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Nursing Intervention for Children 0-5 years needing Intensive Care for Respiratory Infection

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ABSTRACT

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Nursing Intervention for Children 0-5 Years Needing Intensive Care for Respiratory Infection

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The aim was to review nursing interventions for children aged 0-5 years hospitalized for respiratory infections in intensive care units. The focus was on determining possible nursing interventions to improve patient outcomes and to address parental coping mechanisms.

A descriptive literature review was conducted using search portals such as CINAHL and EBSCO. A qualitative content analysis was conducted using the PICO framework, focusing on relevant keywords such as 'respiratory tract infection', 'nursing interventions', 'paediatrics' and 'intensive care'. The search was narrowed down to studies published in the last 10 years that focused specifically on nursing care for the 0–5-year age group.

The review identified important nursing interventions, including the use of paediatric early warning scores, non-invasive ventilation techniques and tailored oxygen therapy. Interventions that resulted in significantly improved outcomes, reduced length of hospital stay and addressed the importance of parental concerns during the admission period in a supportive care environment.

Keywords: Respiratory infections, Paediatrics, Intensive care unit, Nursing intervention, Nursing care.

1 INTRODUCTION

It is a common knowledge that children under the age of five, particularly babies, have a high risk of sickness and hospitalization due to respiratory infections. However, it has been difficult to construct accurate quantitative models for the occurrence of these infection in investigations carried out during the last several decades. Since most large studies were carried out in hospitals, there was no established denominator of patients who were at risk. These studies also differed in terms of the study's geographic location, the kind of hospital used, the patients' ages, the season, the admission requirements, the severity of the sickness, and the quantity and kind of diagnostic tests carried out. (Crowe, 2012.)

Nurses are very important and play a very significant role in taking care of patients. When it comes to children the roles and responsibilities are more crucial, because of the ongoing development of the children. Most of the cases of children are very delicate and should be treated well with quality care. (Suleman, Manning, & Evans,2016.)

When a child is infected with respiratory diseases, the child will often need critical care and will be admitted to the ICU (Intensive care unit). The nurse should not only be responsible for child’s care and good prognosis, but also should be concerned about child’s parents and close family members, because during the child is getting treatment, the family member also undergoes different types of emotions. (Suleman, et.al, 2016.)

The importance of this topic arises from its investigation of the interventions that nurses must make, which can have a significant impact on patient outcomes. The information collected may be used to enhance the quality of treatment and create standardised guidelines for the treatment of respiratory infections in young children. This will help to reduce the length of hospital stays and ease the strain on critical care resources.

2 THEORETICAL STARTING POINT

Nurses have a vital role to fulfil, not only in administration of medication and assisting with clinical treatments, but also in providing support to the child and their family throughout the illness. In certain cases, it is important to educate parents about prevention and avoidance techniques to reduce the possibility of recurrence, which may include immunization and smoking cessation. Admission to intensive care may be necessary for certain children to help them with breathing and other treatments. (Paul, Wilkinson, & Routley, 2014.)

2.1 Respiratory system

The respiratory system begins in the nasal cavity and ends in the alveoli of the lungs. To facilitate comprehension of the various pathologies, it is helpful to distinguish between two principal categories. The upper respiratory system includes the nasal cavity, the pharynx (including the tonsils) and the larynx, which is situated externally to the chest and in a superior position to the sternum junction. The lower respiratory tract has its origin at the trachea. This comprises the bronchi and lungs. (Paul, et.al, 2014.)

2.1.1 Anatomy of Respiration System

Respiration is the process of breathing in and out; oxygen and carbon dioxide are drawn into and released from the lungs. The organs responsible for gas exchange make up the respiratory system: The upper respiratory tract consists of the nose, the nasal cavity and the paranasal sinuses. The lower respiratory tract includes the larynx, trachea, lungs, bronchi and bronchioles. The alveoli are also part of the lower airways. (Health S.M, 2024.)

2.1.2 Physiology of Respiration System

Oxygen enters the lungs. Oxygen is necessary for the body's cells to survive and perform their regular tasks such as removing carbon dioxide, which is a waste product produced by the cells.

