Determinants influencing use of lower tidal volumes, lower inspiratory pressures, and prone positioning in ARDS: A systematic review

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Additional File 2: Determinants influencing implementation of lower tidal volumes and lower inspiratory pressures in patients with ARDS and prone positioning in severe ARDS listed by CFIR domain and construct.

CFIR Domain	CFIR Construct	Determinant
Intervention Characteristics	Complexity	Ease of ensuring a patient is receiving LPV
Intervention Characteristics	Complexity	Ease of ordering and initiating LPV
Intervention Characteristics	Complexity	Not recognizing or diagnosing ARDS is associated with LPV underuse
Intervention Characteristics	Complexity	Not recognizing or diagnosing ARDS is associated with PP underuse
Intervention Characteristics	Complexity	Ease of obtaining information to make a diagnosis of ARDS
Intervention Characteristics	Complexity	Delays in receiving information needed to make the diagnosis of ARDS impedes diagnosis
Intervention Characteristics	Complexity	Clinician documentation of an interpretation of a chest x-ray is associated with LPV use
Intervention Characteristics	Complexity	Clinician documentation of an arterial blood gas in the electronic medical record is associated with LPV use
Intervention Characteristics	Complexity	Physician documentation of the diagnosis of ARDS is associated with LPV use
Intervention Characteristics	Complexity	A higher tidal volume is associated with a clinical diagnosis of ARDS
Intervention Characteristics	Relative Advantage	Physician preference of "pressure-oriented" mode of ventilation impedes LPV
Intervention Characteristics	Relative Advantage	Clinician selection a target static pressure over a target tidal volume
Intervention Characteristics	Relative Advantage	Physician selection of pressure-regulated volume controlled ventilation impedes LPV
Outer Setting	No construct assigned	Geo-economic country status is associated with LPV use
Outer Setting	No construct assigned	Geo-economic country status is associated with PP use
Inner Setting	1. Networks and Communications 2. Culture	ICU team discusses tidal volumes in mL/kg predicted body weight during rounds for patients with ARDS
Inner Setting	1. Networks and Communications 2. Culture	ICU team discusses airway pressures during rounds for patients with ARDS
Inner Setting	Networks and Communication	Staff intensivist transition of care did not effect compliance with LPV
Inner Setting	Culture	Higher monitoring intensity evaluated by the PV-MIISS score had a negative association with compliance with LPV
Inner Setting	Culture	LPV is more likely to be administered to a patient admitted to medical ICU compared to a cardiac, neurological, trauma/surgical, or burn ICU
Inner Setting	Culture	Non-volume controlled mode of ventilation is associated with LPV underuse
Inner Setting	Readiness for Implementation	An electronic paged alert aiding ARDS recognition decreased the time of potentially injurious ventilation
Inner Setting	Readiness for Implementation	A teleintensive care unit-directed ventilator rounds using a checklist improved LPV adherence
Inner Setting	Readiness for Implementation	Tools to assess patient discomfort helped with LPV adherence
Inner Setting	Readiness for Implementation->Access to Knowledge and Information	Use of a protocol aids in LPV implementation
Inner Setting	Readiness for Implementation->Access to Knowledge and Information	Combined staff training and a treatment bundle did not lead to lower tidal volume use
Inner Setting	Readiness for Implementation->Access to Knowledge and Information	ICU leadership support of adequate education about mechanical ventilation for patients with ARDS
Inner Setting	Readiness for Implementation->Access to Knowledge and Information	Use of a protocol aids in PP implementation

