Table S1. Operational definitions

Concept	Definition/criteria
Early mobilization intervention	Any intervention aiming to recover functional status and has been proposed as a promising intervention to counteract the intensive care unit acquired weakness, performed between days 2 and 5 from ICU admission or when safety criteria allowed starting mobilization (1, 2). This can be done by any health professional (e.g. physical therapists, nurses, occupational therapists). Early mobilization can be considered as synonyms of physical rehabilitation, mobilization, exercise, physical therapy and rehabilitation (3). Early mobilization may include interventions such as cycling, progressive mobility, walking, in-bed passive exercise, in-bed active exercise, neuromuscular electrical stimulation, tilt-table, FES-cycling and whole-body vibration (3).
Respiratory support	Any treatment that assists totally or partially the respiratory function, including mechanical ventilation, non-invasive ventilation, extra corporeal carbon dioxide removers, extra corporeal membrane oxygenation. Respiratory support depends of the ventilatory modes setting and the respiratory parameters adjustment.
Ventilatory mode	Refers to the method that the ventilator delivers the positive pressure to the patient, included, assist-control modes (e.g. Pressure-controlled ventilation), assisted modes (e.g. Pressure support ventilation) and proportional modes (e.g. Proportional assist ventilation).
Respiratory parameter	Any respiratory variable programmed by clinical staff to adjust the respiratory support according the respiratory patient's needs. For example, mandatory respiratory rate, fraction of inspired oxygen, positive end expiratory pressure, targeted pressure or volume prescription.
Respiratory support adjustment on early	Any modification on respiratory support setting before, during or after mobilization. For example, increasing support level during pressure

mobilization	support ventilation, using proportional ventilation modes, employing assist-control ventilation or increasing the fraction of inspired oxygen.
Real-time metabolic variable	Any variable that reports about metabolic utilization on a device (e.g. monitor or ventilator) continuously available before, during or after the mobilization. For example, oxygen consumption and carbon dioxide production.
Real-time respiratory variable	Any variable that reports about respiratory function on a device (e.g. monitor or ventilator) continuously available before, during or after the mobilization. For example, respiratory rate, tidal volume, minute ventilation, oesophageal pressure or diaphragm electrical activity derived variables, pulse oximetry saturation.
Leg cycling	Any intervention that produces a movement similar to pedaling with the legs on a cycle-ergometer. Include lower extremity cycle erogmetry, either passively completed by the equipment, components of active participation from the patient, or full participation from the patient (3).
Arm cycling	Any intervention that produces a movement similar to pedaling with the arms on a cycle-ergometer. Include upper extremity cycle erogmetry, either passively completed by the equipment, components of active participation from the patient, or full participation from the patient (3).
Progressive mobility	Any intervention that incrementally modifies the patient's activity level. For example, rolling in bed, sitting on the edge of the bed, standing up, and walking (4). Mobility activities progressing from less difficult (e.g., activity in bed) to more difficult (e.g., out of bed activities such as up to chair or ambulation). May include range of motion or strengthening activities, but only as part of a mobility activity and not as a separate therapeutic program (3).
Walking	Any activity that includes the ambulation of the patient, this can be done with or without assistance, with or without assistance device such as: partial weight support, technical aids. This definition doesn’t

	incudes “marching on the spot”.
In-bed passive exercise	Any passive physical intervention that includes passive range of motion, muscle stretching exercises and in-bed positioning, but that are not part of a progressive mobility regimen (3).
In-bed active exercise	Any serial and programmed active intervention with the aim to improve specific attribute of the physical condition, for example: exercises with manual resistance, elastic band, free weights or body weight, active or active-assisted range of motion, neuromuscular facilitation and therapeutic exercises, but that are not part of a progressive mobility regimen (3).
Neuromuscular electrical stimulation	Any intervention that uses a device that sends electrical impulses to peripheric nerves. Neuromuscular electrical stimulation, is a technique that consists of generating visible muscle contractions with portable devices connected to surface electrodes has been shown to be effective in treating impaired muscles as it has the potential to preserve muscle-protein synthesis and prevent muscle atrophy during prolonged periods of immobilization (5). Application of electrical stimulation via electrodes attached to the skin over pre-determined muscles to elicit a muscle contraction. May include passive only (i.e., no active participation from the patient) or active muscle contractions simultaneously (3).
Tilt-table	Any device that allows a patient to be passively or actively standing or varying angles to the horizontal with the aim to increase ventilation, increase arousal, improve weight bearing of the lower limbs, and facilitate antigravity exercise of the limbs. This technique is used as a precursor to standing when a patient has weakness and cannot stand on his own (6).
FES-cycling	Any intervention that uses a cycle-ergometer coordinated with a functional electrical stimulation system. Passive cycling and NMES can be delivered simultaneously and synchronized to produce a coordinated pattern of movements (7).

