

METHODS

Search Strategy

A literature search was conducted using the PubMed, CINAHL via EBSCOhost, and Scopus.com databases for studies on oxygen therapy in pediatric patients. The search strategies used a combination of relevant controlled vocabulary (i.e., Medical Subject Headings and CINAHL Headings) and keyword variations that related to oxygen therapy, oxygenation techniques, pediatrics, and outcomes. The searches were limited to English language studies about human populations. The searches were also designed to filter out citations indexed as commentaries, editorials, interviews, news, or reviews. No date restrictions were applied to the searches. Refer to the online supplemental material for the complete search strategy executed in each database on January 10, 2020. Cited reference searching was completed for all included studies as well as for studies that were topically relevant but excluded based on study design. Duplicate citations were identified and removed using the EndNote X8 citation management software.

Study Selection

Two reviewers independently assessed study eligibility in the Covidence systematic review software. Inclusion criteria used to assess eligibility were: 1) oxygen therapy; 2) pediatric population, including neonates, infants, and children; and 3) clinical outcomes. The exclusion criteria used were: 1) not oxygen therapy; 2) adult population; 3) preterm newborn; 4) no clinical outcomes relevant to oxygen therapy; 5) not empirical research (e.g., theory, opinion, or review articles); and 6) published prior to 1987.

RESULTS

The search strategies retrieved a total of 3,312 articles. After removal of duplicates, 2,702 articles remained for screening. Through cited reference searching, 1,450 titles were screened and 2 relevant articles not previously retrieved were added to the project. In the title and abstract screening phase, 2,539 articles were excluded. Of the remaining 165 articles, 152 were excluded following full text review against the inclusion and exclusion criteria.

Online Supplemental Material

Search Strategies by Database

PubMed

- #1 "Pediatrics"[Mesh] OR "Hospitals, Pediatric"[Mesh] OR Pediatric[tw] OR pediatrics[tw] OR paediatric[tw] OR paediatrics[tw] OR "Infant"[Mesh] OR "Infant, Newborn"[Mesh] OR "Infant, Premature"[Mesh] OR "Child, Preschool"[Mesh] OR "Child"[Mesh] OR Infant[tw] OR infants[tw] OR newborn[tw] OR newborns[tw] OR premature[tw] OR preterm[tw] OR neonate[tw] OR neonatal[tw] OR toddler[tw] OR toddlers[tw] OR child[tw] OR children[tw] OR kid[tw] OR kids[tw] OR girl[tw] OR girls[tw] OR boy[tw] OR boys[tw]
