	24
Thailand	Hat Yai	Prince of Songkla medical ICU	24
Thailand	Hat Yai	Prince of Songkla surgical ICU	61
Thailand	Hat Yai	Prince of Songkla surgical recovery unit (SRCU)	1
Thailand	Hat Yai	Prince of Songkla medical recovery unit (MRCU)	7
Thailand	Nakornping	Nakornping Hospital Chiang Mai	20
Vietnam	Hanoi	National Hospital for Tropical Diseases	13
Vietnam	Ho Chi Minh City	Hospital for Tropical Diseases	26

ICU, intensive care unit

eTable 2. Participating centres characteristics, aggregated by country

	Overall	Bangladesh	India	Iran	Malaysia	Maldives	Nepal	Pakistan	Sri Lanka	Thailand	Vietnam
Number of centers in study	**54**	6	3	3	4	1	1	10	11	13	2
ICU ORGANIZATION											
ICU type											
Medical	**17 (32)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	2 (20)	4 (36)	8 (61)	2 (100)
Surgical	**11 (20)**	0 (0)	0 (0)	1 (33)	0 (0)	0 (0)	0 (0)	3 (30)	3 (27)	4 (30)	0 (0)
Mixed	**26 (48)**	6 (100)	3 (100)	2 (66)	4 (100)	1 (100)	0 (0)	5 (50)	4 (36)	1 (7)	0 (0)
Arrangement, open ICU	**22 (41)**	3 (50)	0 (0)	2 (67)	0 (0)	1 (100)	0 (0)	8 (80)	4 (36)	4 (30)	0 (0)
Hospital status, Public	**41 (76)**	5 (83)	1 (33)	2 (66)	4 (100)	1 (100)	1 (100)	2 (20)	10 (90)	13 (100)	2 (100)
Hospital type, academic	**47 (87)**	6 (100)	3 (100)	1 (33)	2(50)	1(100)	1(100)	10 (100)	9 (100)	13 (100)	1 (100)
Population served)											
Urban and rural	**42 (78)**	6 (100)	1 (66)	0 (33)	0 (25)	1 (100)	1 (100)	9 (90)	7 (72)	12 (92)	1 (50)
Mainly urban	**11 (20)**	0 (0)	1 (33)	2 (66)	3 (75)	0 (0)	0 (0)	0 (0)	3 (27)	1 (7)	1 (50)
Research active ICU	**42 (77)**	6 (100)	3 (100)	2 (66)	4 (100)	0 (0)	1 (100)	5 (50)	9 (81)	10 (76)	2 (100)
Number of beds in hospital	**877 [500, 1273]**	1125 [675, 1763]	850 [825, 1100]	200 [169, 275]	1050 [750, 1475]	500	700	500 [327, 545]	1093 [1025, 2750]	1200 [800, 1378]	575 [437, 713]
Number of beds in ICU	**13 [9, 26]**	19 [11, 31]	17 [16, 24]	35 [26, 37]	23 [17, 26]	15	13	11 [9, 13]	7 [5, 9.50]	16 [10, 34]	39 [34, 43]
Yearly admission in ICU	**807 [387, 1400]**	869 [662, 1271]	2000 [1945, 2417]	735 [383, 793]	1373 [950, 1621]	NA	676	747 [400, 1040]	387 [379, 687]	720 [356, 1078]	1704 [1602, 1805]
Admissions during study period	**60 [40, 91]**	65 [52, 105]	164 [150, 207]	54 [47, 60]	105 [82, 119]	NA	67 [67, 67]	53 [37, 63]	46 [30, 60]	46 [34, 72]	41 [41, 41]
Number of ventilators	**14 [10, 24]**	20 [14, 32]	15 [15, 23]	30 [26, 31]	28 [22, 30]	15	8 [8, 8]	10 [9, 11]	6 [6, 10]	18 [10, 34]	24 [19, 28]
Number of physicians per shift	**1 [1, 3]**	1 [1, 4]	1 [1, 2]	2 [1, 2]	2 [2, 2]	1	2 [2, 2]	2 [1, 3]	2 [1, 2]	1 [1, 1]	5 [3, 6]
Nurse to bed ratio											
1 nurse to 1 bed	**28 (51)**	1 (16)	0 (0)	0 (0)	2 (50)	1 (100)	0 (0)	6 (60)	10 (90)	8 (61)	0 (0)
1 nurse to 2 beds	**17 (31)**	4 (66)	2 (66)	3 (100)	0 (0)	0 (0)	1 (100)	2 (20)	1 (9)	4 (30)	0 (0)
1 nurse to 3 beds	**4 (7)**	1 (16)	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)	0 (0)	0 (0)	1 (7)	1 (50)
1 nurse to 4 beds or more	**5 (9)**	0 (0)	1 (33)	0 (0)	1 (25)	0 (0)	0 (0)	2 (20)	0 (0)	0 (0)	1 (50)
Type of humidification											
Active humidification	**21 (38)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	1 (10)	6 (54)	12 (92)	1 (50)
HME	**30 (55)**	6 (100)	3 (100)	3 (100)	4 (100)	0 (0)	0 (0)	8 (80)	5 (45)	0 (0)	1 (50)

eTable 2 (continued)

	Overall	Bangladesh	India	Iran	Malaysia	Maldives	Nepal	Pakistan	Sri Lanka	Thailand	Vietnam
AVAILABILITY OF RESOURCES											
NIV	**45 (83)**	5 (83)	3 (100)	3 (100)	4 (100)	1 (100)	1 (100)	9 (90)	7 (63)	11 (84)	1 (50)
HFNT	**28 (51)**	1 (16)	3 (100)	3 (100)	3 (75)	0 (0)	0 (0)	1 (10)	5 (45)	12 (92)	0 (0)
Availability of a physician 24/7	**46 (85)**	5 (83)	3 (100)	3 (100)	4 (100)	1 (100)	1 (100)	10 (100)	7 (63)	10 (76)	2 (100)
RRT											
In ICU	**35 (64)**	4 (66)	2 (66)	1 (33)	4 (100)	1 (100)	0 (0)	2 (20)	9 (81)	10 (76)	2 (100)
In hospital	**15 (27)**	2 (33)	1 (33)	2 (66)	0 (0)	0 (0)	1 (100)	5 (50)	1 (9)	3 (23)	0 (0)
Not available	**4 (7)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (30)	1 (9)	0 (0)	0 (0)
Pulse oximetry	**53 (98)**	5 (83)	3 (100)	3 (100)	4 (100)	1 (100)	1 (100)	10 (100)	11 (100)	13 (100)	2 (100)
End tidal CO_2 monitoring	**31 (57)**	3 (50)	2 (66)	0 (0)	3 (75)	0 (0)	0 (0)	5 (50)	10 (90)	8 (61)	0 (0)
Portable x-ray											
Dedicated ICU apparatus	**29 (53)**	2 (33)	2 (66)	3 (100)	3 (75)	1 (100)	1 (100)	5 (50)	8 (72)	3 (23)	1 (50)
External X-ray providers	**5 (9)**	4 (66)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (7)	0 (0)
Hospital X-ray apparatus	**20 (37)**	0 (0)	1 (33)	0 (0)	1 (25)	0 (0)	0 (0)	5 (50)	3 (27)	9 (69)	1 (50)
Computed tomography	**52 (96)**	6 (100)	3 (100)	3 (100)	4 (100)	1 (100)	1 (100)	10 (100)	10 (90)	13 (100)	2 (100)
Ultrasound apparatus	**43 (79)**	6 (100)	2 (66)	1 (33)	4 (100)	1 (100)	1 (100)	7 (70)	9 (81)	11 (84)	1 (50)
Blood gas analysis											
In ICU	36 (66)	5 (83)	2 (66)	0 (0)	4 (100)	1 (100)	1 (100)	5 (50)	11 (100)	6 (46)	1 (50)
In hospital laboratory	16 (29)	0 (0)	1 (33)	3 (100)	0 (0)	0 (0)	0 (0)	4 (40)	0 (0)	7 (53)	1 (50)
Outsourced	**2 (3)**	1 (16)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (10)	0 (0)	0 (0)	0 (0)
Microbiology lab	**52 (96)**	5 (84)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (90)	0 (0)	0 (0)	0 (0)
Use of ventilation protocols	**34 (63)**	4 (66)	3 (100)	3 (100)	1 (25)	0 (0)	0 (0)	7 (70)	8 (72)	8 (61)	0 (0)

Data are number of centres/total number of ICUs in country (%) or median [IQR]. ICU, intensive care unit; IQR, interquartile range; NIV, non-invasive ventilation; ARDS, acute respiratory distress syndrome; HME, heat and moisture exchangers; HFNT, high flow nasal therapy; RRT, renal replacement therapy

eTable 3. Definitions of pulmonary complications used in study

Complication	Definition
Development of ARDS	Defined according to Berlin criteria;[1] patients are defined as having ARDS if they met the Berlin criteria for ARDS; chest radiographs will be evaluated daily for the presence of bilateral infiltrates and pneumothorax by the participating research physician at each site. The oxygenation criteria of ARDS (PaO_2/FiO_2 < 300) might be substituted when unavailable by the SpO_2/FiO_2 < 315 as outlined in the adapted Kigali criteria of ARDS.[2] Similarly, alternative SpO_2/FiO_2 criteria will be used to define ARDS severity when the PaO_2 is unavailable.[3] If possible, a staff radiologist also reviews the radiographs; for appropriate identification of ARDS patients, physicians are requested to consider only blood gas analysis and pulse oximetry values while patients are clinically stable and not to consider those resulting from an acute event unrelated to the disease process (such as patient ventilator asynchrony, obstruction of endotracheal tubes by secretions, suctioning, ventilator disconnection, sudden pneumothorax, and hemodynamic instability).
Worsening of ARDS	Defined as any worsening in the degree of severity according to Berlin criteria.[1]
Pulmonary infection	Defined as need of new antibiotics in the presence of new or changed lung opacities on chest X–ray and/or new or changed sputum plus at least one of the following criteria: 1) temperature > 38.3 ºC; or 2) WBC count > 12,000.
Atelectasis	Suggested by lung opacification with shift of the mediastinum, hilum, or hemidiaphragm towards the affected area, and compensatory overinflation in the adjacent non–atelectatic lung.
Pleural effusion	Suggested by lung opacification with shift of the mediastinum, hilum, or hemidiaphragm towards the non–affected area.
Pneumothorax	Defined as the air in mediastinum or in the pleural space with no vascular bed surrounding the visceral pleura.
Cardiogenic pulmonary edema	Defined as pulmonary edema due to cardiac failure.
New pulmonary infiltrates	Defined as any new pulmonary infiltrate in the chest X–ray without any other clinical sign.

ARDS, acute respiratory distress syndrome; PaO_2, oxygen partial pressure; FiO_2 fraction of inspired oxygen; SpO_2, pulse oximetry saturation of haemoglobin.