Whole-body vibration	Any intervention that use vibration stimuli platform as a countermeasure to muscle atrophy and bone loss during the absence of gravity in space, as well as a training option for professional athletes (8).

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Table S2. Search terms for the identification of eligible references for scoping review

Database (Date)	Search Terms	Results
PubMed (NCBI) (November 15, 2019)	((((((("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units"))) AND (("Respiration, Artificial" OR "Noninvasive Ventilation" OR "Ventilatory support" OR "Assisted mechanical ventilation" OR "Proportional ventilation" OR "Pressure support" OR "Work of Breathing" OR "Oxygen Consumption" OR "Ventilatory setting" OR "Oxygen consumption" OR "Work efficiency" OR "Neurally adjusted ventilatory assist" OR "Proportional assisted ventilation" OR "Proportional modes" OR "Assisted modes" OR "Assisted mechanical ventilation" OR "Metabolism"))) AND (("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities" OR "Physiotherapy")))) AND (Spanish OR English) **Limits:** from inception to present **Language filters:** English and Spanish	**725**
PubMed (NCBI) (February 9, 2021)	((((((("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units"))) AND (("Respiration, Artificial" OR "Noninvasive Ventilation" OR "Ventilatory support" OR "Assisted mechanical ventilation" OR "Proportional ventilation" OR "Pressure support" OR "Work of Breathing" OR "Oxygen Consumption" OR "Ventilatory setting" OR "Oxygen consumption" OR "Work efficiency" OR "Neurally adjusted ventilatory assist" OR "Proportional assisted ventilation" OR "Proportional modes" OR "Assisted modes" OR "Assisted mechanical ventilation" OR "Metabolism"))) AND (("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities" OR "Physiotherapy")))) AND (Spanish OR English) **Limits:** from November 2019 to present **Language filters:** English and Spanish	**168**
CINAHL plus with full text (EBSCO) (November 15, 2019)	("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units") AND ("Respiration, Artificial" OR "Noninvasive Ventilation" OR "Ventilatory support" OR "Assisted mechanical ventilation" OR "Proportional ventilation" OR "Pressure support" OR "Work of Breathing" OR "Oxygen Consumption" OR "Ventilatory setting" OR "Oxygen consumption" OR "Work efficiency" OR "Neurally adjusted ventilatory assist" OR "Proportional assisted ventilation" OR "Proportional modes" OR "Assisted modes" OR "Assisted mechanical ventilation") AND ("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities") **Limits:** from inception to present **Language filters:** English and Spanish	**275**
Rehabilitation & Sports Medicine (November 15, 2019)	("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units") AND ("Respiration, Artificial" OR "Noninvasive Ventilation" OR "Ventilatory support" OR "Assisted mechanical ventilation" OR "Proportional ventilation" OR "Pressure support" OR "Work	**22**