- #2 Hypoxemia[tw] OR hypoxaemia[tw] OR "Hypoxia"[Mesh] OR anoxia[tw] OR anoxemia[tw] OR hypoxia[tw] OR hypoxic[tw] OR ((Deficiency[tw] OR deficiencies[tw] OR low) AND (oxygen[tw] OR O2[tw] OR PaO2[tw] OR pO2[tw] OR "Oxygen"[Mesh])) OR ((("carbon dioxide"[tw] OR CO2[tw] OR PaCO2[tw] OR pCO2[tw]) AND (retention[tw] OR retained[tw] OR retaining[tw] OR retain[tw]))) OR ((("cardiac arrest"[tw] OR "cardiac arrests"[tw] OR "heart arrest"[tw] OR "heart arrests"[tw] OR "cardiopulmonary arrest"[tw] OR "cardiopulmonary arrests"[tw] OR asystole[tw] OR asystoles[tw] OR "Heart Arrest"[Mesh] OR "Brain Injuries, Traumatic"[Mesh] OR "traumatic brain injury"[tw] OR "traumatic brain injuries"[tw] OR "brain trauma"[tw] OR "brain traumas"[tw] OR TBI[tw] OR TBIs[tw] OR "traumatic encephalopathy"[tw] OR "traumatic encephalopathies"[tw] OR "Stroke"[Mesh] OR stroke[tw] OR strokes[tw] OR "brain ischemia"[tw] OR "intracranial hemorrhage"[tw] OR "intracranial hemorrhages"[tw] OR "cerebral hemorrhage"[tw] OR "cerebral hemorrhages"[tw] OR apoplexy[tw] OR neurological[tw] OR neurologic[tw] OR "Immunocompromised Host"[Mesh] OR Immunocompromised[tw] OR immunosuppressed[tw] OR immunosuppression[tw] OR ((impaired[tw] OR compromised[tw] OR suppressed[tw] OR deficiency[tw] OR deficiencies[tw] OR weak[tw] OR weakened[tw] OR low[tw]) AND ("immune system"[tw] OR "immune systems"[tw] OR "Immune System"[Mesh])) OR "Postoperative Period"[Mesh] OR postoperative[tw] OR "post-operative"[tw]) AND ("Critical Care"[Mesh] OR "critical care"[tw] OR "critically ill"[tw] OR "critical illness"[tw] OR "Critical Illness"[Mesh]))
- #3 "Supplemental oxygen"[tw] OR "oxygen therapy"[tw] OR "oxygen therapies"[tw] OR oxygenation[tw] OR "oxygen delivery"[tw] OR "oxygen target"[tw] OR "oxygen targets"[tw] OR "O2 target"[tw] OR "O2 targets"[tw] OR "oxygen level"[tw] OR "oxygen levels"[tw] OR FiO2[tw] OR "inspired oxygen fraction"[tw] OR "fractional inspired oxygen"[tw] OR "oxygen saturation"[tw] OR "O2 saturation"[tw] OR "Oxygen/Therapy"[Mesh] OR "Oxygen/Therapeutic Use"[Mesh] OR "Nasal cannula"[tw] OR "nasal cannulae"[tw] OR "Cannula"[Mesh] OR Oxymask[tw] OR "oxygen mask"[tw] OR "oxygen masks"[tw] OR HFNC[tw] OR HHFNC[tw] OR "simple mask"[tw] OR "simple masks"[tw] OR "RAM cannula"[tw] OR "RAM cannulae"[tw] OR "venturi mask"[tw] OR "venturi masks"[tw] OR "oxygen hood"[tw] OR "oxygen hoods"[tw] OR "tot huts"[tw] OR "tot hut"[tw] OR "care cube"[tw] OR "care cubes"[tw] OR "oxygen tent"[tw]