References

1. The ARDS Definition Task Force*, Ranieri VM, Rubenfeld GD, et al. Acute respiratory distress syndrome: the Berlin Definition. *JAMA J Am Med Assoc*. 2012;307(23):1
2. Riviello ED, Kiviri W, Twagirumugabe T, et al. Hospital Incidence and Outcomes of the Acute Respiratory Distress Syndrome Using the Kigali Modification of the Berlin Definition. *Am J Respir Crit Care Med*. 2016;193(1):52-59.
3. Rice TW, Wheeler AP, Bernard GR, et al. Comparison of the SpO_2/FiO_2 ratio and the PaO_2/FiO_2 ratio in patients with acute lung injury or ARDS. *Chest*. 2007;132(2):410-417.

eTable 4. Modifications from the original analysis plan

	Original plan (BMJopen2018)	Updated SAP* 20 Dec 2018	In the paper	Post–hoc**
Primary outcome V_T (ml/kg PBW) PEEP (cm H2O)	Compared in groups with two way ANOVA (or Kruskall Wallis test) assessing time interaction between groups and days of observation.	Reported for each day (day 0 and during first 3 days of ventilation) as median [IQR]. Compared among study groups on day 0 using standard tests.	Unchanged	Sensitivity analysis comparing ventilator variables on day 0 and outcomes using linear/logistic mixed-effect models with centre as random effect.
Secondary outcomes				
Identification of factors associated with ICU mortality	Univariable and multivariable logistic regression model	Univariable and multivariable mixed effect model	Univariable and multivariable mixed effect model with participating centre as random effect	None
Time course variables	Repeated ventilation variables analysed by linear mixed–models	Unchanged	Main ventilator variables also compared during first 4 days using mixed–effect longitudinal models with random intercepts for patients and centres and an interaction between time and the group as fixed effect.	None
Time to event variables	Cox regression and visualized by Kaplan Meier	Cox regression and visualized by Kaplan Meier	Competing risk analysis performed with regard to extubation	None
Study groups for main analysis	Not at risk At risk of ARDS With ARDS	Unchanged	Renamed as LIPS<4, LIPS≥4 and ARDS	None
Additional analyses		Driving pressure considered in a sensitivity analysis ICC (ratio between site variance to total variance)	Unchanged	Identification of factors associated with pulmonary complications
Subgroup analysis	Risk of ARDS ARDS vs. no ARDS Reason ICU admission Reason start invasive ventilation	Unchanged	Risk of ARDS ARDS vs. no ARDS	None
Mock tables	Not included	Included	None	None

ICU, intensive care unit; ARDS, acute respiratory distress syndrome; SAP, statistical analysis plan; PEEP, positive end–expiratory pressure; V_T, tidal volume; PBW, predicted body weight; ANOVA, analysis of variance; LIPS, Lung Injury Prediction Score;
*Database locking in June 30th, 2019
**Not considered neither in the original plan nor in the updated SAP

eTable 5. Missing data summary for analysed variables

Variable	ADMISSION			FOLLOW UP		
	Number of missing observations	Total observations	% Missing	Number of missing observations	Total observations	% Missing
Age	1	1315	0.1			
Sex	1	1315	0.1			
Date of Hospital admission	0	1315	0.0			
Date of ICU admission	0	1315	0.0			
Date of start MV	0	1315	0.0			
Ventilated in ward before admission	1	1315	0.1			
NIV before IMV	3	1315	0.2			
Reason ICU admission	1	1315	0.1			
Admission source	10	1315	0.8			
Height	8	1315	0.6			
Predicted body weight	9	1315	0.7			
Smoking status	1	1315	0.1			
Reason of Intubation	1	1315	0.1			
Cause respiratory failure	0	1315	0.0			
Comorbidities	1	1315	0.1			
LIPS conditions	3	1315	0.2			
LIPS surgery	2	1315	0.2			
LIPS trauma	4	1315	0.3			
LIPS modifiers	5	1315	0.4			
SOFA components						
GCS total	0	1315	0.0	11	2957	0.4
Mean arterial blood pressure	15	1315	1.1			
Use of vasopressors	4	1315	0.3			
Platelets*	159	1315	12.1			
Creatinine*	167	1315	12.7			
Bilirubin*	394	1315	30.0			
At least one component missing	406	1315	30.9			
Ventilation variables						
Mode of ventilation	0	1315	0.0	1	2308	0.0
PEEP	0	1315	0.0	3	2308	0.1
V_T PBW	17	1315	1,3	22	2308	1.0
Peak pressure	135	1315	10.3	340	2308	14 .7
Pplat (VCV) or Pmax (PCV)	221	1270	17.4	420	2308	18.2
Respiratory rate set	55	1315	4.2	7	2308	0.3
Respiratory rate measured	78	1315	5.9	127	2308	5.5
FiO_2	3	1315	0.2	4	2308	0.2
SpO_2	9	1315	0.7	11	2308	0.5
PaO_2 *	205	1315	15.6	516	2308	22.4
Pulmonary Complications	0	1315	0.0	63	4794	1.3
Discharge						
End ICU stay	5	1315	0.4			
Discharge type	15	1315	1.1			
Discharge date	15	1315	1.1			
Extubation date	96	1315	7.3			

Data are numbers and %. ICU, intensive care unit; IMV, invasive mechanical ventilation; MV, mechanical ventilation; NIV, non–invasive ventilation; LIPS, lung injury prediction score; SOFA, sequential organ failure assessment; GCS, Glasgow coma scale; PEEP, positive end–expiratory pressure; V_T, tidal volume; PBW, predicted body weight; Pplat, plateau pressure; VCV, volume–control ventilation; PCV, pressure–control ventilation; FiO_2, fraction of inspired oxygen; SpO_2, pulse oximetry saturation of haemoglobin; PaO_2, oxygen partial pressure.
*Missing values reflect availability of resources (e.g. blood gas analysis)

ADDITIONAL RESULTS

eTable 6. Patients recruited per country

Country	Income status[$]	All patients (n=1315)	LIPS<4 (n=389)	LIPS≥4 (n=837)	ARDS (n=89)	*p* value LIPS<4 *vs.* LIPS≥4	*p* value*
Country						<0.0001	<0.0001
Bangladesh	**LM**	131	19 (14.5)	104 (79.4)	8 (6.1)		
India	**LM**	119	21 (17.6)	79 (66.4)	19 (16.0)		
Iran	**UM**	16	2 (12.5)	14 (87.5)	0 (0.0)		
Malaysia	**UM**	261	94 (36.0)	153 (58.6)	14 (5.4)		
Maldives	**UM**	3	2 (66.6)	1 (33.3)	0 (0.0)		
Nepal	**L**	19	1 (5.3)	17 (89.5)	1 (5.3)		
Pakistan	**LM**	244	96 (39.3)	136 (55.7)	12 (4.9)		
Sri Lanka	**LM**	174	43 (24.7)	116 (66.7)	15 (8.6)		
Thailand	**UM**	309	86 (27.8)	204 (66.0)	19 (6.1)		
Vietnam	**LM**	39	25 (64.1)	13 (33.3)	1 (2.6)		

Data are numbers (%), where the percentages refer to the proportion of patients recruited per group considering the total number of patients recruited in the country.
[$]Country income status defined according to the 2018 World Bank country and lending group classification.
ARDS, acute respiratory distress syndrome; LM, lower middle income country; UM, upper middle income country; L, low income country.
*P value represents comparisons across the three study groups for each variable

eTable 7a. Ventilatory characteristics day 1

	All patients (n=1059)	LIPS<4 (n=314)	LIPS≥4 (n=665)	ARDS (n=80)	*p* value LIPS<4 *vs.* LIPS≥4	*p* value*
Absolute V_T (ml)	450 [384, 500]	450 [400, 500]	450 [389, 500]	400 [340, 470]	0.855	0.0002
V_T PBW (ml/kg PBW)	7.8 [6.7, 9.1]	7.8 [6.9, 9.0]	7.8 [6.8, 9.2]	6.8 [5.9, 8.4]	0.729	0.0002
Controlled mode	7.7 [6.7, 8.9]	7.7 [6.8, 8.8]	7.8 [6.8, 9.0]	6.7 [5.8, 8.2]	0.524	0.0003
Spontaneous mode	8.1 [6.8, 9.7]	8.1 [6.9, 9.7]	8.1 [6.7, 9.8]	7.3 [6.7, 8.6]	0.885	0.632
PEEP (cm H_2O)	5 [5, 8]	5 [5, 7]	5 [5, 8]	10 [5, 13]	0.0466	<0.0001
Ventilation mode (%)					0.0004	0.0003
Volume–controlled	318 (30.0)	109 (34.7)	190 (28.6)	19 (23.8)		
Pressure–controlled	198 (18.7)	42 (13.4)	135 (20.3)	21 (26.2)		
PSV	244 (23.0)	95 (30.3)	138 (20.8)	11 (13.8)		
SIMV	244 (23.0)	59 (18.8)	163 (24.5)	22 (27.5)		
APRV	3 (0.3)	1 (0.3)	1 (0.2)	1 (1.2)		
PRVC	51 (4.8)	8 (2.5)	37 (5.6)	6 (7.5)		
Other	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)		
Ppeak (cm H2O)	21 [17, 26]	19 [16, 23]	21 [18, 26]	27 [20, 34]	<0.0001	<0.0001
Pplat (cm H_2O)[#]	18 [16, 23]	17 [14, 19]	18 [16, 22]	28 [21, 30]	0.0036	<0.0001
Driving pressure (cm H_2O)	14 [12, 18]	13 [8, 16]	15 [12, 18]	16 [12, 20]	0.0102	0.0124
Set RR (bpm)	15 [14, 18]	14 [12, 16]	15 [14, 18]	20 [15, 24]	<0.0001	<0.0001
Measured RR (bpm)	18 [15, 22]	16 [14, 21]	18 [15, 22]	20 [18, 25]	0.0001	<0.0001
FiO_2 (%)	40 [35, 50]	40 [30, 40]	40 [40, 50]	60 [44, 80]	<0.0001	<0.0001
PaO_2/FiO_2	284 [190, 386]	317 [240, 417]	279 [187, 383]	162 [86, 287]	0.0001	<0.0001
SpO_2/FiO_2	248 [196, 280]	250 [243, 327]	245 [194, 250]	155 [109, 226]	<0.0001	<0.0001
Arterial pH level	7.39 [7.33, 7.44]	7.41 [7.36, 7.45]	7.38 [7.32, 7.44]	7.37 [7.28, 7.41]	<0.0001	<0.0001
$PaCO_2$ (mm Hg)	35 [30, 40]	35 [29, 39]	35 [30, 40]	39 [32, 45]	0.424	0.0026
Use of neuromuscular blockers (%)	129/1016 (12.7)	42/288 (14.6)	57/648 (8.8)	30/80 (37.5)	0.011	<0.0001
Use of prone positioning (%)	12 (1.1)	2 (0.6)	2 (0.3)	8 (10.0)	0.816	<0.0001
Use of recruitment maneuvers (%)	23 (2.2)	1 (0.3)	6 (0.9)	16 (20.0)	0.545	<0.0001

Day 1 refers to the second day of mechanical ventilation, given that we defined the first calendar day the patient received invasive ventilation in the ICU as day 0.

Data are numbers of patients/total numbers of patients (%) or median [IQR]. ARDS, acute respiratory distress syndrome; V_T, tidal volume; PBW, predicted body weight; PEEP, positive end-expiratory pressure; PSV, pressure support ventilation; SIMV, synchronized intermittent mandatory ventilation; APRV, airway pressure release ventilation; PRVC, pressure regulated volume-controlled ventilation; Ppeak, peak inspiratory airway pressure; Pplat, plateau airway pressure; RR, respiratory rate; PaO_2, oxygen partial pressure; FiO_2, fraction of inspired oxygen; SpO_2, pulse oximetry saturation of haemoglobin; $PaCO_2$, carbon dioxide partial pressure.

[#]Plateau pressure values are restricted to patients in whom this value was reported and in whom either an assist control mode was used or in whom a mode permitting spontaneous ventilation was used.