‘‘The lungs are a pair of cone-shaped organs composed of spongy pinkish-grey tissue. They occupy the majority of the space within the chest, which is also known as the thorax. The pleura is a membrane that covers the lungs and is divided by the mediastinum, which includes the following regions:

- Heart and its large vessels
- Windpipe (trachea)
- Esophagus
- Thymus gland
- Lymph nodes

The right lung is composed of three lobes and the left lung of two lobes. During respiration,

- air is inhaled into the body via the nose or mouth
- Passes via the trachea (windpipe) and larynx (voice box) and down the throat.
- enters the lungs via tubes called the main bronchi.
    - One main bronchus goes to the right lung and another to the left
    - In the lungs, the main bronchi split into smaller bronchi
    - Then the bronchi divide into even smaller tubes called bronchioles
    - Bronchioles end in tiny air sacs called alveoli’’. (Health S.M, 2024.)

2.1.3 Anatomical and Physiological difference

Compared to adults, infants and children have significant anatomical and physiological differences. Some of the specific anatomical and physiological variations that must be considered when providing care for newborns and children. The disparities are especially noticeable in younger children. Narrower airways increase the risk of obstruction from: Swelling (inhalations burns or conditions such as croup) Foreign bodies (small toys or food) Nasal mucous (caused by infections such as RSV bronchiolitis) Large tongues with small

mouths in infants' external pressure inadvertently placed on the soft cartilage of the airway funnel shaped larynx and trachea with the narrowest point being at the cricoid cartilage. The glottis is rigid and sits high. A higher respiratory rate resulting from a higher metabolic rate causes an increase in oxygen intake. The lungs are losing more water because of the faster breathing rate. Due to their dependence on the diaphragm for negative pressure and chest wall movement, infants, and young children experience weariness more quickly. The chest wall is flexible, the thoracic cage is soft, and the intercostal muscles are underdeveloped. Infants must breathe through their noses. increases resistance, even if it is only partially clogged, which can lead to trouble feeding and labored breathing. Due to their smaller and less numerous alveoli, children's airways contain more dead space and less alveolar surface available for gas exchange. For infants to get enough ventilation, their breathing must be faster in a minute. (Group, 2024.)

2.2 Respiratory Infections

Respiratory infections, either chronic or acute, are common in people of all ages, posing a costly burden on healthcare systems. Specifically, respiratory infection causes severe hypoxemic respiratory failure, which is the primary reason for ICU admission in patients with weakened immune systems. Most respiratory infections are caused by bacteria, viruses, parasites, smoking, or air pollution. Over the last two decades, there has been significant progress in understanding and detecting respiratory infections. (Zhao, Wu, Xu, Wei, Niu, Liu, Yu, Zhou & Liu, 2023.)

Respiratory infection is divided into two parts, which are upper and lower respiratory tract infection (RTIs) And Upper respiratory infection. Respiratory tract infections (RTIs) are infections of parts of the body involved in breathing, such as the sinuses, throat, airways, or lungs. (World Health Organization, 2022.)

An acute respiratory tract infection (ARTI) is defined by the World Health Organisation (WHO) as an infection that affects either the upper or lower respiratory system and typically lasts less than 30 days. These diseases, which

include pneumonia and the common cold, can make it difficult to breathe normally. More serious conditions like bronchitis and bronchiolitis can be caused by lower respiratory tract infections (LRTIs), which affect the lungs or lower airways. (World Health Organization, 2022.)

Most common ARI seen in children are Upper respiratory tract infections, common cold, Influenza, respiratory syncytial virus (RSV). Most common Lower respiratory tract infections in children are bronchiolitis, pneumonia. (World Health Organization, 2022.)

Coughing and wheezing are often associated with respiratory tract infections (RTI's), while stridor is typically seen with upper RTI's in children, with a mixture of symptoms that can blur the boundaries between upper and lower RTI's. This presents a challenge to classify the infection. (Paul, Wilkinson, & Routley, 2014.)