OR "oxygen tents"[tw] OR "non-rebreather mask"[tw] OR "non-rebreather masks"[tw] OR
"aerosol mask"[tw] OR "aerosol masks"[tw] OR "mist tent"[tw] OR "mist tents"[tw] OR
(oxygen[tw] AND (incubator[tw] OR incubators[tw] OR isolette[tw] OR isolettes[tw])) OR "low
flow oxygen delivery"[tw] OR "cool mist"[tw] OR "oxygen delivery device"[tw] OR "oxygen
delivery devices"[tw]

- #4 heated[tw] OR heat[tw] OR heating[tw] OR humidified[tw] OR humidity[tw] humidification[tw]
OR humidifier[tw] OR humidifiers[tw] OR "heat moisture exchanger"[tw] OR
"Humidifiers"[Mesh] OR "Bennett Cascade"[tw] OR "non-heated"[tw] OR nonheated[tw] OR
((Monitor[tw] OR monitoring[tw]) AND (continuous[tw] OR intermittent[tw] OR standard[tw] OR
timing[tw] OR time[tw] OR frequency[tw])) OR oximetry[tw] OR oximetries[tw] OR
"Oximetry"[Mesh] OR "oxygen monitoring"[tw] OR "oxygen monitor"[tw] OR "monitoring
oxygen"[tw] OR "monitor oxygen"[tw] OR "transcutaneous oxygen"[tw] OR SpO2[tw] OR "non-
invasive monitoring"[tw] OR "non-invasive monitor"[tw] OR "non-invasive monitors"[tw] OR
"noninvasive monitoring"[tw] OR "noninvasive monitor"[tw] OR "noninvasive monitors"[tw] OR
"saturation target"[tw] OR "saturation targets"[tw] OR "saturation targeting"[tw] OR "saturation
targeted"[tw] OR "target saturation"[tw] OR "oxygen saturation"[tw] OR "O2 saturation"[tw] OR
Aerosolized[tw] OR aerosol[tw] OR nebulizer[tw] OR nebulizers[tw] OR nebulized[tw] OR
"infection control"[tw] OR "infection prevention"[tw] OR "prevent infection"[tw] OR "control
infection"[tw] OR "Infection Control"[Mesh] OR feeding[tw] OR feed[tw] OR fed[tw] OR diet[tw]
OR diets[tw] OR nutrition[tw] OR "Diet"[Mesh] OR ((device[tw] OR devices[tw] OR cannula[tw]
OR cannulae[tw] OR mask[tw] OR masks[tw])) AND (selection[tw] OR selected[tw] OR select[tw]
OR selects[tw] OR selecting[tw] OR choose[tw] OR chose[tw] OR choosing[tw] OR chosen[tw] OR
choice[tw] OR choices[tw] OR option[tw] OR options[tw] OR decide[tw] OR decides[tw] OR
decided[tw] OR deciding[tw] OR decision[tw] OR Flow[tw] OR occlusive[tw] OR occlusion[tw] OR
fit[tw] OR fits[tw] OR fitted[tw] OR limit[tw] OR limits[tw])) OR Cost[tw] OR costs[tw] OR
economic[tw] OR economics[tw] OR financial[tw] OR financing[tw] OR financed[tw] OR
finance[tw] OR "Costs and Cost Analysis"[Mesh] OR price[tw] OR pricing[tw]
- #5 #1 AND #2 AND #3 AND #4
- #6 #5 NOT ("Animals"[Mesh] NOT "Humans"[Mesh])
- #7 #6 NOT (Comment[sb] OR Editorial[ptyp] OR Interview[ptyp] OR Letter[ptyp] OR News[ptyp] OR
Newspaper Article[ptyp] OR Review[ptyp])
- #9 #7 AND English[lang]

CINAHL via EBSCOhost

- S1 TI(Pediatric OR pediatrics OR paediatric OR paediatrics OR Infant OR infants OR newborn OR
newborns OR premature OR preterm OR neonate OR neonatal OR toddler OR toddlers OR child

OR children OR kid OR kids OR girl OR girls OR boy OR boys) OR AB(Pediatric OR pediatrics OR paediatric OR paediatrics OR Infant OR infants OR newborn OR newborns OR premature OR preterm OR neonate OR neonatal OR toddler OR toddlers OR child OR children OR kid OR kids OR girl OR girls OR boy OR boys) OR MH "Pediatrics" OR MH "Hospitals, Pediatric" OR MH "Infant+" OR MH "Infant, Newborn+" OR MH "Infant, Premature" OR MH "Child, Preschool" OR MH "Child+"