Database (Date)	Search Terms	Results
	of Breathing" OR "Oxygen Consumption" OR “Ventilatory setting” OR “Oxygen consumption” OR “Work efficiency” OR “Neurally adjusted ventilatory assist” OR “Proportional assisted ventilation” OR "Proportional modes" OR "Assisted modes" OR “Assisted mechanical ventilation”) AND ("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR “Physical activity” OR “Early mobilization” OR “Early mobility” OR "Rehabilitation" OR "Physical Therapy Modalities") **Limits:** from inception to present **Language filters:** English and Spanish	
Cochrane (November 18, 2019)	"Respiration, Artificial" OR "Noninvasive Ventilation" OR “Ventilatory support” OR “Assisted mechanical ventilation” OR “Proportional ventilation” OR “Pressure support” OR "Work of Breathing" OR "Oxygen Consumption"	**10**
PEDro (November 14, 2019)	Early mobilization AND mechanical ventilation	15
ClinicalTrials.gov (November 14, 2019)	("Physical Therapy Modalities") AND (“assisted mechanical ventilation” OR "Respiration, Artificial" OR "Critical Illness" OR “critically ill patients” OR “mechanically ventilated patients” OR "Intensive Care Units" OR “ventilatory support”) **Limits:** from inception to present **Language filters:** English and Spanish	44
Epistemónikos (November 21, 2019)	(title:((title: ("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units") OR abstract:("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units")) AND (title:("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities" OR "Physiotherapy") OR abstract:("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities" OR "Physiotherapy"))) OR abstract:((title:("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units") OR abstract:("Critical Illness" OR "Critically ill patients" OR "Mechanically ventilated patients" OR "Intensive Care Units")) AND (title:("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities" OR "Physiotherapy") OR abstract:("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR "Physical activity" OR "Early mobilization" OR "Early mobility" OR "Rehabilitation" OR "Physical Therapy Modalities" OR "Physiotherapy")))) **Limits:** from inception to present **Language filters:** No filters	**147**
Scielo Citation Index (November 18, 2019)	("Critical Illness" OR “Critically ill patients” OR “Mechanically ventilated patients” OR "Intensive Care Units") AND TEMA: ("Respiration, Artificial" OR "Noninvasive Ventilation" OR “Ventilatory support” OR “Assisted mechanical ventilation” OR “Proportional ventilation” OR “Pressure support” OR "Work of Breathing" OR "Oxygen Consumption" OR “Ventilatory setting”	**13**

Database (Date)	Search Terms	Results
	OR “Oxygen consumption” OR “Work efficiency” OR “Neurally adjusted ventilatory assist” OR “Proportional assisted ventilation” OR "Proportional modes" OR "Assisted modes" OR “Assisted mechanical ventilation”) AND TEMA: ("Exercise" OR "Exercise Tolerance" OR "Early Ambulation" OR “Physical activity” OR “Early mobilization” OR “Early mobility” OR "Rehabilitation" OR "Physical Therapy Modalities") **Limits:** from inception to present **Language filters:** No filters (Results in English and Spanish)	
Hand Search (November 18, 2019)	Screening of the reference lists of the relevant articles identified in the final search and selection the eligible titles	**25**

Table S3. Early mobilization interventions and equipment included [a]

Intervention	Assistive equipment and technology	n = 35, *n* (%)
Leg cycling (1–15)		15 (43)
	MOTOmed Letto 2, RECK-Technik	8 (23)
	Flexmotor, Cajumoro	4 (11)
	RT-300 supine cycle, Restorative Therapies	1 (3)
	Thera-Vital	1 (3)
	Not specified	2 (6)
Progressive mobility [b] (9, 15–27)		14 (40)
In-bed passive exercise [b] (4, 10, 14–16, 22, 25, 26, 28)		9 (26)
Walking [b] (15–20, 25, 26)		8 (23)
In-bed active exercise [b] (4, 14, 15, 25, 26, 29)		6 (17)
NMES (10, 25, 29–31)		5 (14)
	COMPEX device, MI theta PRO	1 (3)
	Neurodyn II, Ibramed	1 (3)
	Not specified	3 (9)
Tilt-table [b] (15, 22, 23, 32)		4 (11)
Arm cycling (15, 33, 34)		3 (9)
	MOTOmed Letto 2, RECK-Technik	1 (3)
	Active Passive Train, Tzora	1 (3)
	Not specified	1 (3)
FES-cycling (10)		1 (3)
	RehaMove, Hasomed	1 (3)
Whole-body vibration (35)		1 (3)
	Promedi, Vibrosphere and Galileo, home-ICU	1 (3)

[a] Each of the 35 documents reported 1 or more early mobilization intervention.

[b] No assistive equipment and technology was used or specified for this intervention.