RTIs are more common in the winter due to children usually being closer to each other, given that children spend more time indoors. It is important to keep in mind that a child's age-related heart rate and respiratory rate differ from those of an adult, and any other characteristics may differ from those of the average adult. Following any abnormality in a child's heart and respiratory rate for this age, a nurse must correlate the general information of vital signs presented in Table 1 with those of the affected child. (Paul, et.al, 2014.)

Age	**Respiratory rate (per minute**	**Heart rate (per minute)**
< 1	30–40	110–160
1–2	25–35	100–150
2–5	25–30	95–140
5–12	15–20	80–120

Table 1. Normal Respiratory and heart rate of children (Paul, et.al.,2014.)

2.2.1 Pneumonia

Pneumonia is inflammation of the lung caused by bacterial, viral, or other pathogenic infections. According to World Health Organization, pneumonia is the leading cause of death among children globally. Newborns are most likely to get pneumonia due to the physiology of their lungs and in certain cases they might lead to death. (WHO, n.d.)

Pneumonia occurs in four stages. Stage one begins within 24 hours and is distinguished by alveolar edema and vascular congestion, as well as the presence of bacteria and neutrophils. The second stage is red hepatization, which has the consistency of a liver. During this stage, neutrophils, red blood cells, and exfoliated epithelial cells are present. Alveolar fibrin deposits are frequent. The third stage is gray hepatization and emerges 2-3 days later, that is when the lung turns dark brown. Red cell hemolysis and hemosiderin buildup are present. The resolution is the final stage, which is the resorption of the infiltrating cellula and the restoration of the lung. If the healing does not go well, parapneumonic effusions and pleural adhesions may develop. (Edeledike & Ahmad, 2023.)

Common causes of pneumonia: pneumococcal streptococcus; pneumonia caused by Mycoplasma; The staphylococcus aureus group B streptococcus virus also called respiratory syncytial (RSV); Parainfluenza virus; viral influenza Adenovirus. Symptoms of pneumonia always vary according to the severity of the diseases. Common symptoms are respiratory rate greater than 60 breaths/min; fever greater than 38.5°C; dyspnea; chills, fatigue; cough and hypoxemia. (Perretta, 2014.)

2.2.2 Respiratory Syntical Virus

Common respiratory virus that impacts the nose, throat, and lungs is known as the respiratory syncytial virus (RSV). Symptoms of RSV make it hard to differentiate it with other various form of respiratory viruses, including the flu or COVID-19, or the common cold. Along with other respiratory viruses, RSV spreads around the autumn and winter. (About RSV, 2024). RSV may spread via direct contact, for instance by kissing or touching a sur-face where the virus is present on, or through the virus droplets sprayed when an infected person coughs

or sneezes. RSV may trigger illness one or two days prior to virus encounter, but it can also remain contagious for three to eight days. (How RSV Spreads, 2024.)

Common symptoms of RSV are runny nose, congestion, decreased appetite, coughing, sneezing, fever, and wheezing. Usually, these symptoms take a while to manifest and rarely occur all at once. The primary symptoms of respiratory syncytial virus (RSV) in newborns include irritability, decreased activity, and breathing difficulties. (Symptoms and Care of RSV,2024.)

2.2.3 Bronchiolitis

Bronchiolitis is a viral inflammatory disease of the lower respiratory tract, which is primarily observed in infants and toddlers on a global scale. The human respiratory syntycal virus (RSV) is mainly the cause of bronchiolitis. It is estimated that every year RSV disease contributes to about 30 million incidences of lower respiratory tract infection among under-fives and to over 32 million hospitalizations, with an additional 200 000 deaths across the globe. Bronchiolitis comprises the most common diagnosis on admission in children aged less than 1 year in countries with high gross national product and it is most prevalent cause of death in developing countries. (Dalziel, Haskell, O'Brien, Borland, Plint, Babl, & Oakley, 2022.) As small airway epithelium gets inflamed, the secretions, oedema, and necrosis of cells occur, which is known as bronchiolitis. At last, there may be airway wheezing as the airway gets blocked due to inflammation of these cells and their necrosis. (Erickson, Bhakta & Mendez, 2023.)