- S2 TI(Hypoxemia OR hypoxaemia OR anoxia OR anoxemia OR hypoxia OR hypoxic) OR AB(Hypoxemia OR hypoxaemia OR anoxia OR anoxemia OR hypoxia OR hypoxic) OR MH "Anoxia+" OR ((TI(Deficiency OR deficiencies OR low) OR AB(Deficiency OR deficiencies OR low)) AND (TI(oxygen OR O2 OR PaO2 OR pO2) OR AB(oxygen OR O2 OR PaO2 OR pO2) OR MH "Oxygen")) OR ((TI("carbon dioxide" OR CO2 OR PaCO2 OR pCO2) OR AB("carbon dioxide" OR CO2 OR PaCO2 OR pCO2)) AND (TI(retention OR retained OR retaining OR retain) OR AB(retention OR retained OR retaining OR retain))) OR ((TI("cardiac arrest" OR "cardiac arrests" OR "heart arrest" OR "heart arrests" OR "cardiopulmonary arrest" OR "cardiopulmonary arrests" OR asystole OR asystoles OR "traumatic brain injury" OR "traumatic brain injuries" OR "brain trauma" OR "brain traumas" OR TBI OR TBIs OR "traumatic encephalopathy" OR "traumatic encephalopathies" OR stroke OR strokes OR "brain ischemia" OR "intracranial hemorrhage" OR "intracranial hemorrhages" OR "cerebral hemorrhage" OR "cerebral hemorrhages" OR apoplexy OR neurological OR neurologic OR Immunocompromised OR immunosuppressed OR immunosuppression OR postoperative OR "post-operative") OR AB("cardiac arrest" OR "cardiac arrests" OR "heart arrest" OR "heart arrests" OR "cardiopulmonary arrest" OR "cardiopulmonary arrests" OR asystole OR asystoles OR "traumatic brain injury" OR "traumatic brain injuries" OR "brain trauma" OR "brain traumas" OR TBI OR TBIs OR "traumatic encephalopathy" OR "traumatic encephalopathies" OR stroke OR strokes OR "brain ischemia" OR "intracranial hemorrhage" OR "intracranial hemorrhages" OR "cerebral hemorrhage" OR "cerebral hemorrhages" OR apoplexy OR neurological OR neurologic OR Immunocompromised OR immunosuppressed OR immunosuppression OR postoperative OR "post-operative") OR ((TI(impaired OR compromised OR suppressed OR deficiency OR deficiencies OR weak OR weakened OR low) OR AB(impaired OR compromised OR suppressed OR deficiency OR deficiencies OR weak OR weakened OR low)) AND (TI("immune system" OR "immune systems") OR AB("immune system" OR "immune systems") OR MH "Immune System+")) OR MH "Heart Arrest+" OR MH "Brain Injuries+" OR MH "Stroke+" OR MH "Immunocompromised Host" OR MH "Postoperative Period") AND (MH "Critical Care+" OR "critical care" OR "critically ill" OR "critical illness" OR MH "Critical Illness"))
- S3 TI("Supplemental oxygen" OR "oxygen therapy" OR "oxygen therapies" OR oxygenation OR "oxygen delivery" OR "oxygen target" OR "oxygen targets" OR "O2 target" OR "O2 targets" OR "oxygen level" OR "oxygen levels" OR FiO2 OR "inspired oxygen fraction" OR "fractional inspired oxygen" OR "oxygen saturation" OR "O2 saturation" OR "Nasal cannula" OR "nasal cannulae" OR Oxymask OR "oxygen mask" OR "oxygen masks" OR HFNC OR HHFNC OR "simple mask" OR "simple masks" OR "RAM cannula" OR "RAM cannulae" OR "venturi mask" OR "venturi masks")

OR "oxygen hood" OR "oxygen hoods" OR "tot huts" OR "tot hut" OR "care cube" OR "care cubes" OR "oxygen tent" OR "oxygen tents" OR "non-rebreather mask" OR "non-rebreather masks" OR "aerosol mask" OR "aerosol masks" OR "mist tent" OR "mist tents" OR (oxygen AND (incubator OR incubators OR isolette OR isolettes)) OR "low flow oxygen delivery" OR "cool mist" OR "oxygen delivery device" OR "oxygen delivery devices") OR AB ("Supplemental oxygen" OR "oxygen therapy" OR "oxygen therapies" OR oxygenation OR "oxygen delivery" OR "oxygen target" OR "oxygen targets" OR "O2 target" OR "O2 targets" OR "oxygen level" OR "oxygen levels" OR FiO2 OR "inspired oxygen fraction" OR "fractional inspired oxygen" OR "oxygen saturation" OR "O2 saturation" OR "Nasal cannula" OR "nasal cannulae" OR Oxymask OR "oxygen mask" OR "oxygen masks" OR HFNC OR HHFNC OR "simple mask" OR "simple masks" OR "RAM cannula" OR "RAM cannulae" OR "venturi mask" OR "venturi masks" OR "oxygen hood" OR "oxygen hoods" OR "tot huts" OR "tot hut" OR "care cube" OR "care cubes" OR "oxygen tent" OR "oxygen tents" OR "non-rebreather mask" OR "non-rebreather masks" OR "aerosol mask" OR "aerosol masks" OR "mist tent" OR "mist tents" OR (oxygen AND (incubator OR incubators OR isolette OR isolettes)) OR "low flow oxygen delivery" OR "cool mist" OR "oxygen delivery device" OR "oxygen delivery devices") OR MH "Oxygen/TU" OR MH "Nasal Cannula"