NMES = Neuromuscular electrical stimulation, FES = functional electrical stimulation.

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Table S4. Summary of the 35 included documents

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
Silva, 2020 (1)	Observational study	8	8.3 ± 2.6 [b]; 53.3 ± 8.3 [e]	Leg cycling	Flexmotor, Cajumoro	PCV and no change ventilatory parameters during early mobilization	Servo S/Maquet	RR, Vt, SpO_2 and asynchrony index	The asynchrony index increased during exercise (median 32.1%), compared to baseline (median 6.6%), returning to initial levels during the recovery period (median 2.7%)	Multiparameter monitor: DX 2020 monitor, Dixtal Biomédica, Brazil	Safety
Black, 2020 (2)	Observational study	26	9 (2-14) [b]	Progressive mobility and walking	Not specified	PS level adjustment	Not specified	RR, VE, VO_2, VCO_2 and RER	There was considerable variation in the VO_2 of the physical activities between participants. The recovery time for 1 in 4 rehabilitation sessions was longer than the rehabilitation activity time	Indirect calorimeter: Medgraphics Ultima (MGU)	Physiological response
Nydahl, 2019 (3)	Observational study	66	5.6±1.6 [b]	Progressive mobility	Not specified	Assisted mode	Engström/Carestation GE Healthcare	EE	Active transfer to a chair showed higher differences of caloric consumption (n=12, mean 217.5 Kcal/d) than passive transfer without standing (n=5, mean 161.5 Kcal/d), however, the difference is not significant. A typical sequence of progressive mobility, would require an additional 4.56 Kcal compared to caloric consumption without mobility	Indirect calorimeter: COV-X, ESCOV-X or ventilation system Engstrom Carestation (attached or included in the ventilation circuit)	Physiological response
Rebel, 2019 (4)	Observational study	119	21.4±7.7	Progressive mobility, PROM and Tilt-table	Not specified	Not specified	Not specified	SpO_2 and RR	Patients who were more likely to experience an adverse event were those with higher SpO_2 (OR=1.83, 95% CI=1.11 to 3.10), and with lower RR (OR=1.03)	Not specified	Safety
Santos, 2019 (5)	Clinical trial (Randomized controlled trial)	30	CG: 22.6±4.2, IC: 22.7±8.4	Leg cycling	Flexmotor, Cajumoro	VCV and Vt	Not specified	RR	There were no differences for the RR measured before, soon after the end of the protocol, and at 10 and 30min after the application of passive cycling and in the CG	Not specified	Physiological response
Sommers, 2019 (6)	Observational study	37	73 (60–104) [c]	Leg cycling	MOTOmed Letto 2	Not specified	Not specified	RR, SpO_2, RER, VO_2, and VCO_2	During peak exercise in the active cycling test, the median RR, VO_2, and VCO_2 increased significantly, from 20 to 24 breaths/min ($p<001$); the VO_2 increased from 291to 384 mL/min; and the VCO_2 increased from 217 to 279 mL/min ($p<.001$).	Indirect calorimeter: Quark RMR ICU, COSMED, The Metabolic Company	Physiological response