*P value represents comparisons across the three study groups for each variable

eTable 7b. Ventilatory characteristics day 2

	All patients (n=721)	LIPS<4 (n=201)	LIPS≥4 (n=455)	ARDS (n=65)	*p* value LIPS<4 vs. LIPS≥4	*p* value*
Absolute VT (ml)	450 [380, 500]	450 [398, 500]	450 [380, 500]	374 [335, 450]	0.772	0.0004
V_T PBW (ml/kg PBW)	7.6 [6.5, 8.8]	7.6 [6.7, 8.6]	7.7 [6.6, 8.9]	6.7 [5.8, 8.3]	0.590	0.0005
Controlled mode	7.5 [6.5, 8.6]	7.6 [6.7, 8.4]	7.6 [6.6, 8.8]	6.4 [5.5, 7.5]	0.592	0.0001
Spontaneous mode	7.9 [6.8, 9.4]	7.8 [6.9, 9.6]	7.9 [6.8, 9.3]	8.1 [6.5, 10.2]	0.741	0.939
PEEP (cm H_2O)	5 [5, 8]	5 [5, 8]	5 [5, 8]	10 [6, 12]	0.0479	<0.0001
Ventilation mode (%)					0.0005	0.0007
Volume–controlled	196 (27.2)	74 (37)	105 (23.1)	17 (26.2)		
Pressure–controlled	110 (15.3)	19 (9.5)	78 (17.1)	13 (20)		
PSV	222 (30.8)	71 (35.5)	140 (30.8)	11 (16.9)		
SIMV	158 (21.9)	32 (16)	108 (23.7)	18 (27.7)		
APRV	1 (0.1)	0 (0)	1 (0.2)	0 (0)		
PRVC	29 (4.0)	4 (2.0)	20 (4.4)	5 (7.7)		
Other	4 (0.6)	0 (0)	3 (0.7)	1 (1.5)		
Ppeak (cm H2O)	21 [18, 26.5]	20 [17, 24]	21 [17, 26]	28 [22, 34]	0.0166	<0.0001
Pplat (cm H2O)#	18 [16, 24]	16 [14, 19]	18 [16, 24]	26 [22, 30]	0.0029	<0.0001
Driving pressure (cm H_2O)	14 [11, 17]	12 [9, 16.5]	14 [12, 17]	16 [14, 18]	0.0436	0.0192
Set RR (bpm)	15 [14, 20]	14 [12, 16]	15 [14, 19]	22 [15, 25]	0.0002	<0.0001
Measured RR (bpm)	18 [15, 23]	18 [14, 22]	18 [16, 23]	23 [18, 26]	0.0251	<0.0001
FiO_2 (%)	40 [30, 50]	35 [30, 40]	40 [35, 50]	50 [40, 70]	<0.0001	<0.0001
PaO_2/FiO_2	278 [184, 383]	322 [250, 421]	266 [183, 364]	160 [108, 305]	<0.0001	<0.0001
SpO_2/FiO_2	250 [198, 323]	286 [248, 333]	248 [196, 286]	184 [139, 243]	<0.0001	<0.0001
Arterial pH level	7.41 [7.35, 7.46]	7.44 [7.39, 7.48]	7.40 [7.34, 7.45]	7.37 [7.30, 7.42]	<0.0001	<0.0001
$PaCO_2$ (mm Hg)	36 [30, 42]	35 [29, 40]	35 [30, 42]	40 [34, 47]	0.0924	0.0005
Use of neuromuscular blockers (%)	87 (12.7)	28/184 (15.2)	33/437 (7.6)	26 (40)	0.0054	<0.0001
Use of prone positioning (%)	12 (1.7)	2 (1.0)	1 (0.2)	9 (13.8)	0.466	<0.0001
Use of recruitment maneuvers (%)	16 (2.2)	2 (1.0)	10 (2.2)	4 (6.2)	0.457	0.0491

Day 2 refers to the third day of mechanical ventilation, given that we defined the first calendar day the patient received invasive ventilation in the ICU as day 0.

Data are numbers of patients/total numbers of patients (%) or median [IQR]. ARDS, acute respiratory distress syndrome; V_T, tidal volume; PBW, predicted body weight; PEEP, positive end-expiratory pressure; PSV, pressure support ventilation; SIMV, synchronized intermittent mandatory ventilation; APRV, airway pressure release ventilation; PRVC, pressure regulated volume-controlled ventilation; Ppeak, peak inspiratory airway pressure; Pplat, plateau airway pressure; RR, respiratory rate; PaO_2, oxygen partial pressure; FiO_2, fraction of inspired oxygen; SpO_2, pulse oximetry saturation of haemoglobin; $PaCO_2$, carbon dioxide partial pressure.

#Plateau pressure values are restricted to patients in whom this value was reported and in whom either an assist control mode was used or in whom a mode permitting spontaneous ventilation was used.

*P value represents comparisons across the three study groups for each variable

eTable 7c. Ventilatory characteristics day 3

	All patients (n=528)	LIPS<4 (n=149)	LIPS≥4 (n=331)	ARDS (n=48)	*p* value LIPS<4 *vs.* LIPS≥4	*p* value*
Absolute V_T (ml)	449 [373, 500]	450 [383, 500]	450 [380, 500]	378 [330, 450]	0.925	0.0007
V_T PBW (ml/kg PBW)	7.5 [6.5, 8.6]	7.6 [6.7, 8.4]	7.6 [6.6, 8.6]	6.4 [5.4, 7.7]	0.877	0.0002
Controlled mode	7.5 [6.4, 8.4]	7.6 [6.7, 8.1]	7.6 [6.5, 8.6]	6.1 [5.2, 7.3]	0.395	<0.0001
Spontaneous mode	7.6 [6.7, 9.0]	7.7 [6.8, 9.3]	7.6 [6.7, 8.7]	7.1 [6.5, 10.1]	0.447	0.755
PEEP (cm H_2O)	5.0 [5.0, 8.0]	5.0 [5.0, 8.0]	5.0 [5.0, 8.0]	10.0 [6.8, 12.0]	0.101	<0.0001
Ventilation mode (%)					<0.0001	<0.0001
Volume–controlled	149 (28.2)	57 (38.3)	74 (22.4)	18 (37.5)		
Pressure–controlled	83 (15.7)	13 (8.7)	61 (18.4)	9 (18.8)		
PSV	165 (31.2)	55 (36.9)	102 (30.8)	8 (16.7)		
SIMV	103 (19.5)	19 (12.8)	75 (22.7)	9 (18.8)		
APRV	2 (0.4)	2 (1.3)	0 (0.0)	0 (0.0)		
PRVC	21 (4.0)	3 (2.0)	16 (4.8)	2 (4.2)		
Other	5 (0.9)	0 (0.0)	3 (0.9)	2 (4.2)		
Ppeak (cm H2O)	21 [17, 26]	19 [16, 23]	21 [17, 26]	29 [22, 34]	0.0192	<0.0001
Pplat (cm H_2O)[#]	18 [15, 24]	16 [14, 21]	18 [16, 23]	26 [22, 28]	0.0624	<0.0001
Driving pressure (cm H_2O)	14 [10, 17]	11 [9, 17]	14 [12, 16]	16 [14, 19]	0.0646	0.0078
Set RR (bpm)	15 [14, 18]	14 [12, 16]	15 [14, 18]	24 [16, 25]	0.0707	<0.0001
Measured RR (bpm)	18 [16, 24]	17 [14, 21]	19 [16, 24]	23 [18, 26]	0.0018	<0.0001
FiO_2 (%)	40 [30, 50]	30 [30, 40]	40 [30, 50]	50 [4, 60]	<0.0001	<0.0001
PaO_2/FiO_2	277 [186, 393]	340 [243, 430]	267 [184, 372]	185 [117, 305]	0.0001	<0.0001
SpO_2/FiO_2	250 [200, 323]	313 [248, 333]	248 [196, 307]	198 [148, 248]	<0.0001	<0.0001
Arterial pH level	7.4 [7.4, 7.5]	7.4 [7.4, 7.5]	7.4 [7.4, 7.5]	7.4 [7.3, 7.4]	0.0094	0.0006
$PaCO_2$ (mm Hg)	36 [30, 43]	34 [29, 39]	37 [30, 44]	41 [36, 48]	0.0237	0.0002
Use of neuromuscular blockers (%)	71/511 (13.9)	28/145 (19.7)	26/322 (8.1)	17/47 (36.2)	0.0006	<0.0001
Use of prone positioning (%)	9 (1.7)	2 (1.3)	0 (0.0)	7 (14.6)	0.178	<0.0001
Use of recruitment maneuvers (%)	8 (1.5)	1 (0.7)	4 (1.2)	3 (6.2)	0.959	0.0172

Day 3 refers to the fourth day of mechanical ventilation, given that we defined the first calendar day the patient received invasive ventilation in the ICU as day 0.

Data are numbers of patients/total numbers of patients (%) or median [IQR]. ARDS, acute respiratory distress syndrome; V_T, tidal volume; PBW, predicted body weight; PEEP, positive end–expiratory pressure; PSV, pressure support ventilation; SIMV, synchronized intermittent mandatory ventilation; APRV, airway pressure release ventilation; PRVC, pressure regulated volume–controlled ventilation; Ppeak, peak inspiratory airway pressure; Pplat, plateau airway pressure; RR, respiratory rate; PaO_2, oxygen partial pressure; FiO_2, fraction of inspired oxygen; SpO_2, pulse oximetry saturation of haemoglobin; $PaCO_2$, carbon dioxide partial pressure.

[#]Plateau pressure values are restricted to patients in whom this value was reported and in whom either an assist control mode was used or in whom a mode permitting spontaneous ventilation was used.

*P value represents comparisons across the three study groups for each variable

eTable 8. Number of pulmonary complications per patient in the three study groups

Number of complications	All patients (n=283)	LIPS<4 (n=72)	LIPS≥4 (n=177)	ARDS (n=34)	*p* value LIPS<4 *vs.* LIPS≥4	*p* value*
1	199 (70.3)	51 (70.8)	119 (67.2)	29 (85.3)	0.320	0.319
2	72 (25.4)	21 (29.2)	47 (26.6)	4 (11.8)		
3	10 (3.5)	0 (0.0)	9 (5.1)	1 (2.9)		
4	1 (0.4)	0 (0.0)	1 (0.6)	0 (0.0)		
5	1 (0.4)	0 (0.0)	1 (0.6)	0 (0.0)		

ARDS, acute respiratory distress syndrome
*P value represents comparison across the three study groups

eTable 9. Day of occurrence of pulmonary complications per patient in the three study groups

Day of complication	All patients (n=283)	LIPS<4 (n=72)	LIPS≥4 (n=177)	ARDS (n=34)	*p* value LIPS<4 vs. LIPS≥4	*p* value*
Day 0[#]	---	---	---	---		
Day 1	105 (37.1)	27 (37.5)	68 (38.4)	10 (29.4)	0.129	<0.0001
Day 2	68 (24.0)	10 (13.9)	50 (28.2)	8 (23.5)		
Day 3	31 (1.0)	12 (16.7)	17 (9.6)	2 (5.9)		
Day 4	32 (11.3)	11 (15.3)	13 (7.3)	8 (23.5)		
Day 5	26 (9.2)	7 (9.7)	16 (9.0)	3 (8.8)		
Day 6	8 (2.8)	3 (4.2)	5 (2.8)	0 (0.0)		
Day 7	13 (4.6)	2 (2.8)	8 (4.5)	3 (8.8)		

ARDS, acute respiratory distress syndrome

[#]Complications reported on day of start of invasive ventilation in the ICU were not considered as they could represent the reason for intubation (these are reported separately in eTable 10). The 'day of occurrence' was defined as the first day a pulmonary complication was reported by the treating physician.