- S4 TI(heated OR heat OR heating OR humidified OR humidity humidification OR humidifier OR humidifiers OR "heat moisture exchanger" OR "Bennett Cascade" OR "non-heated" OR nonheated OR ((Monitor OR monitoring) AND (continuous OR intermittent OR standard OR timing OR time OR frequency)) OR oximetry OR oximetries OR "oxygen monitoring" OR "oxygen monitor" OR "monitoring oxygen" OR "monitor oxygen" OR "transcutaneous oxygen" OR SpO2 OR "non-invasive monitoring" OR "non-invasive monitor" OR "non-invasive monitors" OR "noninvasive monitoring" OR "noninvasive monitor" OR "noninvasive monitors" OR "saturation target" OR "saturation targets" OR "saturation targeting" OR "saturation targeted" OR "target saturation" OR "oxygen saturation" OR "O2 saturation" OR Aerosolized OR aerosol OR nebulizer OR nebulizers OR nebulized OR "infection control" OR "infection prevention" OR "prevent infection" OR "control infection" OR feeding OR feed OR fed OR diet OR diets OR nutrition OR ((device OR devices OR cannula OR cannulae OR mask OR masks) AND (selection OR selected OR select OR selects OR selecting OR choose OR chose OR choosing OR chosen OR choice OR choices OR option OR options OR decide OR decides OR decided OR deciding OR decision OR Flow OR occlusive OR occlusion OR fit OR fits OR fitted OR limit OR limits)) OR Cost OR costs OR economic OR economics OR financial OR financing OR financed OR finance OR price OR pricing) OR AB(heated OR heat OR heating OR humidified OR humidity humidification OR humidifier OR humidifiers OR "heat moisture exchanger" OR "Bennett Cascade" OR "non-heated" OR nonheated OR ((Monitor OR monitoring) AND (continuous OR intermittent OR standard OR timing OR time OR frequency)) OR oximetry OR oximetries OR "oxygen monitoring" OR "oxygen monitor" OR "monitoring oxygen" OR "monitor oxygen" OR "transcutaneous oxygen" OR SpO2 OR "non-invasive monitoring" OR "non-invasive monitor" OR "non-invasive monitors" OR "noninvasive monitoring" OR "noninvasive monitor" OR "noninvasive monitors" OR "saturation target" OR "saturation targets" OR "saturation targeting" OR "saturation targeted" OR "target

saturation" OR "oxygen saturation" OR "O2 saturation" OR Aerosolized OR aerosol OR nebulizer OR nebulizers OR nebulized OR "infection control" OR "infection prevention" OR "prevent infection" OR "control infection" OR feeding OR feed OR fed OR diet OR diets OR nutrition OR ((device OR devices OR cannula OR cannulae OR mask OR masks) AND (selection OR selected OR select OR selects OR selecting OR choose OR chose OR choosing OR chosen OR choice OR choices OR option OR options OR decide OR decides OR decided OR deciding OR decision OR Flow OR occlusive OR occlusion OR fit OR fits OR fitted OR limit OR limits)) OR Cost OR costs OR economic OR economics OR financial OR financing OR financed OR finance OR price OR pricing) OR MH "Nebulizers and Vaporizers" OR MH "Oximetry+" OR MH "Infection Control+" OR MH "Diet+" OR MH "Costs and Cost Analysis+"

S5 S1 AND S2 AND S3 AND S4

S6 S5 NOT (MH "Animals+" NOT MH "Human")

S7 S6 NOT PT ("Commentary" OR "Editorial" OR "Interview" OR "Letter" OR "Review")

S8 S7 AND LA English

Scopus via Scopus.com/

#1 TITLE-ABS(Pediatric OR pediatrics OR paediatric OR paediatrics OR Infant OR infants OR newborn OR newborns OR premature OR preterm OR neonate OR neonatal OR toddler OR toddlers OR child OR children OR kid OR kids OR girl OR girls OR boy OR boys)