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
									There was no change in the RER		
de Beer, 2018 (7)	Observational study	30	Not specified	Arm cycling	MOTOmed Letto 2	Not specified	Avea and Vela/ Carefusion	RSBI	RSBI 38.0 (25.0 to 65.0) prior to the tests.	None	Safety
Eggmann, 2018 (8)	Clinical trial (Randomized controlled trial)	107	CG: 23±7, IG: 22±8	Leg cycling and Progressive mobility	MOTOmed Letto 2	Not specified	Not specified	VO_2 and SpO_2	VO_2 had significant differences ($p<0.013$) before, during and after the intervention between the IG and the CG (approximate values at 300-325 mL/min). There were no differences for SpO_2.	Not specified	Physiological response
Lago, 2018 (9)	Study protocol	N/A	N/A	NMES	Neurodyn II, Ibramed	Not specified	Evita XL/Dräger	EE, VO_2, VCO_2, RR and SpO_2	N/A (Study protocol)	Indirect calorimeter: DELTATRAC II Metabolic Monitor, Datex-Ohmeda, Helsinki, Finland	Physiological response
Medrinal, 2018 (10)	Cross-over study	19	57.5±24 [d]	PROM, Leg cycling, NMES and FES-cycling	MOTOmed Letto 2 and RehaMove. There is no information about the NMES device used.	PSV mode, PS level, PEEP and FiO2	ICU ventilator	HbO_2, HHb, RR and Vt	RR was significantly higher during FES-cycling than during PROM and quadriceps NMES (respectively, 24 c/min vs. 20 c/min ($p<0.001$) vs. 21 c/min ($p=0.005$)). There was no difference for Vt. HbO_2 decreased significantly by 13% (95% CI − 31.8 to − 4.7) during FES-cycling.	Not specified	Physiological response
Ringdal, 2018 (11)	Observational study	6	Not specified	Leg cycling	Not specified	Not specified	Not specified	SpO_2 and RR	The maximum changes in physiological parameters in the group monitored during IBC were: RR -7 to +11 breaths per minutes and SpO_2 -3 to +4%.	Not specified	Safety
Sommers, 2018 (12)	Observational study	9	17.5 (14–21)	Leg cycling	MOTOmed Letto 2	Not specified	Not specified	SpO_2 and RR	Not specified.	Not specified	Safety
Akar, 2017 (13)	Clinical trial (Randomized trial)	30	Not specified	AROM and NMES	COMPEX device, MI theta PRO	Not specified	Not specified	RR	RR decrease in time to move from bed to chair in the group treated additionally with NMES	Not specified	Safety
Akoumianaki, 2017 (14)	Cross-over study	10	21 (16.5–27.3)	Leg cycling	MOTOmed Letto 2	PSV, PAV, NAVA, PS level, inspiratory flow triggering, cycling off and FiO2	Servo I/Maquet and Puritan Bennett 840/Covidien	VO_2, Vt, VE, SpO_2, RR and asynchrony index	Despite a difference in baseline VO_2, the patients ventilated with PSV exhibited a significant increase in VO_2 during exercise (ΔVO2 77.6 mL/min, 59.9–96.5) while VO_2 did not change compared to baseline value during exercise with PAV or NAVA (ΔVO_2 46.3 mL/min, 5.7–	Indirect calorimeter: Quark RMR ICU, COSMED, Rome, Italy. Pneumotachograph: Fleish No. 2; Metabo; Epalinges, Switzerland.	Physiological response

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
						adjustment			63.7) ($p < 0.05$). As a result, PAV or NAVA were associated with a better work efficiency ($\Delta VO2/Wmean$) than PSV.		
Beach, 2017 (15)	Observational study	47	23.0±7.5	Progressive mobility and Tilt-table	Not specified	Not specified	Not specified	EE	The mean difference in measures of REE of 79.9 kcal (favouring indirect calorimetry) with 95% of the differences falling between−722.1 and 881.9 kcal.	Indirect calorimeter: DELTATRAC II Metabolic Monitor, Datex-Ohmeda, Helsinki, Finland	Physiological response
Machado, 2017 (16)	Clinical trial (Randomized clinical trial)	38	CG: 18.1±6.4, IG: 17.3±6.7	Leg cycling, PROM and AROM	MOTOmed Letto 2	Not specified	Not specified	SpO_2	SpO_2 were measured but the results of these variables are not specified.	Multiparameter monitor: DX 2022; Dixtal Biomédica, Manaus, Brazil	Safety
Wollersheim, 2017 (17)	Clinical trial (Pilot interventional study)	19	53 (35–78) [d]	Whole-body vibration (WBV)	Promedi, Vibrosphere and Galileo, home-ICU	Not specified	Not specified	EE, VO_2, VCO_2, SpO_2 and RR	There was an increase EE only during WBV. Comparing the WBV period with the baseline, VO_2 were significantly increased ($p=0.012$) and VCO2 was enhanced ($p<0.001$), showing increased EE ($p=0.007$). Physiotherapy led to increase VCO_2 ($p=0.041$) but not to increased VO_2 or EE. Physiotherapy ($p<0.01$) and WBV ($p<0.001$) increased the RR significantly compared with baseline. The RQ increase significant during physiotherapy ($p=0.033$), which is caused by increased VCO_2. SpO_2 did not differ significantly from baseline, interventions and resting periods.	Multiparameter monitor: Intellivue, MP30, Phillips. Indirect calorimeter: DELTATRAC II Metabolic Monitor, Datex-Ohmeda, Helsinki, Finland.	Physiological response
Hickmann, 2016 (18)	Observational study	171	18±7	Leg cycling, Arm cycling, Progressive mobility, Walking, PROM, AROM and Tilt-table	Not specified	VCV, PCV and PSV	Not specified	SpO_2 and RR	RR and SpO_2 variations observed immediately after active exercises like walking, cycling, or manual mobilization were not clinically significant, returning to baseline values after 15 min.	Not specified	Physiological response
Kho, 2016 (19)	Observational study	33	24.3±6.7	Leg cycling	RT-300 supine cycle	FiO2 adjustment	Not specified	SpO_2 and asynchrony	There no was differences in the pre and post SpO_2 (95.6% to 95.3%).	Not specified	Safety
Maia Coutinho,	Clinical trial (Randomized	25	CG: 23,6±7,6, IG: 27,8±4,9	Leg cycling, PROM and	Flexmotor, Cajumoro	Not specified	Servo I/Maquet	RR and Vt	There were no significant differences for Vt and RR from pre	ICU multi-parametric monitor: Infinity Kappa,	Physiological response