Diagnosing bronchiolitis requires a thorough examination of the history and physical status of the patient. Given the increased risk of deterioration, young infants and children with known risk factors would benefit from early evaluation by a nurse. (Paul, et.al.,2014.)

Transmission occurs between people by direct infection or by inhalation of large droplets, resulting in an influx of lymphocytes, granulocytes and natural killer cells. Most of the children hospitalized with bronchiolitis had symptoms of other

viruses present in their nasopharynx, leading to co-infection, which can make it difficult to identify the causative virus. (Weis & Hailey, 2024.)

The early symptoms are runny nose, stuffy nose, reduced appetite, and an ordinary cough that typically lasts for about three days. As the disease progresses, wheeze, tachypnoea, and use of accessory muscles of respiration with intercostal and sub-costal retractions may be present. SIowly, signs like bluish skin, the inability to breathe, flaring of mouth, and retching sounds may come into recognition. For this reason, special attention should be paid to all children with this disease, especially if they are aged below one year. During the treatment, 76.67% of patients had an occasional fever. (Erickson et al., 2023.)

2.2.4 Epiglottitis

Epiglottitis happens when the child epiglottis (a little piece of cartilage covering the windpipe) expands and blocks airflow to their lungs, which can lead to a potentially fatal bacterial infection. Haemophiles influenzae type B (Hib) bacteria that spreads through the upper respiratory system is one cause of epiglottitis but, actual cause for epiglottitis is still unknown as for why some children develop epiglottitis whereas some don’t. (Hospital, 2024.)

Symptoms for epiglottitis can be different from one child to another, the most common symptoms can be, upper respiratory infections, onset sore throat, fever, muffled voice, no cough, drooling, unable to talk. To keep child from losing their breath, epiglottitis requires emergency attention right away. Usually, the disease stops spreading in a day or two after the child is under observation, their airway is secure, and medications are underway. Depending on the state of each child, full healing takes longer. (Hospital, 2024.)

2.3 Cause of the hospitalization

Indications for infant admission include respiratory distress, apnea, cyanosis, oxygen saturation below 92%, loss of appetite, respiratory rate above 70 breaths

per minute, or a family that cannot ensure sufficient monitoring or supervision to the infants (Forton, & Thomson, 2011). Admitting is indicated in older children when their oxygen saturation is less than 92% and they demonstrate cyanotic, the respiratory rate more than 50 breaths per minute, the difficulty in breathing, clinical signs of dehydration. (Forton, et.al, 2011.)

Reasons for intensive care transfer include the following: the patient cannot maintain a FiO2(Fraction of inspired oxygen) of greater than 0.6 while maintaining an SaO2 of greater than 92%; the patient develops an episode of clinical shock; cogent clinical indications for severe respiratory distress and fatigue are accompanied by increased pulse rate and respiratory rate, with or without a rise in arterial carbon dioxide tension (PaCO2). Key symptoms are recurring apnea or sluggish, irregular breathing. (Forton, et.al, 2011.)

2.3.1 Definition of Intensive Care Unit

An intensive care unit (ICU) is a hospital unit dedicated to providing critical care to patients. Patients in the ICU have serious medical conditions that can be fatal. The Patient is intensively monitored 24 hours a day by teams of professional health practitioners. During their stay in the ICU, they will need medication, and life support technology to maintain normal body functions. The difference between ICUs from an ordinary hospital ward is having a larger staff-to-patient ratio and exclusive access to cutting-edge medical supplies and technology. (Health direct,2024.)
Intensive care unit is divided into multiple parts, for example Neonatal and pediatric intensive care unit.

Neonatal Intensive care unit

Neonatal intensive care unit (NICU) is made to care for newborn infants who need urgent medical treatment and monitoring. NICU provides care for infants born with abnormalities, full-term babies who develop serious illnesses and premature babies. Nurses in NICU are skilled in caring for neonates. In the NICU you can find incubators, heaters, ventilators, and others special gears that help maintain

tine bodies that are still developing. The NICU's environment is meant to prevent babies from being over stimulated. The treatment goals are promoting growth and infection control by stabilizing breathing, circulation, and other physiological symptoms. (Health Carousel,2024.)