*P value represents comparisons across the three study groups.

eTable 10. Pulmonary complications reported on day of start of mechanical ventilation (day 0)

Type of pulmonary complication*	All patients (n=1315)	LIPS<4 (n=389)	LIPS≥4 (n=837)	ARDS (n=89)	*p* value LIPS<4 *vs* LIPS≥4	*p* value*
Pulmonary infection	148 (11.3)	19 (4.9)	110 (13.1)	19 (21.3)	<0.001	<0.0001
Pneumothorax	8 (0.6)	0 (0.0)	7 (0.8)	1 (1.1)	0.161	0.175
Pleural effusion	35 (2.7)	6 (1.5)	22 (2.6)	7 (7.9)	0.327	0.0037
Atelectasis	36 (2.7)	6 (1.5)	24 (2.9)	6 (6.7)	0.231	0.0235
Cardiogenic edema	55 (4.2)	4 (1.0)	47 (5.6)	4 (4.5)	0.0003	0.0009
New pulmonary infiltrates	42 (3.2)	5 (1.3)	32 (3.8)	5 (5.6)	0.0252	0.0254
ARDS severity						
mild	23 (25.8)	-	-	23 (25.8)	-	-
moderate	24 (27.0)	-	-	24 (27.0)	-	-
severe	42 (47.2)	-	-	42 (47.2)	-	-

***These pulmonary complications were not considered in main analysis as may have contributed to the reason for initiating invasive mechanical ventilation.**
ARDS, acute respiratory distress syndrome
* P value represents comparisons across the three study groups for each variable

eTable 11. Sensitivity analysis of factors associated with ICU mortality using driving pressure (excluding PEEP, Pplat and Ppeak) in patients receiving mechanical ventilation

Clinical characteristics and co-morbidities	Unadjusted analyses		Multivariable analyses	
	Odds Ratio (95% CI)	*p* value	Odds Ratio (95% CI)	*p* value
Age (years)				
≤ 65 years	1 (reference)		1 (reference)	
> 65 years	1.37 (1.02 – 1.85)	0.038	2.23 (1.18 – 4.23)	**0.014**
Gender, female	1.07 (0.82 – 1.39)	0.628	---	---
BMI (kg/m^2)	0.99 (0.86 –1.13)	0.844	---	---
Hypertension	1.15 (0.88 –1.50)	0.300	---	---
Diabetes mellitus	1.31 (0.98 – 1.73)	0.064	1.42 (0.80 – 2.53)	0.226
Heart failure	0.74 (0.43 – 1.25)	0.259	---	---
Chronic kidney disease	1.02 (0.49 – 1.46)	0.938	---	---
Chronic liver failure	2.64 (1.43 – 4.88)	0.002	2.45 (0.49 – 12.35)	0.277
COPD	0.63 (0.35 – 1.11)	0.109	0.66 (1.19 – 2.26)	0.507
Cancer	1.22 (0.76 – 1.96)	0.406	---	---
Severity of illness				
SOFA Total	2.14 (1.85 – 2.49)	< 0.001	---	---
Non-Pulmonary SOFA	2.05 (1.78 – 2.38)	< 0.001	1.71 (1.25 – 2.34)	**0.001**
Pulmonary SOFA	1.31 (1.15 – 1.50)	< 0.001	1.05 (0.76 – 1.45)	0.753
LIPS	1.86 (1.61 – 2.15)	< 0.001	1.14 (0.82 – 1.59)	0.436
Management				
Tidal volume (ml/kg PBW)	0.89 (0.77 – 1.03)	0.124	0.84 (0.60 – 1.19)	0.328
PEEP (cm H_2O)	1.10 (1.04 – 1.16)	0.001	--	--
< 8 cmH2O	1 (reference)		--	--
8 - 12 cmH2O	1.52 (1.02 – 2.26)	0.037	--	--
≥ 12 cmH2O	2.47 (1.37 – 4.45)	0.002	0.72 (0.33 – 1.57)	0.408
Use of NIV before intubation	1.53 (1.03 – 2.25)	0.031	2.62 (1.21 – 5.68)	**0.015**
Ventilated in ward before admission	1.47 (0.93 – 2.30)	0.095	0.72 (0.31 – 1.67)	0.440
Maximum airway pressure (cm H_2O)	1.53 (1.30 – 1.79)	< 0.001	--	--
Driving pressure (cm H_2O)	1.43 (1.10 – 1.88)	0.008	1.31 (0.94 – 1.81)	0.112
Respiratory rate (mpm)	1.42 (1.22 – 1.66)	< 0.001	1.41 (0.96 – 2.09)	0.081
FiO_2 (%)	1.74 (1.51 – 2.01)	< 0.001	---	---
Laboratory parameters				
PaO_2/FiO_2 (mmHg)	0.67 (0.57 – 0.78)	< 0.001	---	---
$PaCO_2$ (mmHg)	1.10 (0.96 – 1.26)	0.157	0.61 (0.40 – 0.92)	**0.020**
HCO_3 (mEq/L)	0.68 (0.59 – 0.79)	< 0.001	---	---
Arterial pH level	0.63 (0.53 – 0.73)	< 0.001	0.73 (0.63 – 0.94)	**0.001**
Vital signs				
SpO_2 (%)	0.71 (0.61 – 0.83)	< 0.001	---	---
SpO_2/FiO_2 (mmHg)	0.55 (0.47 – 0.64)	< 0.001	---	---
Heart rate (bpm)	1.49 (1.29 – 1.70)	< 0.001	1.27 (1.06 – 1.52)	**0.008**
MAP (mm Hg)	0.65 (0.56 – 0.75)	< 0.001	0.85 (0.71 – 1.02)	0.080
Pulmonary complications				
Occurrence of at least one complication	1.18 (0.86 – 1.61)	0.311	---	---

BMI, body mass index; BPM, beats per minute; CI, confidence interval; COPD, chronic obstructive pulmonary disease; FiO_2, inspired fraction of oxygen; NIV, non–invasive ventilation; MPM, movements per minute; PBW, predicted body weight; PEEP, positive end–expiratory pressure; SOFA, Sequential Organ Failure Assessment; SpO_2, oxygen saturation; LIPS, Lung Injury Prediction Score; MAP, mean arterial pressure. The multivariable model considered all variables with $p < 0.2$ in the univariable model. All parameters were measured in the first day of ventilation (day 0); numerical variables were standardized in the multivariate analysis to improve convergence of the model; HCO_3 was excluded from the multivariable analysis due to multicollinearity with pH. Total SOFA score and single organ SOFA scores were excluded from the multivariable analysis due to multicollinearity with non-pulmonary SOFA. Pmax and PEEP were excluded due to multicollinearity with driving pressure. PaO_2/FiO_2 and SpO_2/FiO_2 and FiO_2 were excluded due to multicollinearity with pulmonary SOFA. Age and PEEP did not meet the linearity assumption and were thus entered as categorical variables.

eTable 12. Analysis of factors associated with pulmonary complications in patients receiving mechanical ventilation

Clinical characteristics and comorbidities	Unadjusted analyses Odds Ratio (95% CI)	*p* value	Multivariable model Odds Ratio (95% CI)	*p* value
Age (years)				
≤ 65	1 (Reference)		--	--
> 65	1.19 (0.87 to 1.63)	0.268	--	--
Sex, female	0.82 (0.61 to 1.09)	0.163	0.78 (0.56 to 1.08)	0.137
BMI (kg/m^2)	1.09 (0.95 to 1.26)	0.204	--	--
Hypertension	0.96 (0.72 to 1.27)	0.758	--	--
Diabetes	1.08 (0.80 to 1.46)	0.615	--	--
Heart failure	1.21 (0.73 to 1.98)	0.463	--	--
Chronic liver failure	2.35 (1.30 to 4.24)	0.005	2.35 (1.30 to 4.24)	**0.005**
COPD	0.82 (0.45 to 1.50)	0.520	--	--
Cancer	1.13 (0.69 to 1.83)	0.629	--	--
Severity of illness				
SOFA	1.16 (1.00 to 1.34)	0.045	--	--
Non–pulmonary SOFA	1.01 (0.88 to 1.17)	0.872	--	--
Pulmonary SOFA	1.44 (1.25 to 1.67)	< 0.001	--	--
0	--	--	1 (reference)	
1	--	--	1.22 (0.70 to 2.12)	0.488
2	--	--	2.06 (1.25 to 3.38)	**0.005**
3	--	--	2.56 (1.55 to 4.25)	**< 0.001**
4	--	--	3.02 (1.54 to 5.90)	**0.001**
LIPS				
< 4	1 (Reference)		1 (Reference)	
≥ 4	1.25 (0.91 to 1.71)	0.174	1.11 (0.75 to 1.66)	0.592
Management				
V_T PBW (ml/kg PBW)	0.94 (0.81 to 1.10)	0.445	--	--
PEEP (cm H_2O)				
< 8	1 (Reference)		1 (Reference)	
8 - 12	1.21 (0.80 to 1.83)	0.373	0.83 (0.51 to 1.33)	0.429
≥ 12	1.70 (0.91 to 3.17)	0.097	0.84 (0.39 to 1.82)	0.665
Ppeak (cm H_2O)				
≤ 25	1 (Reference)		1 (Reference)	
> 25	1.44 (1.03 to 2.01)	0.032	1.32 (0.89 to 1.97)	0.166
Measured RR (mpm)	1.16 (0.99 to 1.37)	0.064	1.10 (0.91 to 1.32)	0.329
FiO_2	1.30 (1.12 to 1.51)	< 0.001	--	--
Use of NIV before intubation	1.52 (1.01 to 2.28)	0.044	1.23 (0.77 to 1.96)	0.393
Ventilated in ward before admission	1.02 (0.59 to 1.76)	0.941	--	--
Laboratory parameters				
PaO_2/FiO_2	0.66 (0.56 to 0.79)	< 0.001	--	--
$PaCO_2$ (mm Hg)	1.06 (0.91 to 1.23)	0.468	--	--
HCO_3 (mEq/L)	1.13 (0.97 to 1.32)	0.106	--	--
Arterial pH level	1.16 (0.98 to 1.36)	0.087	1.30 (1.07 to 1.56)	**0.007**
Vital signs				
SpO_2 (%)	1.04 (0.90 to 1.21)	0.589	--	--
SpO_2/FiO_2	0.79 (0.68 to 0.93)	0.003	--	--
Heart rate (bpm)	1.02 (0.88 to 1.18)	0.784	--	--
MAP (mm Hg)	0.98 (0.85 to 1.12)	0.754	--	--

BMI, body mass index; BPM, beats per minute; CI, confidence interval; COPD, chronic obstructive pulmonary disease; FiO_2, inspired fraction of oxygen; SOFA, Sequential Organ Failure Assessment; LIPS, Lung Injury Prediction Score; MPM, movements per minute; PBW, predicted body weight; PEEP, positive end–expiratory pressure; RR, respiratory rate; NIV, non-invasive ventilation; SpO_2, pulse oximetry oxygen saturation; MAP, mean arterial pressure.

All ventilator parameters were measured in the first day of ventilation in ICU; numerical variables were standardized in the multivariate analysis to improve convergence of the model. The multivariable model considered all variables with $p < 0.2$ in the univariable model. SOFA, FiO_2, PaO_2/FiO_2, SpO_2 and SpO_2/FiO_2 were excluded due to relationship and multicollinearity with SOFA pulmonary. HCO_3 was excluded due to multicollinearity with pH.

eTable 13. Ventilation characteristics in day 0 with comparative analysis considering clustering of observations in participating centres.