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
2016 (20)	clinical trial)			AROM			and Evita 4/Dräger		to post intervention for the IG (Vt: 455 to 431; RR: 21,7 to 20,3) and CG (Vt: 506 to 537; RR: 18,8 to 20,2).	Dräger, Germany	
Chen, 2015 (21)	Observational study	15	Not specified	Arm cycling	Active Passive Train, Tzora	PSV mode and PS level adjustment	Not specified	SpO_2 and RR	No significant differences among the three PS levels in the changes of RR and SpO_2 at the end of the exercise test were observed.	Multiparameter monitor: Philips Medizin System GmbH 71034, Böblingen, Germany	Physiological response
Collings, 2015 (22)	Cross-over study	10	Arm A: 16.8 (15.04–26.16), Arm B: 20.6 (12.86–20.74)	Progressive mobility	Not specified	Assisted mode	Engström Elvira/Carestation GE Healthcare	VO_2, VCO_2, RR, Vt, VE	SOEOB was associated with a significant increase in VO_2 in comparison to PCT. During SOEOB, VO_2 increasing from 262.33 to 353.02 mL/min (p=0.002) and VCO_2 increasing from 171.93 to 206.23 mL/min (p=0.026). PCT elicited a minimal increase in VO_2, VCO_2 and VE suggesting a low metabolic demand.	Indirect calorimeter: CCOX module via the Engström Elvira ventilator	Physiological response
Ko, 2015 (23)	Observational study	8	Not specified	Progressive mobility, Walking, PROM, AROM and NMES	Not specified	FiO2 adjustment, ECMO blood and sweep gas flow adjustment	Not specified	SpO_2, RR, and ECMO blood flow	The blood flow rate of ECMO was higher during PT than before PT (paired t; p = 0.013). RR was 21.2±1.2 (NMES and PROM) 26.3±6.3 (sitting) 34±4.2 (Strengthening), 30.9±0.9 (standing or marching in place) and 28 (walking).	Not specified	Safety
Rialp, 2015 (24)	Study protocol	N/A	N/A	Leg cycling	MOTOmed Letto 2	Not specified	Not specified	SpO_2 and RR	N/A (Study protocol)	Not specified	Safety
Genc, 2014 (25)	Observational study	120	Not specified	PROM	Not specified	PCV, PRVC, PSV, and SIMV modes	Not specified	SpO_2 and RR	In the patients who did not receive vasopressor/inotropic support (group 1), SpO_2 increased significantly (P <0.05). In group 2, SpO_2 increased significantly after PLEs.	Patient-monitoring equipment: Dräger Medical Systems, Inc, Telford, Pennsylvania	Physiological response
Hickmann, 2014 (26)	Observational study	49	15±7, 16±4 and 22±6	Leg cycling	MOTOmed Letto 2 and Thera-Vital	PSV mode	Not specified	EE, RQ, VO_2 and VCO_2	Exercise-induced changes in VO_2 and EE differed significantly between patients (Pat) and healthy volunteers (Ctrl) at 3W and were close to significance at 6W: increment in VO_2 (mL/min) in Pat-3W vs Ctrl-3W was from 297 to 400 vs 268 to 343 (p=0.04).	Indirect calorimeter: DELTATRAC II Metabolic Monitor, Datex-Ohmeda, Helsinki, Finland	Physiological response