Paediatric Intensive Care Unit

The pediatric Intensive care Unit (PICU) is needed when a child, baby or even adolescent is seriously ill. The PICU is made up of pediatric doctors, specialized nurses and other healthcare professionals who received training to take care of pediatric patients. Children are admitted to the PICU for serious infection, trauma injuries, respiratory failure, or post operative care. During their stay in the PICU, the patient is constantly monitored. In the PICU technologies like ventilation and dialysis machines can be found to help the patient stabilize their state. (Health Carousel, Nursing and Allied health,2024.)

2.4 Family centred care In Intensive care unit

Admission to an ICU causes significant stress and concern for families. They interpret the setting as hostile and intimidating since it raises the possibility of the patient passing away. The ICU environment can produce feelings of doubt, powerlessness, mental disorganization, difficulty making decisions, and other reactions, including depression and stress-related disorders. (Barth, Weigel, Dummer, Kelly, & Tissot. 2016.)

The importance of Family centred care (FCC) in ICUs is to improve patient outcomes and reduce stress for the patient and their family underlines how critical it is to establish effective communication and offer families emotional support. Families can prevent post-intensive care syndrome, which is marked by long-term mental health and social issues brought on by the ICU stay, by implementing Family centre care. (Davidson, 2017.)

2.5 Nursing Intervention

The nursing interventions is based on scientific knowledge and is intended to improve a child's health outcomes, and the purposes is to supports nurses in developing, carrying out, and assessing nursing care, making sure that the surroundings are secure and stress-free for the child's wellbeing. (Monteiro, Silva, Lopes, & Araujo, 2007.)

The principles of nursing care for respiratory infections include supportive therapy, fluid therapy and assessment of respiratory function. Care plans and treatments must be organized to provide a stress-free environment for the infant. Nasal aspiration is part of the supportive techniques, but it is important to remember that the best way to clear the lungs is to cough. (Xue, Liu, Xue, Xue, Liu, & Wang, 2022.)

2.5.1 The use of Pediatric Early Warning Score

Paediatric Early Warning Score (PEWS) represent an assessment instrument employed by nursing professionals with the objective of facilitating the early identification of potential clinical deterioration in paediatric patients. used by the nurse to assist with early detection of deteriorating young children (Agulnik, Mora Robles, Forbes, Soberanis Vasquez, Mack, Antillon-Klussmann, Kleinman, & Rodriguez-Galindo, 2017). In order to evaluate the clinical status of patients, the PEWS employs a systematic approach to monitoring vital signs and relevant clinical information, including blood pressure, heart rate, respiration rate, respiratory effort, nervous system health, and body temperature. In the context of the emergency room, the implementation of PEWS enables medical practitioners to make well-informed judgements by utilizing data to forecast the duration of the hospital stay (Wang, Zheng, Wang, Ma, Zhang, Ma, Ma, Chang, & Cui, 2024.)

0-3months		4	2	1	0	1	2	4
A B	Respiratory rate(bpm)	<15	15-19	20-29	30-60	61-80	81-90	>91
	Respiratory effort	severe/ apnea	difficult		Normal			Severe
	O2 therapy	<85	85-90	91-94	>94			
	SPO2				No		<50% or 4l/min	>50% or >4l/min
C D	Systolic BP (mmHG)	<45	45-49	50-59	60-80	81-100	101-130	>130
	Heart rate	<80	80-89	90-109	110-150	151-180	181-190	>190
	CRT				<3s			>3s
E	AVPU	abnormal			normal			