	All patients (n=1315)	LIPS<4 (n=389)	LIPS≥4 (n=837)	ARDS (n=89)	*p* value LIPS<4 vs. LIPS≥4	*p* value*
Absolute V_T, (ml)	450 [400, 500]	450 [400, 500]	450 [400, 500]	400 [360, 470]	0.202	0.184
Absolute V_T (ml), mode	500	500	500	400	--	
V_T PBW (ml/kg PBW)	7.9 [6.8, 9.1]	7.9 [6.8, 8.9]	8.0 [6.8, 9.2]	7.0 [5.8, 8.4]	0.069	0.084
Controlled mode	7.9 [6.8, 9.1]	7.9 [6.8, 8.9]	8.0 [6.8, 9.2]	7.0 [5.8, 8.5]	0.114	0.137
Spontaneous mode	8.1 [7.0, 9.2]	7.8 [6.5, 9.5]	8.3 [7.4, 9.3]	7.7 [7.1, 8.0]	0.492	0.464
≤7.0	396 (30.5)	111 (28.8)	240 (29.2)	45 (50.6)	--	--
7.1-8.9	561 (43.2)	181 (46.9)	350 (42.5)	30 (33.7)	--	--
9.0-10.0	143 (11.0)	31 (8.0)	107 (13.0)	5 (5.6)	--	--
>10.0	198 (15.3)	63 (16.3)	126 (15.3)	9 (10.1)	--	--
V_T ABW (ml/kg)	7.0 [6.0, 8.2]	7.1 [6.2, 8.3]	7.0 [6.0, 8.1]	6.4 [5.6, 7.3]	0.221	0.207
PEEP (cm H_2O)	5.0 [5.0, 8.0]	5.0 [5.0, 7.0]	5.0 [5.0, 7.5]	10.0 [5.0, 12.0]	0.0010	0.0050
≤5	804 (61.1)	261 (67.1)	520 (62.1)	23 (25.8)	--	--
6-8	335 (25.5)	94 (24.2)	220 (26.3)	21 (23.6)	--	--
9-10	112 (8.5)	27 (6.9)	69 (8.2)	16 (18.0)	--	--
>10	64 (4.9)	7 (1.8)	28 (3.3)	29 (32.6)	--	--
Ventilation mode (%)						
Volume-controlled	483 (36.7)	171 (44.0)	288 (34.4)	24 (27.0)	--	--
Pressure-controlled	327 (24.9)	80 (20.6)	218 (26.0)	29 (32.6)	--	--
PSV	40 (3.0)	16 (4.1)	22 (2.6)	2 (2.2)	--	--
SIMV	389 (29.6)	108 (27.8)	255 (30.5)	26 (29.2)	--	--
APRV	3 (0.2)	0 (0.0)	1 (0.1)	2 (2.2)	--	--
PRVC	68 (5.2)	14 (3.6)	48 (5.7)	6 (6.7)	--	--
Other	5 (0.4)	0 (0.0)	5 (0.6)	0 (0.0)	--	--
Ppeak (cm H2O)	22 [18, 28]	21 [18, 25]	22 [18, 28]	28 [23, 36]	<0.0001	<0.0001
Pplat (cm H_2O)[♯]	18 [15, 21]	16 [14, 18]	18 [16, 21]	28 [22, 30]	<0.0001	0.0010
Driving pressure (cm H_2O)	14 [11, 18]	13 [10, 17]	15 [11, 18]	16 [14, 20]	<0.0001	<0.0001
Set RR (bpm)	14 [12, 16]	14 [12, 16]	14 [14, 16]	17 [14, 22]	<0.0001	<0.0001
Measured RR (bpm)	18 [15, 22]	16 [14, 20]	18 [15, 22]	20 [16, 25]	<0.0001	<0.0001
FiO_2 (%)	50 [40, 60]	40 [40, 50]	50 [40, 60]	80 [60, 100]	<0.0001	<0.0001
PaO_2/FiO_2 (mm Hg)	258 [157, 378]	311 [229, 419]	253 [151, 375]	112 [76, 211]	<0.0001	<0.0001
SpO_2/FiO_2	200 [155, 250]	245 [194, 250]	200 [150, 245]	119 [95, 167]	<0.0001	<0.0001
Arterial pH level	7.3 [7.3, 7.4]	7.4 [7.3, 7.4]	7.3 [7.2, 7.4]	7.3 [7.2, 7.4]	<0.0001	<0.0001
$PaCO_2$ (mmHg)	36 [31, 43]	35 [29, 40]	37 [31, 44]	41 [34, 52]	0.0280	0.0300
Use of neuromuscular blockers (%)	225 (17.2)	74 (19.2)	117 (14.1)	34 (38.2)	0.753	0.795
Use of prone positioning (%)	6 (0.5)	0 (0.0)	0 (0.0)	6 (6.7)	--	--
Use of recruitment maneuvers (%)	24 (1.8)	0 (0.0)	8 (1.0)	16 (18.0)	1.0	0.99
Tracheostomy	95 (7.2)	34 (8.7)	49 (5.9)	12 (13.5)	0.0583	0.048

Data are number of patients/total number of patients (%) or median [IQR]. ARDS, acute respiratory distress syndrome; V_T, tidal volume; PBW, predicted body weight; PEEP, positive end–expiratory pressure; PSV, pressure support ventilation; SIMV, synchronized intermittent mechanical ventilation; APRV, airway pressure release ventilation; PRVC, pressure regulated volume–controlled ventilation; Ppeak, peak inspiratory airway pressure; Pplat, plateau airway pressure; RR, respiratory rate; PaO_2, oxygen partial pressure; FiO_2, fraction of inspired oxygen; SpO_2, pulse oximetric saturation of haemoglobin; $PaCO_2$, carbon dioxide partial pressure.

[♯]Plateau pressure values are restricted to patients in whom this value was reported and in whom either an assist control mode was used or in whom a mode permitting spontaneous ventilation was used.

*P value represents comparisons across the study groups for each variable using linear (for numerical variables) and logistic (for categorical variables) mixed-effects models, with centre as the random effect.

eTable 14. Pulmonary complications observed in first 7 days of mechanical ventilation and clinical outcomes with comparative analysis taking into account clustering of observations in participating centres

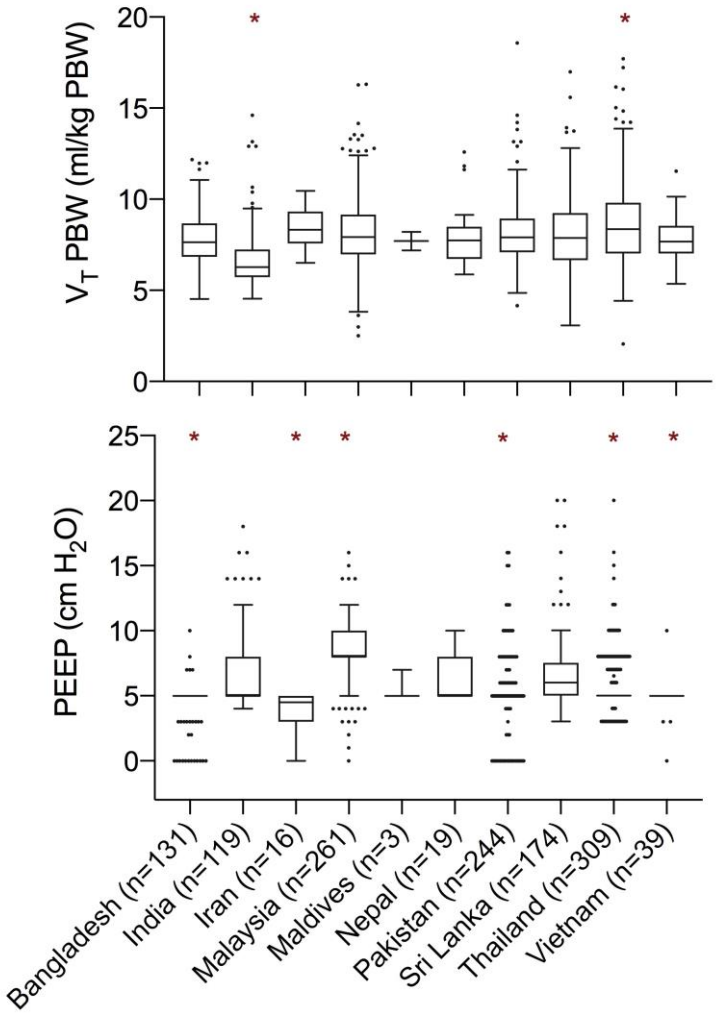
	All patients (n=1315)	LIPS<4 (n=389)	LIPS≥4 (n=837)	ARDS (n=89)	*p* value LIPS<4 vs. LIPS≥4	*p* value**
Patients with at least one new pulmonary complication between day 1 and 7	283 (21.5)	72 (18.5)	177 (21.1)	34 (38.2)	0.378	0.390
Type of pulmonary complication						
Pulmonary infection	110 (8.4)	34 (8.7)	65 (7.8)	11 (12.4)	<0.0001	<0.0001
ARDS	51 (3.9)	11 (2.8)	40 (4.8)	--	0.155	--
Pneumothorax	10 (0.8)	1 (0.3)	8 (1.0)	1 (1.1)	0.227	0.221
Pleural effusion	44 (3.3)	6 (1.5)	35 (4.2)	3 (3.4)	0.0206	0.019
Atelectasis	62 (4.7)	14 (3.6)	41 (4.9)	7 (7.9)	0.236	0.0240
Cardiogenic pulmonary edema	28 (2.1)	6 (1.5)	20 (2.4)	2 (2.2)	0.378	0.0393
New pulmonary infiltrates	72 (5.5)	21 (5.4)	40 (4.8)	11 (12.4)	0.418	0.420
Outcomes						
Death in ICU	388 (29.8)	66 (17.2)	282 (34.1)	40 (44.9)	<0.0001	<0.0001
Death during ICU stay	362 (27.8)	60 (15.7)	265 (32.0)	37 (41.6)	<0.0001	<0.0001
Palliative care	26 (2.0)	6 (1.6)	17 (2.1)	3 (3.4)	0.0089	0.0070
Duration of MV (days)	2.0 [1.0, 5.0]	2.0 [1.0, 5.0]	2.0 [1.0, 5.0]	4.0 [2.0, 8.0]	0.663	0.645
Reintubation	52 (4.0)	16 (4.1)	34 (4.1)	2 (2.2)	0.895	0.910
Length of stay in ICU (days)	4.0 [2.0, 7.0]	3.0 [2.0, 7.0]	4.0 [2.0, 7.0]	5.0 [2.0, 9.0]	0.737	0.797
Length of stay in survivors	4.0 [2.0, 7.0]	3.0 [2.0, 7.0]	4.0 [2.0, 7.0]	6.0 [3.0, 9.0]	0.0132	0.0165
Length of stay in non survivors	3.0 [1.0, 7.0]	3.0 [2.0, 8.0]	3.0 [1.0, 6.0]	3.0 [2.0, 8.0]	0.0476	0.0419
Ventilator-free days at day 28*	24.0 [0.0, 27.0]	26.0 [16.5, 27.0]	23.0 [0.0, 27.0]	8.0 [0.0, 24.5]	<0.0001	<0.0001
Type of discharge for survivors						
Transferred to ward	689 (53.0)	257 (67.1)	399 (48.2)	33 (37.1)	<0.0001	<0.0001
Discharged home	46 (3.5)	11 (2.9)	32 (3.9)	3 (3.4)	0.461	<0.0001
Transferred to other ICU	40 (3.1)	14 (3.7)	25 (3.0)	1 (1.1)	0.485	0.490
Transferred to intermediate care	137 (10.5)	35 (9.1)	90 (10.9)	12 (13.5)	0.581	0.512

Data are number of patients/total number of patients (%) or median [IQR]. ARDS, acute respiratory distress syndrome; ICU, intensive care unit.

*in patients who died while receiving invasive mechanical ventilation, invasive ventilation free days are counted as 0. Patients discharged alive from ICU were assumed to be alive at day 28.