#2 TITLE-ABS-KEY(Hypoxemia OR hypoxaemia OR anoxia OR anoxemia OR hypoxia OR hypoxic OR ((Deficiency OR deficiencies OR low) AND (oxygen OR O2 OR PaO2 OR pO2)) OR ((carbon dioxide" OR CO2 OR PaCO2 OR pCO2) AND (retention OR retained OR retaining OR retain)) OR ((cardiac arrest" OR "cardiac arrests" OR "heart arrest" OR "heart arrests" OR "cardiopulmonary arrest" OR "cardiopulmonary arrests" OR asystole OR asystoles OR "traumatic brain injury" OR "traumatic brain injuries" OR "brain trauma" OR "brain traumas" OR TBI OR TBIs OR "traumatic encephalopathy" OR "traumatic encephalopathies" OR stroke OR strokes OR "brain ischemia" OR "intracranial hemorrhage" OR "intracranial hemorrhages" OR "cerebral hemorrhage" OR "cerebral hemorrhages" OR apoplexy OR neurological OR neurologic OR Immunocompromised OR immunosuppressed OR immunosuppression OR ((impaired OR compromised OR suppressed OR deficiency OR deficiencies OR weak OR weakened OR low) AND ("immune system" OR "immune systems")) OR postoperative OR "post-operative") AND ("critical care" OR "critically ill" OR "critical illness")))

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"nasal cannulae" OR Oxymask OR "oxygen mask" OR "oxygen masks" OR HFNC OR HHFNC OR "simple mask" OR "simple masks" OR "RAM cannula" OR "RAM cannulae" OR "venturi mask" OR "venturi masks" OR "oxygen hood" OR "oxygen hoods" OR "tot huts" OR "tot hut" OR "care cube" OR "care cubes" OR "oxygen tent" OR "oxygen tents" OR "non-rebreather mask" OR "non-rebreather masks" OR "aerosol mask" OR "aerosol masks" OR "mist tent" OR "mist tents" OR (oxygen AND (incubator OR incubators OR isolette OR isolettes)) OR "low flow oxygen delivery" OR "cool mist" OR "oxygen delivery device" OR "oxygen delivery devices")

- #4 TITLE-ABS-KEY(heated OR heat OR heating OR humidified OR humidity humidification OR humidifier OR humidifiers OR "heat moisture exchanger" OR "Bennett Cascade" OR "non-heated" OR nonheated OR ((Monitor OR monitoring) AND (continuous OR intermittent OR standard OR timing OR time OR frequency)) OR oximetry OR oximetries OR "oxygen monitoring" OR "oxygen monitor" OR "monitoring oxygen" OR "monitor oxygen" OR "transcutaneous oxygen" OR SpO2 OR "non-invasive monitoring" OR "non-invasive monitor" OR "non-invasive monitors" OR "noninvasive monitoring" OR "noninvasive monitor" OR "noninvasive monitors" OR "saturation target" OR "saturation targets" OR "saturation targeting" OR "saturation targeted" OR "target saturation" OR "oxygen saturation" OR "O2 saturation" OR Aerosolized OR aerosol OR nebulizer OR nebulizers OR nebulized OR "infection control" OR "infection prevention" OR "prevent infection" OR "control infection" OR feeding OR feed OR fed OR diet OR diets OR nutrition OR ((device OR devices OR cannula OR cannulae OR mask OR masks) AND (selection OR selected OR select OR selects OR selecting OR choose OR chose OR choosing OR chosen OR choice OR choices OR option OR options OR decide OR decides OR decided OR deciding OR decision OR Flow OR occlusive OR occlusion OR fit OR fits OR fitted OR limit OR limits)) OR Cost OR costs OR economic OR economics OR financial OR financing OR financed OR finance OR price OR pricing)
- #5 #1 AND #2 AND #3 AND #4
- #6 #5 AND (EXCLUDE (DOCTYPE , "ed") OR EXCLUDE (DOCTYPE , "le") OR EXCLUDE (DOCTYPE , "re"))
- #7 #6 AND (LIMIT-TO (LANGUAGE , "English")