3-12months		4	2	1	0	1	2	4
A B	Respiratory rate(bpm)	<15	15-19	20-24	25-50	51-70	71-80	>80
	Respiratory effort	severe/ apnea	difficult		Normal			Severe
	O2 therapy	<85	85-90	91-94	>94			
	SPO2				No		<50% or 4l/min	>50% or >4l/min
C D	Systolic BP (mmHG)	<60	60-69	70-79	80-99	100-120	121-150	>150
	Heart rate	<70	70-79	80-99	100-150	151-170	171-180	>180
	CRT				<3s			>3s
E	AVPU	abnormal			normal			

1-5years		4	2	1	0	1	2	4
A B	Respiratory rate(bpm)	<12	12-14	15-19	20-40	41-60	61-70	>70
	Respiratory effort	severe/ apnea	difficult		Normal			Severe
	O2 therapy	<85	85-90	91-94	>94			
	SPO2				No		<50% or 4l/min	>50% or >4l/min
C D	Systolic BP (mmHG)	<60	60-69	70-79	80-99	100-120	121-150	>150
	Heart rate	<60	60-69	75-89	90-120	121-150	151-170	>170
	CRT				<3s			>3s
E	AVPU	abnormal			normal			

Table 2. Pews chart, from pocket card, (sairaanhoitajat.fi)

2.5.2 Non-invasive monitoring

Pulse oximetry monitoring

Pulse oximetry is a precise, easy, and noninvasive way to measure arterial oxygen saturation (SaO2). Pulse oximetry (SpO2) may enhance our capacity to evaluate the cardiorespiratory health of infants and children since it can reliably detect desaturation and quantify normal SaO2 under a range of circumstances. Children in good health who breathe room air should have a SpO 2 reading higher than 97%, just like adults. In children, pulse oximetry provides more diagnostic information than just monitoring breathing rate. (Perretta, 2014.)

Peak Expiratory Flow Rate

With the use of a peak expiratory flow meter (PEFR), Information about major airways functioning can be acquired on children older than four to five. Children who have respiratory failure, or long-term airway disorders will have a lower PEFR. Records taken on a frequent basis during a child's acute sickness can show if the child's respiratory condition is improving or declining. (Dixon, Crawford,Teasdale, & Murphy, 2009.)

2.5.3 Airway Therapy

The core component of care is respiratory therapy (Friedman, & Nitu, 2018). Oxygen is important for the adequate cellular respiration and proper oxygenation and for the prevention of cell damage (Dixon, et.al, 2009). The usage of noninvasive respiratory support methods has dramatically increased, despite the continued prevalence of invasive mechanical ventilation. Bi-level positive airway pressure (BiPAP), continuous positive airway pressure (CPAP), and high flow nasal cannula oxygen (HFNCO2) are examples of noninvasive breathing techniques (Friedman, et.al.,2018). When administering extra oxygen, it is important to consider the type of sickness, the therapeutic objectives, the child's size, and age, and the quantity of oxygen needed. (Dixon, et.al, 2009.)

Chest Physiotherapy

The main goal of chest physiotherapy is to help eliminate tracheobronchial secretions, which lowers airway resistance, enhances gas exchange, and facilitates breathing. This treatment is efficient for children who have ongoing respiratory infection therapy. Although children and adults had a similar and yet different respiratory system, the procedure for the chest therapy is the same as adult, so it is important to consider the unique characteristics of children's respiratory systems. These traits restrict or even preclude the application of some physiotherapy procedures. (Chaves, et.al, 2019.)

Physiotherapy can help a child's respiratory condition and speed up their recuperation, but it can also be detrimental in some cases. For example, it might increase bronchospasm, cause pulmonary hypertension, reposition foreign substances, or destabilize an ill kid. Still, several methods of chest physical therapy have been created specifically for children. (Chaves, et.al, 2019.)

2.5.4 Non-invasive ventilation

Non-invasive ventilation (NIV) is a respiratory support technique that do not require an implanted tube for breathing named Endotracheal tube. The severely sick child's alveolar ventilation and gas exchange significantly improve when NIV is used to activate the lung and unload the respiratory muscles. Thus, NIV lowers the morbidity and mortality linked to mechanical breathing by decreasing the rate of endotracheal intubation. Additionally, NIV enhances cardiac output and decreases afterload by lowering left ventricular transmural pressure. As a result, NIV is a valuable tool for treating youngsters who are in severe condition.
(Demaret et al., 2015.)