Inner Setting	Structural Characteristics	Intensivist staffing was associated with more PP for patients with ARDS
Inner Setting	Structural Characteristics	The ratio of nursing and respiratory therapists to patients was associated with LPV use
Inner Setting	Structural Characteristics	The number of ICU beds was associated with PP for patients with ARDS
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception of hypoxia severity
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception of applicability of evidence to their patient population
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception that a patient is too sick for LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception that care provided by physicians is more labor intensive with LPV compared to other modes of mechanical ventilation
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception that care provided by non-physician staff (e.g. RN, RT) is more labor intensive with LPV compared with other modes of mechanical ventilation
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception of other ICU staff awareness of LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception of physician knowledge of the use of LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception that “sometimes it may be too late” for LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception of need to convince or teach other ICU members to use LPV
Characteristics of Individuals	Knowledge and Beliefs	Respiratory therapist or nurse discomfort with LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician discomfort with using LPV unless certain of ARDS diagnosis
Characteristics of Individuals	Knowledge and Beliefs	Clinician belief or perception that the patient has a contraindication to LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician feedback and education aids in LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician knowledge of ventilator equipment needed to achieve LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician knowledge of ventilator settings needed to achieve LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician knowledge of the target parameters for LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician knowledge of benefits of LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician concern about sedation requirement impeded LPV
Characteristics of Individuals	Knowledge and Beliefs	Clinician perception that patients require more sedation with LPV compared with other ventilation practices
Characteristics of Individuals	Knowledge and Beliefs	Clinician concern about patient discomfort (e.g. tachypnea) impeded LPV use
Characteristics of Individuals	Knowledge and Beliefs	Clinician concerns about patient safety related to hypercapnea, acidosis and hypoxia impeded LPV use
Characteristics of Individuals	Knowledge and Beliefs	Clinician concerns over patient safety with LPV
Characteristics of Individuals	Other personal attributes	Clinicians with a higher level of training were more likely to select LPV
Characteristics of Individuals	Other personal attributes	RT unwilling to relinquish control impeded LPV
Characteristics of Individuals	Other personal attributes	Physician unwillingness to relinquish control of the ventilator to a protocol impeded LPV
Process	Executing	Incorrect calculation of tidal volume based on absolute body weight or dry weight impeded LPV use
Process	Executing	Implementation failure of ordered or documented LPV
Process	Executing	Duration of elapsed time from ordering LPV to patient receiving it
1. Characteristics of Individuals 2. Intervention Characteristics	1. Knowledge and Beliefs 2. Complexity	Clinician lack of comfort and/or familiarity regarding patient-ventilator interactions to achieve LPV
1. Characteristics of Individuals 2. Intervention Characteristics	1. Knowledge and Beliefs 2. Complexity	Clinician knowledge of appropriate ventilator changes based on patient factors
1. Characteristics of Individuals 2. Intervention Characteristics	1. Knowledge and Beliefs 2. Evidence Strength and Quality	Clinician belief that evidence supports a benefit of LPV for patients with ARDS
Patient Factors	Dynamic Patient Attributes	Duration of elapsed time of illness affects LPV use
Patient Factors	Dynamic Patient Attributes	Higher APACHE II is associated with increased LPV use
Patient Factors	Dynamic Patient Attributes	Lower SAPS II score is associated with LPV underuse
Patient Factors	Dynamic Patient Attributes	Rapid change in clinical status is associated with LPV underuse
Patient Factors	Dynamic Patient Attributes	Lower PaO2 is associated with increased LPV use

Patient Factors	Dynamic Patient Attributes	Lower P:F associated with increased LPV use
Patient Factors	Dynamic Patient Attributes	Higher FiO2 associated with increased LPV use
Patient Factors	Dynamic Patient Attributes	Lower inspiratory pressure associated with severity of hypoxia
Patient Factors	Dynamic Patient Attributes	Lower plateau pressure is associated with LPV use
Patient Factors	Dynamic Patient Attributes	Higher plateau pressure is associated with LPV use
Patient Factors	Dynamic Patient Attributes	Lower static compliance is associated with LPV use
Patient Factors	Dynamic Patient Attributes	Lower radiographic lung injury score is associated with LPV underuse and an increasing lung injury score is associated with LPV use
Patient Factors	Dynamic Patient Attributes	Serum bicarbonate is associated with LPV use
Patient Factors	Dynamic Patient Attributes	RASS associated with LPV adherence
Patient Factors	Dynamic Patient Attributes	Muscle relaxant use associated with LPV adherence
Patient Factors	Static Patient Attributes	Sepsis more commonly associated with LPV use
Patient Factors	Static Patient Attributes	Pneumonia more commonly associated with LPV use
Patient Factors	Static Patient Attributes	Younger age is associated with LPV use
Patient Factors	Static Patient Attributes	Male sex is associated with LPV use while female sex is associated with LPV underuse
Patient Factors	Static Patient Attributes	Shorter stature is associated with LPV underuse
Patient Factors	Static Patient Attributes	Charlson Comorbidities Index is associated with LPV use
Patient Factors	Static Patient Attributes	White race is associated with LPV underuse
Patient Factors	Static Patient Attributes	Female sex is associated with higher plateau pressure
Patient Factors	Static Patient Attributes	Female sex is associated with LPV underuse

Table Legend:

APACHE II=Acute Physiology and Chronic Health Evaluation II; ARDS=Acute Respiratory Distress Syndrome; CFIR=Consolidated Framework for Implementation Science Research; FiO2=Fraction of inspired oxygen; ICU=Intensive Care Unit; LPV=Lung Protective Ventilation; PaO2=Partial pressure of oxygen; P:F=Partial pressure of oxygen/fraction of inspired oxygen; PP=Prone Positioning; PV-MIISS= Patient Ventilator Monitoring Intervention Intensity Scoring System; RASS=Richmond agitation-sedation score; RN=Registered nurse; RT=respiratory therapist; SAPS II=Simplified Acute Physiology Score II