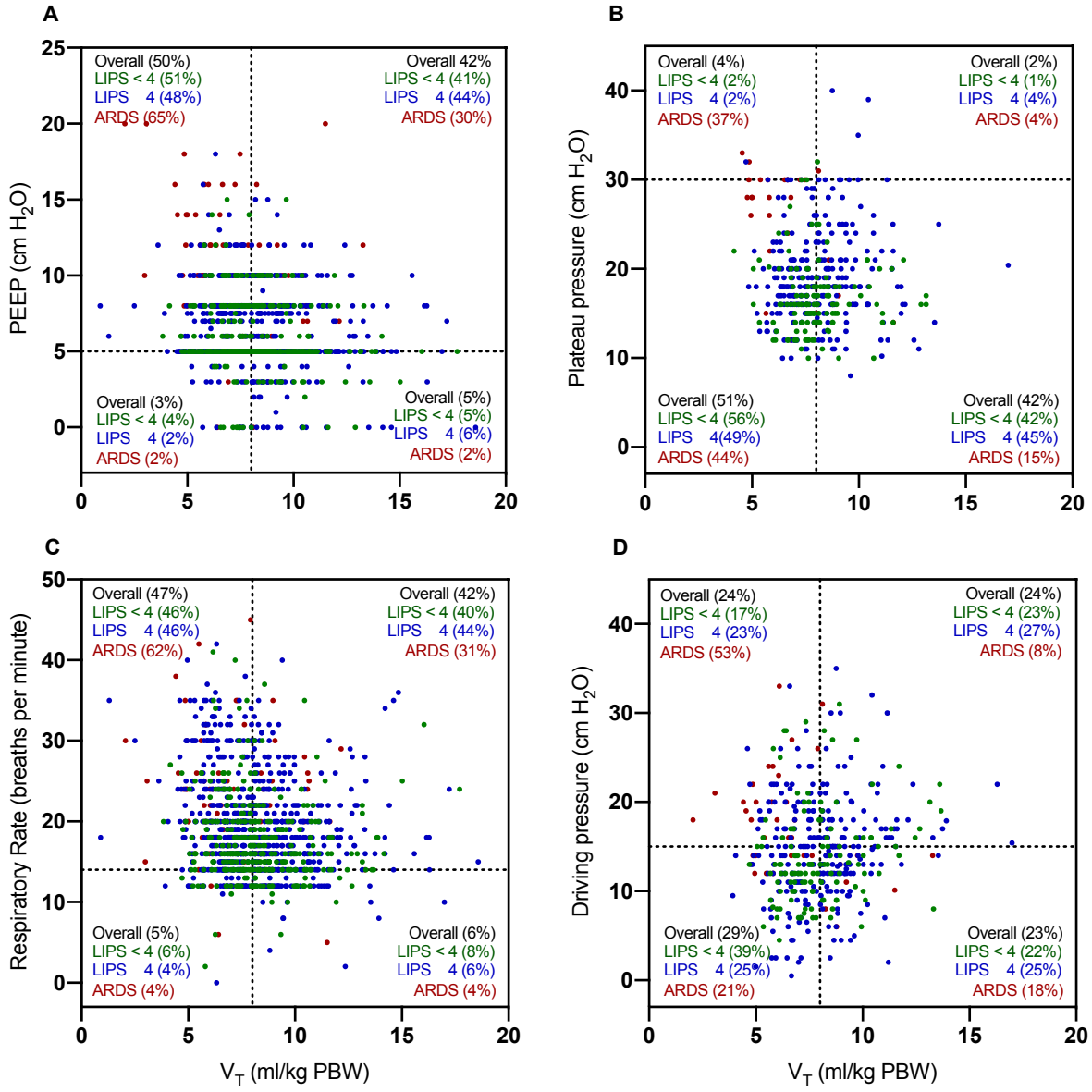
**P value represents comparisons across the study groups for each variable using linear (for numerical variables) and logistic (for categorical variables) mixed-effects models, with centre as the random effect.

eFigure 1. Variation across countries of tidal volume and PEEP reported on day 0



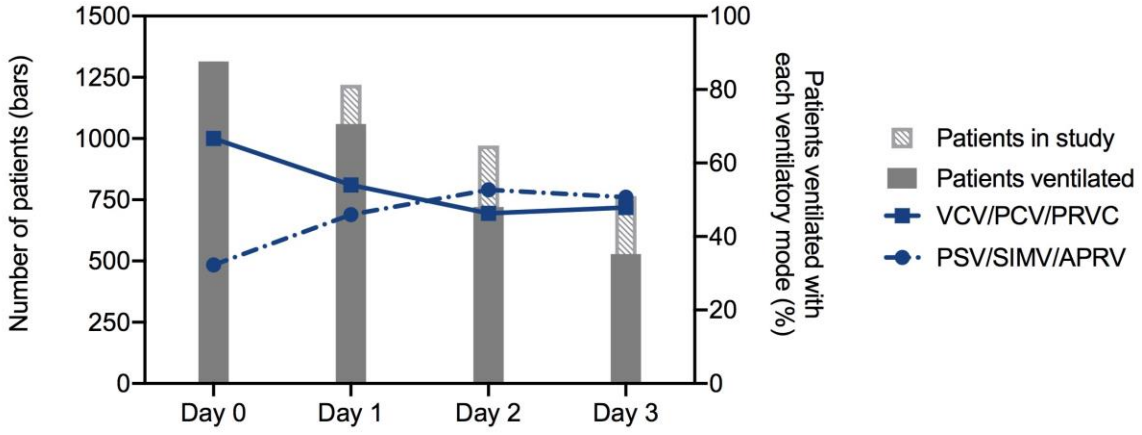
Boxes represent median and interquartile range (IQR). Whiskers are calculated using the Tukey method (1.5 times IQR). *represents P<0.05 and a significant difference of country mean rank compared to whole sample mean rank (Kruskal-Wallis test), with multiplicity adjusted P value using Dunn's test. V_T, tidal volume; PEEP, positive end–expiratory pressure

eFigure 2. Distribution of ventilator parameters on the first day of invasive ventilation



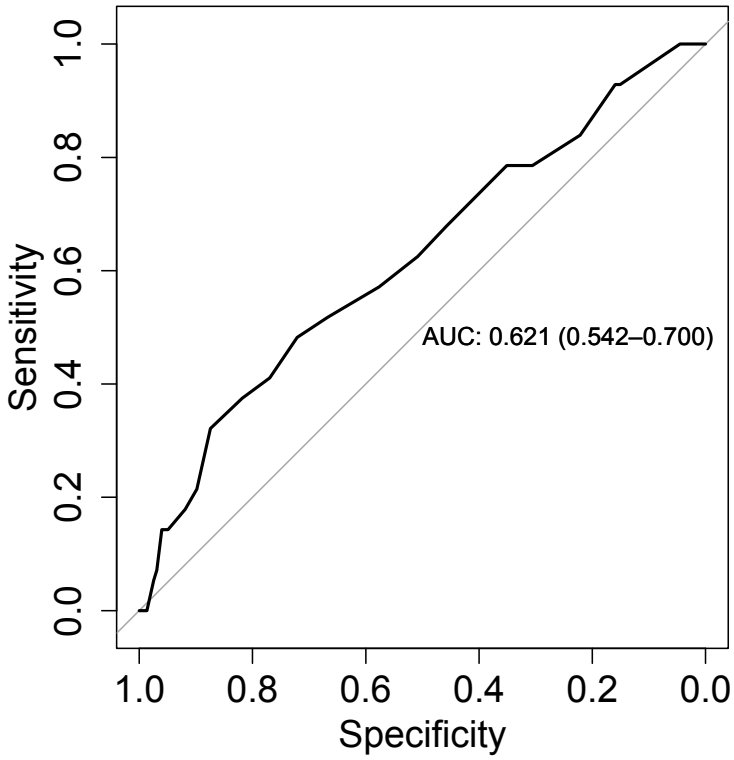
Distribution of V_T against (A) PEEP, (B) plateau pressure, (C) respiratory rate, and (D) driving pressure. Dotted horizontal and vertical lines represent the respective cut-offs for each variable. Cutoffs for ventilator parameters were like those used in previous published reports on invasive ventilation practices, i.e., 8 ml/kg PBW for V_T, 5 cm H_2O for PEEP, 14 breaths per minute for respiratory rate, 30 cm H_2O for Pplat, and 15 cm H_2O for ΔP.
Abbreviations: PEEP, positive end-expiratory pressure; ARDS, acute respiratory distress syndrome; V_T, tidal volume; PBW, predicted body weight

eFigure 3. Number of patients mechanically ventilated and ventilator modes used during the first 4 days



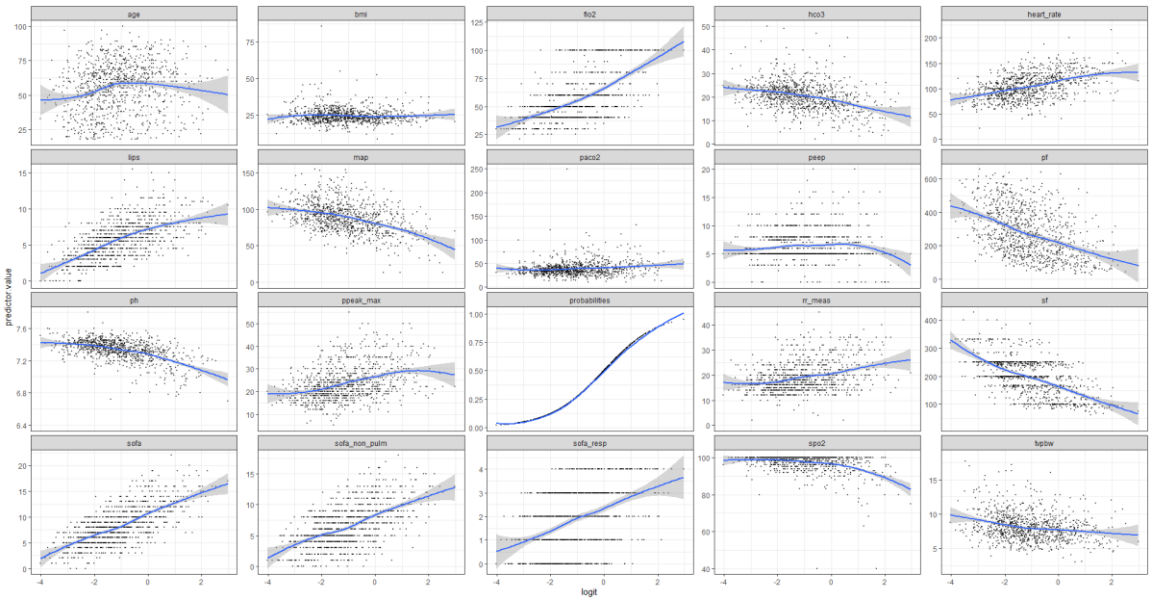
VCV, volume–controlled ventilation; PCV, pressure–controlled ventilation; PRVC, pressure regulated volume controlled ventilation; PSV, pressure support ventilation; SIMV, synchronized intermittent mechanical ventilation; APRV, airway pressure release ventilation.

eFigure 4. Receiver operating characteristics curve for LIPS in predicting development of ARDS

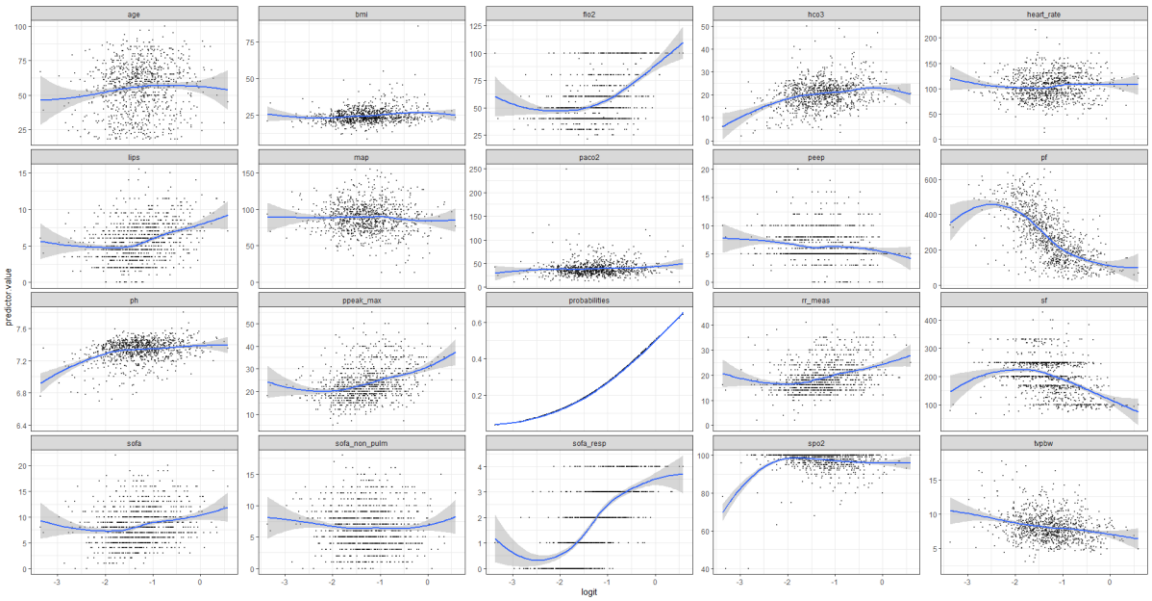


ARDS, acute respiratory distress syndrome; LIPS, lung injury prediction score; AUC, area under the curve

eFigure 5. Linearity check (logit x predictor) for multivariable model exploring risk factors for death in ICU



eFigure 6. Linearity check (logit x predictor) for multivariable model exploring risk factors for pulmonary complications