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
									Expressed in EE (kcal/24 h), this increment was from 2,006 to 2,710 vs 1,817 to 2,308 (p=0.04) for the same population. In Pat-6W vs Ctrl-6W, VO2 increment was from 281 to 425 vs 243 to 360 (p=0.20) and 1,900 to 2,891 vs 1,651 to 2,465 (p=0.23) when expressed in EE (kcal/24 h).		
Camargo Pires-Neto, 2013 (27)	Observational study	18	58±13 [e]	Leg cycling	Flexmotor, Cajumoro	VCV and PCV; and no change ventilatory parameters during early mobilization	Engström/Carestation GE Healthcare	VO_2, VCO_2, $EtCO_2$, RR, Vt and SpO_2	RR and Vt (mean RR rest level = 23/min and mean Vt rest level = 350 mL) did not change during exercise and recovery. Metabolic parameters did not change during exercise and recovery. The VO_2 rest value was 185.7 mL/min with no mean change during exercise (-9% to 21%) and 2% after recovery (-25% to 31%; NS). The VCO_2 rest value was 168.5 mL/min with a mean increase of 5% during exercise (-30% to 21%) and 1% after recovery (-24% to 31%; NS). The $EtCO_2$ rest value was 32.8 mmHg with a mean change of 0.9% during exercise (-4% to 5%) and after recovery (-8% to 3%; NS)	Indirect calorimeter: GE-Engstrom Carestation, CT, USA	Physiological response
Mah, 2013 (28)	Clinical trial (Quazi-experimental trial)	28	CG: 26.2±5, IC: 26.9±4.5	Progressive mobility, Walking, PROM and AROM	Not specified	VCV and PSV mode; FiO2 and PS level adjustment	Not specified	None	None	Not specified	N/A
Chang, 2011 (29)	Clinical trial (Randomized controlled study)	36	CG: 14.6±7.6, IG: 17.3±8.3	Progressive mobility	Not specified	VCV and PCV mode; and PEEP	Puritan Bennett 840/Covidien	SpO_2, RR, Vt, and RSBI	Before the treatment on day 1, there were no significant differences in RR, Vt, RSBI, SpO_2 and between the 2 groups.	Patient Monitor: Intellivue, Phillips Medizin System, Boeblingen, Germany	Physiological response
Pohlman, 2010 (30)	Observational study	49	20 (15.8–24)	Progressive mobility, Walking and PROM	Not specified	No change ventilatory parameters during early mobilization	Transport ventilator	SpO_2 and RR	SpO_2 and RR were measured but the results of these variables are not specified.	Not specified	Safety
Gerovasili,	Observational	35	CG: 14±8,	NMES	Not specified	VCV mode	Not	StO_2, RR and	The mean StO_2 did not differ	Sto2: InSpectra,	Physiological