CASE REPORT FORMS

Print out of case report form

Print out of ICU characteristics survey form

Inclusion And Exclusion Criteria

Record ID _____

IDENTIFICATION

Patient initials (fictive) _____

Country
◯ Bangladesh ◯ India
◯ Iran ◯ Malaysia ◯ Maldives
◯ Myanmar ◯ Nepal
◯ Pakistan ◯ Sri Lanka
◯ Thailand ◯ Vietnam
◯ Other

INCLUSION CRITERIA
(All should be YES)

Admitted to a participating ICU ◯ Yes ◯ No

Need of invasive mechanical ventilation ◯ Yes ◯ No

EXCLUSION CRITERIA
(All should be NO)

Age < 18 years ◯ Yes ◯ No

Receiving only non-invasive ventilation ◯ Yes ◯ No

Patient under invasive mechanical ventilation before the beginning of the 28 days period of inclusion ◯ Yes ◯ No

Patient transferred from another hospital under invasive mechanical ventilation ◯ Yes ◯ No

INCLUSION OF PATIENT

Date of inclusion _____
(D-M-Y)

Waiver of informed consent ◯ Yes ◯ No

Informed consent signed ◯ Yes ◯ No

Date of informed consent _____

Admission Form

DEMOGRAPHIC DATA

Age _____

Gender ◯ Male ◯ Female

Date of hospital admission _____ (D-M-Y)

Date of ICU admission _____ (D-M-Y)

Date of START of invasive VENTILATION in the present ICU (= Day 0) _____ (D-M-Y)

Has the patient received invasive mechanical ventilation in the ward for more than 12h before admission to the ICU? ◯ Yes ◯ No

Non-Invasive ventilation before intubation ◯ Yes ◯ No

Duration of non-invasive ventilation before intubation _____ (minutes)

Reason for ICU admission
◯ Planned / Scheduled Surgery
◯ Emergency Surgery (excluding trauma)
◯ Trauma
◯ Clinical (Medical) Condition

Admission Source
◯ ED - Emergency Department
◯ OR - Operating/recovery room
◯ Ward (medical or surgical)
◯ Ward (obstetric/maternity)
◯ Directly from community
◯ Other Hospital/ICU

Height ◯ Measured ◯ Estimated

Height, cm _____ (cm)

Weight ◯ Measured ◯ Estimated

Weight, kg _____ (kg)

Smoker
◯ Never
◯ Stopped
◯ Current (still smoking)
◯ Unknown

REASON FOR INTUBATION AND MECHANICAL VENTILATION

Reason for intubation
- ☐ Cardiac Arrest
- ☐ Planned Postoperative Mechanical Ventilation
- ☐ Depressed Level of Consciousness
- ☐ Acute Respiratory Failure
- ☐ Hemodynamic instability
- ☐ Other

Other reason for intubation _____

Which cause of depressed level of consciousness
- ◯ Ischemic Stroke
- ◯ Hemorrhagic Stroke
- ◯ Subarachnoid Hemorrhage
- ◯ Traumatic Brain Injury
- ◯ Meningo-Encephalitis
- ◯ Metabolic / Hepatic Encephalopathy
- ◯ Intoxication
- ◯ Sepsis
- ◯ Other

Other cause of depressed level of consciousness _____

Which cause of Acute Repiratory Failure
- ◯ Community-acquired Pneumonia
- ◯ Nosocomial Pneumonia
- ◯ Unplanned Postoperative Ventilation
- ◯ Cardiogenic Pulmonary Edema
- ◯ Sepsis (other than pneumonia)
- ◯ COPD exacerbation
- ◯ Acute Respiratory Distress Syndrome (ARDS)
- ◯ Other

Other cause of repiratory failure _____

CHRONIC CO-MORBIDITIES

Chronic co-morbidities
- ☐ None
- ☐ Arterial Hypertension
- ☐ Heart Failure
- ☐ Diabetes Mellitus
- ☐ Chronic Kidney Disease
- ☐ Liver Cirrhosis
- ☐ Chronic Obstructive Pulmonary Disease
- ☐ Cancer
- ☐ Neuromuscular Disease
- ☐ Other

Treatment for chronic kidney disease or failure
- ◯ Conservative ◯ Hemodialysis
- ◯ Peritoneal Dialysis

Stage of cancer
- ◯ Former (successfully treated)
- ◯ Actual

Type of cancer

- ☐ Brain
- ☐ Head and Neck
- ☐ Lung
- ☐ Stomach
- ☐ Liver
- ☐ Kidney
- ☐ Breast
- ☐ Prostate
- ☐ Colon
- ☐ Pancreas
- ☐ Bladder
- ☐ Hematological
- ☐ Musculoskeletal
- ☐ Other

Other type of cancer _____

Type of neuromuscular disease

- ☐ Guillain-Barre Syndrome
- ☐ Multiple Sclerosis
- ☐ Amyotrophic Lateral Sclerosis
- ☐ Myasthenia Gravis
- ☐ Other

Other type of neuromuscular disease _____

LUNG INJURY PREDICTION SCORE (LIPS) BEFORE INTUBATION
(please click all options that apply)

Conditions

- ☐ None
- ☐ Shock
- ☐ Aspiration
- ☐ Sepsis
- ☐ Pneumonia

High-Risk Surgery

- ☐ None
- ☐ Orthopedic Spine
- ☐ Acute Abdomen
- ☐ Cardiac
- ☐ Aortic Vascular
- ☐ Emergency Procedure

High-Risk Trauma

- ☐ None
- ☐ Traumatic Brain Injury
- ☐ Smoke Inhalation
- ☐ Near-Drowning
- ☐ Lung Contusion
- ☐ Multiple Fractures

Risk modifiers

- ☐ None
- ☐ Alcohol Abuse
- ☐ Hypoalbuminemia
- ☐ Chemotherapy
- ☐ Fraction of Inspired Oxygen > 35% (or > 4 L/min)
- ☐ Respiratory Rate > 30 bpm
- ☐ Pulse Oximetry < 95%
- ☐ pH < 7.35 (only if available)

Admission Evaluation

ADMISSION EVALUATION

(at the first hour of ICU admission if not specified otherwise)

Glasgow Coma Scale - Eye opening (pre-intubation value)
- ◯ 4 - Spontaneous
- ◯ 3 - To sound
- ◯ 2 - To pressure
- ◯ 1 - None
- ◯ Not Testable

Glasgow Coma Scale - Verbal response (pre-intubation value)
- ◯ 5 - Orientated
- ◯ 4 - Confused
- ◯ 3 - Words
- ◯ 2 - Sounds
- ◯ 1 - None
- ◯ Not Testable (Vt)

Glasgow Coma Scale - Motor response (pre-intubation value)
- ◯ 6 - Obey commands
- ◯ 5 - Localizing
- ◯ 4 - Normal flexion
- ◯ 3 - Abnormal flexion
- ◯ 2 - Extension
- ◯ 1 - None
- ◯ Not Testable

Glasgow Coma Score (Total) _____

Systolic blood pressure (SBP) _____ (mmHg)

Dyastolic blood pressure _____ (mmHg)

Heart rate (HR) _____ (beats per minute)

Use of Vasopressors - Inotropes
- ☐ None
- ☐ Dopamine
- ☐ Noradrenaline (Norepinephrine)
- ☐ Adrenaline (Epinephrine)
- ☐ Dobutamine

(for at least 1h)

Dopamine dose? _____ (mcg/kg/min)

Noradrenaline (Norepinephrine) dose? _____ (mcg/kg/min)

Adrenaline (Epinephrine) dose? _____ (mcg/kg/min)

Platelets _____ (x 103 / microl)

Urine Output (last 24 hours) _____ (millilitres / day)

Creatinine levels _____ (mg/dl or micromol/liter)

Bilirubin (total bilirubin level) _____ (mg/dl or micromol/liter)

VENTILATION

(at first hour after INTUBATION if intubated in the ICU or at the first hour after admission in the ICU if intubated outside)

Mode of ventilation
- ◯ Volume-Controlled (VCV)
- ◯ Pressure-Controlled (PCV)
- ◯ Pressure Support (PSV)
- ◯ Synchronized Intermittent Mandatory Ventilation (SIMV)
- ◯ Airway Pressure Release Ventilation (APRV)
- ◯ Other

Other mode of ventilation _____

Positive end-expiratory pressure (PEEP) _____ (cmH2O)

Maximum airway pressure (Pmax) _____ (cmH2O)

Peak pressure (Ppeak) _____ (cmH2O)

Plateau pressure (Pplateau) _____ (cmH2O)

Level of pressure support above PEEP _____ (cmH2O)

Level of pressure control above PEEP _____ (cmH2O)

Tidal volume (TV exp) _____ (milliliters)

SET respiratory rate
(put 0 when in spontaneous modes) _____ (breaths per minutes)

MEASURED respiratory rate _____ (breaths per minutes)

Inspired fraction of oxygen (FiO2) _____ (%)

Pulse oximetry (SpO2) _____ (%)

Arterial blood gas available? ◯ Yes ◯ No

Arterial blood gas Units ◯ mmHg ◯ kpa

Partial pressure of Oxygen (PaO2) _____ (kPa or mmHg)

Partial pressure of carbon dioxide (PaCO2) _____ (kPa or mmHg)

pH _____

Bicarbonate (HCO3) _____ (mEq/L)

Arterial lactates level _____ (mEq/L)

End tidal carbon dioxide oxygen (etCO2)
- ◯ Available in kpa
- ◯ Available in mmHg
- ◯ Not available

End tidal carbon dioxide (etCO2) _____

Use of neuro-muscular blockers during ventilation? ◯ Yes ◯ No

Use of rescue therapy (prone positioning, recruitment manouvers)? ◯ Yes ◯ No

Type of rescue therapy
- ☐ Prone Positioning
- ☐ Recruitment Maneuvers

PULMONARY COMPLICATIONS

Pulmonary complications
- ☐ None
- ☐ Pulmonary Infection
- ☐ Acute Respiratory Distress Syndrome (ARDS)
- ☐ Pneumothorax
- ☐ Pleural Effusion
- ☐ Atelectasis
- ☐ Cardiogenic Edema
- ☐ New Pulmonary Infiltrates

Pulmonary infection confirmed by microbiology? ◯ Yes ◯ No

Severity of ARDS
- ◯ Mild (PaO2 / FiO2 201-300)
- ◯ Moderate (PaO2 / FiO2 101-200)
- ◯ Severe (PaO2 / FiO2 ≤ 100)
- ◯ Blood gas analysis not available

Severity of ARDS by SpO2/FiO2 ratio (if P/F not available)
- ◯ Mild (SpO2 / FiO2 236 - 315)
- ◯ Moderate (SpO2 / FiO2 151 - 235)
- ◯ Severe (SpO2 / FiO2 ≤ 150)

ARDS confirmed by consistent chest X-ray? ◯ Yes ◯ No

Discharge

DISCHARGE

(on ICU discharge or death, maximum day 60 after enrolment)

End of ICU stay
◯ Yes - discharged
◯ No - still in ICU at day 60

Discharged to
◯ Ward
◯ Home
◯ Transferred to other ICU
◯ Transferred to Medium Care or High Dependency Unit
◯ Die at home (palliative care)
◯ Deceased

Date of ICU DISCHARGE or DEATH _____

Date of EXTUBATION (if done) _____

Date of re-intubation (if done) _____

Date of re-extubation (if done) _____

Date of tracheostomy (if done) _____

ICU Followup

FOLLOW-UP
(from day 1 to 3, ICU discharge or death, whichever comes first)

Follow-up performed ◯ Yes ◯ No, patient discharged in previous days

Date of assessment (Day 0 + follow up day) _____

The Day 0 (start of invasive ventilation) was: *[admission_arm_1][date_start_vent]*

Follow-up day (for paper CRF) ◯ Day 1 ◯ Day 2 ◯ Day 3

DAILY EVALUATION
(on morning round; i.e. closest to 08:00 AM)

Glasgow Coma Scale - Eye Opening
◯ 4 - Spontaneous
◯ 3 - To Sound
◯ 2 - To Pressure
◯ 1 - None
◯ Not Testable

Glasgow Coma Scale - Verbal response
◯ 5 - Orientated
◯ 4 - Confused
◯ 3 - Words
◯ 2 - Sounds
◯ 1 - None
◯ Not Testable

Glasgow Coma Scale - Motor Response
◯ 6 - Obey commands
◯ 5 - Localizing
◯ 4 - Normal flexion
◯ 3 - Abnormal flexion
◯ 2 - Extension
◯ 1 - None
◯ Not Testable

Glasgow Coma Score - Total _____

Systolic blood pressure (SBP) _____ (mmHg)

Heart rate (HR) _____ (beats per minute)

Pulse oximetry (SpO2) _____ (%)

VENTILATION

(on morning round; i.e. closest to 08:00 AM or before the first arterial blood gas analysis of the day)

Mechanical ventilation at any time? ◯ Yes ◯ No

Mode of ventilation
◯ Volume-Controlled (VCV)
◯ Pressure-Controlled (PCV)
◯ Pressure Support (PSV)
◯ Synchronized Intermittent Mandatory Ventilation (SIMV)
◯ Airway Pressure Release Ventilation (APRV)
◯ Other

Other mode of ventilation _____

Positive end-expiratory pressure (PEEP) _____ (cmH2O)

Level of pressure support above PEEP _____ (cmH2O)

Level of pressure control above PEEP _____ (cmH2O)

Maximum inspiratory airway pressure (Pmax) _____ (cmH2O)

Peak pressure (Ppeak) _____ (cmH2O)

Plateau pressure (Pplat) _____ (cmH2O)

Tidal volume (TV exp) _____ (milliliters)

SET respiratory rate
(put 0 when in spontaneous modes) _____ (breaths per minutes)

MEASURED respiratory rate _____ (breaths per minutes)

Inspired fraction of oxygen (FiO2) _____ (%)

Arterial blood gas available? ◯ Yes ◯ No

Partial pressure of oxygen (PaO2) _____ (kPa or mmHg)

Partial pressure of carbon dioxide (PaCO2) _____ (kPa or mmHg)

pH _____

Bicarbonate (HCO3) _____ (mEq/L)

Arterial lactates level _____ (mmol/L)

End tidal carbon dioxide oxygen (etCO2)
- ◯ Available in kPa
- ◯ Available in mmHg
- ◯ Not available

End tidal carbon dioxide (etCO2) _____

Use of neuro-muscular blockers during ventilation? ◯ Yes ◯ No

Use of rescue therapy (prone positioning, recruitment manouvers) ◯ Yes ◯ No

Type of rescue therapy
- ☐ Prone Positioning
- ☐ Recruitment Maneuvers

PULMONARY COMPLICATIONS

Pulmonary complications
- ☐ None
- ☐ Pulmonary Infection
- ☐ Acute Respiratory Distress Syndrome (ARDS)
- ☐ Pneumothorax
- ☐ Pleural Effusion
- ☐ Atelectasis
- ☐ Cardiogenic Edema
- ☐ New Pulmonary Infiltrates

Pulmonary infection confirmed by microbiology? ◯ Yes ◯ No

Severity of ARDS
- ◯ Mild (PaO2 / FiO2 201-300)
- ◯ Moderate (PaO2/ FiO2 101-200)
- ◯ Severe (PaO2 / FiO2 ≤ 100)
- ◯ Blood gas analysis not available

Severity of ARDS by SpO2/FiO2 ratio (if P/F value not available)
- ◯ Mild (SpO2 / FiO2 236-315)
- ◯ Moderate (SpO2 / FiO2 151-235)
- ◯ Severe (SpO2 / FiO2 ≤ 150)

ARDS confirmed by consistent chest x-ray? ◯ Yes ◯ No

Pulmonary Complications

FOLLOW-UP
(from day 4 to 7, ICU discharge or death, whichever comes first)

Follow-up performed? ◯ Yes ◯ No, patient discharged in previous days

Date of assessment (Day 0 + follow up day) _____

Day 0 (start of invasive ventilation): *[admission_arm_1][date_start_vent]*

Follow up day (for paper CRF) ◯ Day 4 ◯ Day 5 ◯ Day 6 ◯ Day 7

DAILY EVALUATION
(on morning round; i.e. closest to 08:00 AM)

Systolic blood pressure (SBP) _____ (mmHg)

Heart rate (HR) _____ (bpm)

SpO2 _____ (%)

PULMONARY COMPLICATIONS

Pulmonary complications
- ☐ None
- ☐ Pulmonary Infection
- ☐ Acute Respiratory Distress Syndrome (ARDS)
- ☐ Pneumothorax
- ☐ Pleural Effusion
- ☐ Atelectasis
- ☐ Cardiogenic Edema
- ☐ New Pulmonary Infiltrates

Pulmonary Infection confirmed by microbiology? ◯ Yes ◯ No

Severity of ARDS
- ◯ Mild (PaO2 / FiO2 201-300)
- ◯ Moderate (PaO2 / FiO2 101-200)
- ◯ Severe (PaO2 / FiO2 ≤ 100)
- ◯ Blood gas analysis not available

Severity of ARDS by SpO2/FiO2 ratio (if P/F unavailable)
- ◯ Mild (SpO2 / FiO2 236-315)
- ◯ Moderate (SpO2 / FiO2 151-235)
- ◯ Severe (SpO2 / FiO2 ≤ 150)

ARDS confirmed by consistent chest x-ray? ◯ Yes ◯ No

Pulmonary Complications

FOLLOW-UP
(from day 4 to 7, ICU discharge or death, whichever comes first)

Follow-up performed? ◯ Yes ◯ No, patient discharged in previous days

Date of assessment (Day 0 + follow up day) _____

Day 0 (start of invasive ventilation): *[admission_arm_1][date_start_vent]*

Follow up day (for paper CRF) ◯ Day 4 ◯ Day 5 ◯ Day 6 ◯ Day 7

DAILY EVALUATION
(on morning round; i.e. closest to 08:00 AM)

Systolic blood pressure (SBP) _____ (mmHg)

Heart rate (HR) _____ (bpm)

SpO2 _____ (%)

PULMONARY COMPLICATIONS

Pulmonary complications
- ☐ None
- ☐ Pulmonary Infection
- ☐ Acute Respiratory Distress Syndrome (ARDS)
- ☐ Pneumothorax
- ☐ Pleural Effusion
- ☐ Atelectasis
- ☐ Cardiogenic Edema
- ☐ New Pulmonary Infiltrates

Pulmonary Infection confirmed by microbiology? ◯ Yes ◯ No

Severity of ARDS
- ◯ Mild (PaO2 / FiO2 201-300)
- ◯ Moderate (PaO2 / FiO2 101-200)
- ◯ Severe (PaO2 / FiO2 ≤ 100)
- ◯ Blood gas analysis not available

Severity of ARDS by SpO2/FiO2 ratio (if P/F unavailable)
- ◯ Mild (SpO2 / FiO2 236-315)
- ◯ Moderate (SpO2 / FiO2 151-235)
- ◯ Severe (SpO2 / FiO2 ≤ 150)

ARDS confirmed by consistent chest x-ray? ◯ Yes ◯ No

Participating ICU survey

Dear PRoVENT-iMIC Investigator,

Please complete the survey below only once for your center. It will only take 6-7 minutes.

This questionnaire aims at gathering basic organizational information on your ICU as participating center in PRoVENT-iMIC.

Thank you

Luigi Pisani,

PRoVENT-iMIC International Coordinator

on behalf of Ary Serpa Neto, Arjen Dondorp and Marcus Schultz and the PRoVENT-iMIC investigators

For any query please contact:

Luigi Pisani

Tel. +31683876341 E-mail: luigipisani@gmail.com

Hospital and ICU characteristics

1) Country

- ◯ Bangladesh
- ◯ Malaysia
- ◯ Sri Lanka
- ◯ Thailand
- ◯ Vietnam
- ◯ Pakistan
- ◯ India
- ◯ Myanmar
- ◯ Iran
- ◯ Nepal
- ◯ Maldives

2) Name of the institution _____

3) City/Town _____

4) Name Investigator completing this form _____

5) E-mail investigator _____

6) Phone number _____

7) Hospital status ◯ Public ◯ Private

8) Hospital type
◯ Academic/University
◯ Non-academic

9) Type of population served
◯ Mainly urban
◯ Mainly rural
◯ Both

10) Type of ICU
◯ Medical
◯ Surgical
◯ Cardiothoracic
◯ Neurosurgical
◯ Mixed

11) ICU arrangement
◯ Open ICU
◯ Closed ICU
(Open ICU = the physician responsible for the patient admits the patient to the ICU and keeps the formal responsibility for the patient and his treatment) Closed ICU = responsibility for the patient and his treatment is transferred to the intensivist)

12) Total number of beds in Hospital _____ (beds)

13) Number of beds in ICU _____ (beds)

14) Total number of ICU admissions in last calendar year _____ (admissions)

15) Total number of ICU admissions during the PRoVENT-iMIC study period (28 days) _____ (admissions)

16) Was this ICU involved in research activities (other than surveys) in the past 5 years? ◯ No ◯ Yes

Mechanical Ventilation in your ICU

17) Total number of VENTILATORS available for invasive ventilation

_____ (ventilators)

18) Number of functioning ventilators at the moment

_____ (ventilators)

19) Type of humidification mostly used

◯ None
◯ HME
◯ Active humidification

20) Routine use of Non Invasive Ventilation (NIV)

◯ No ◯ Yes

21) Availability of high flow nasal oxygen (HFNT) devices?

◯ No ◯ Yes

Average number of Health Professionals present in ICU

22) Is a dedicated physician available in ICU 24/7?

◯ No ◯ Yes

23) Number of staff Physicians per shift

_____ (Doctors/Physicians)

24) Number of doctors in training or residents per shift (mark 0 if none)

_____ (Residents/Trainees)

25) Number of Nurses per shift

_____ (Nurses)

26) Usual nurse to bed ratio

◯ 1 nurse to 1 bed
◯ 1 nurse to 2 beds
◯ 1 nurse to 3 beds
◯ 1 nurse to 4 beds
◯ Other

27) Availability of Renal Replacement Therapy

◯ Not available
◯ Available in hospital
◯ Available in ICU

Units used

28) Units used for biochemical laboratory values (e.g. creatinine)

◯ Traditional units (mg/dl)
◯ International units (micromoles/L)

29) Units used for vasopressors

◯ micrograms/min ◯ micrograms/kg/min
◯ milligrams/hour

Availability of monitoring devices

30) Is pulseoxymetry available for all ventilated patients?
◯ No ◯ Yes

31) Is End Tidal CO2 available and functioning in your ICU?
◯ No ◯ Yes

32) Can chest x-ray be performed?
◯ No
◯ Yes with dedicated ICU portable x-ray
◯ Yes with hospital x-ray apparatus
◯ Yes with external x-ray providers

33) Is Computed Tomography available?
◯ No
◯ Yes - in hospital
◯ Yes - outsourced

34) Ultrasound machine available?
◯ No
◯ Yes, in hospital
◯ Yes, there is a dedicated machine in the ICU

35) Is Lung ultrasound routinely performed in the ICU?
◯ No
◯ Yes

36) Is blood gas analysis available and functional?
◯ No
◯ Yes - in ICU
◯ Yes - in hospital laboratory
◯ Yes - outsourced

37) Are microbiology cultures available?
◯ No
◯ Yes - in hospital
◯ Yes - outsourced

38) Use of ventilation protocols
◯ No ◯ Yes