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
2009 (31)	study		IG: 17±5			and PSV mode	specified	SpO_2	significantly before and after the NMES session (81±16% vs 83±16%, respectively). The StO_2 value did not differ between the two measurements in control patients. The RR increased by 1 breath/min after the NMES session (mean RR, 18±6 breaths/min vs 19±7 breaths/min, respectively), although it did not reach statistical significance (p>0.05).	Hutchinson Technology, Hutchinson, MN and InSpectra, version 2.0, for Windows running in MatLab, version 7.0, MathWorks, Inc; Natick, MA)	response
Perme, 2008 (32)	Narrative Review	N/A	N/A	Progressive mobility and Walking	Not specified	Not specified	Not specified	RR	N/A (Narrative review)	N/A	Safety
Bailey, 2007 (33)	Observational study	103	21±6.3	Progressive mobility and Walking	Not specified	A/C mode and FiO2 adjustment	Not specified	SpO_2	SpO_2 were measured but the results of these variables are not specified.	Not specified	Safety
Chang, 2004 (34)	Observational study	15	4 (4–7) [b]	Tilt-table	Not specified	FiO2 adjustment	Not specified	RR, Vt and VE	Standing in the tilted position for 5 minutes produced significant increases in VE (P<0.001) and produced both increases in respiratory rate (P<0.001) and VT (P<0.016) compared with baseline levels. These changes were maintained during the tilt intervention and immediately post tilt. Twenty minutes after the tilt, there were no significant changes in ventilatory measures of Vm, Vt, compared with initial values.	Portable respiratory mechanics monitor: Ventrak, model 1550	Physiological response
Zafiropoulos, 2004 (35)	Observational study	15	Not specified	Progressive mobility and Walking	Not specified	FiO2 adjustment	Not specified	RR, Vt, VE, Ti, Te and SpO_2	Standing resulted in significant increases in VE from 15.1±3.1 l/min in supine to 21.3±3.6 l/min in standing (p<0.001). The increase in VE in standing was achieved by significant increases in Vt from 712.7±172.8 ml to 883.4±196.3 ml (p=0.008) and in RR from 21.4±5.0 breaths/min to 24.9±4.5 breaths/min (p=0.03). No further increases were observed in these parameters beyond standing when	Pneumotachograph: Model 3813 Hans Rudolph Inc., Kansas, USA Patient Monitor: Spacelabs Inc., 90600A Series Monitor, Washington USA	Physiological response

Author, Year	Study design	Study sample	APACHE II [a]	Early mobilization intervention(s)	Assistive rehabilitation equipment and technology	Ventilatory mode and respiratory parameter	Mechanical ventilator(s)	Metabolic and respiratory real-time variables	Main results of the metabolic and respiratory variables on early mobilization	Device(s) to assess metabolic/respiratory variables (other than ventilator)	Reason to measure variables
									activity was progressed to walking on the spot for one minute. There was no change in the SpO_2.		

APACHE II = Acute Physiology and Chronic Health Evaluation II, CG = control group, IG = intervention group, N/A = not applicable, NMES = Neuromuscular electrical stimulation, PROM = in-bed passive exercise, AROM = In-bed active exercise, FES = functional electrical stimulation, A/C = assist control mode, PAV = Proportional assist ventilation, NAVA = Neurally adjusted ventilatory assist, VCV = volume-controlled ventilation, PCV = pressure-controlled ventilation, PRVC = pressure-regulated volume control ventilation, SIMV = synchronized intermittent mandatory ventilation, PSV = pressure support ventilation, PS = pressure support, PEEP = Positive end-expiratory pressure, FiO2 = fraction of inspired oxygen, ECMO = extracorporeal membrane oxygenation, EM = early mobilization, GE = General Electric, ICU = intensive care unit, EE = energy expenditure, RR = respiratory rate, VO_2 = oxygen consumption, VCO_2 = carbon dioxide of production, $EtCO_2$ = end-tidal carbon dioxide, RER = respiratory exchange ratio, Vt = tidal volume, W = watts, SpO_2 = pulse oximetry saturation, Sto2 = tissue oxygen saturation, REE = resting energy expenditure, WBW = whole-body vibration, RQ = respiratory quotient, SOEOB = sitting on the edge of the bed, PCT = passive chair transfer, VE = minute ventilation, PLEs = passive limb exercises, Kcal = kilocalorie, RSBI = rapid shallow breathing index, PT = physical therapy, HbO_2 = oxyhaemoglobin, HHb = deoxyhaemoglobin.

[a] APACHE II scores are shown as mean±SD or median (IQR) according to each study

[b] Sequential Organ Failure Assessment (SOFA)

[c] APACHE IV

[d] Simplified Acute Physiology Score II (SAPS II)

[e] Simplified Acute Physiology Score II (SAPS III)

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