HFNCO2 (High Flow Nasal Canula Oxygen)

HFNCO2 is a preferred method of respiratory support for newborns and young children. To minimize issues and improve patient comfort, the air given via nasal cannula is heated and humidified at high flow rates (Friedman, et.al.,2018). By supplying high FiO2(fraction of expired oxygen) to cure hypoxia and by generating positive pressure in the alveoli and small airways to lessen respiratory

effort, HFNCO2 helps treat acute respiratory failure. HFNCO2 may be used to increase oxygenation in bigger individuals, although substantial flow rates (30–60 L/min) are required to increase respiratory effort. (Friedman, et.al.,2018.)

CPAP continuous positive airway pressure

To sustain lung expansion, CPAP applies a single pressure during the breathing cycle. Around the CPAP pressure, patients can breathe on their own. BiPAP is a synchronized breathing technique that adds an inspiratory pressure to the lower continuous positive end-expiratory pressure to help with ventilation. CPAP and BiPAP are often administered using a form-fitting mask that covers the mouth or nose. The masks used for BiPAP and CPAP might cause vomiting or secretion aspiration and the breakdown of the facial skin. (Friedman, et.al.,2018.)

2.5.5 Mechanical ventilation

In the paediatric intensive care unit (PICU), mechanical ventilatory assistance is frequently provided via positive pressure ventilation, is a device that regulates gas flow into a child's airways. The gas is mixed and pressure-reduced in accordance with the recommended inspired oxygen tension (FiO_2), which is obtained from cylinders or wall outlets. The gas is then stored in a container inside the machine and administered to the patient via one of the several ventilation options. This involves the ventilator creating pressure outside the child at a higher pressure, which effectively blows the gas into the child's lower-pressure lungs. (Dawson, Cook, Holliday, & Reddy, 2012.)

2.5.6 Medication Therapy

The treatment is aimed on a specific pathogen identified from acquired information through physical exam findings and patient history. An adjuvant and symptomatic treatment are necessary, it includes giving additive oxygen for hypoxia, giving antipyretics for fever, and administration of fluids for dehydration. These treatments are important in the case of viral pneumonia or non-infectious

pneumonia where the need for antibiotics is not present. (Ebeledike, & Ahmad, 2023.)

To alleviate discomfort, analgesics and antipyretics are advised as part of a multimodal strategy for treating fever and pain. For fever management, ibuprofen and acetaminophen/paracetamol may be more effective when used together or alternately than when used alone. However, some guidelines advise against simultaneous usage and suggest alternating only if suffering persists or recurs before the next dose is due, to reduce the chance of dosage mistakes. (Gill, Onakpoya, Buchanan, Birnie, & Van den Bruel, 2024.)

It is not possible for antibiotics to be of benefit in the treatment of viral diseases. However, they can be useful in instances of disease when there is bacteremia. Conversely, it is possible that some antibiotics can modulate inflammation and relieve symptoms. (Farley, Spurling, Eriksson, & Del Mar,2014.)

To avoid potential problems caused by overuse of antibiotics, it's important to carefully consider when to administer antibiotic as the role of non-medical prescribers in nursing grows. (Paul & Fisher, 2014.)

In case of epiglottitis treatment for the infection with intravenous (IV) antibiotic medication. Steroids medication (to lessen swelling in the airways). IV fluids, indefinitely, or until the infant regains the ability to swallow. (Hospital, B. c. 2024.)

3 PURPOSE, TASKS, AND OBJECTIVES

The purpose of this thesis is to conduct a descriptive literature review while gathering evidence base information about Nursing care provided to patient 0–5-year-old that are hospitalized due to respiratory infections in ICU (PICU AND NICU).

The objective is to increase knowledge and awareness regarding the impact of respiratory infections on youngest children between the ages of 0 and 5.

The task is to explain about the importance of nursing intervention for children suffering from respiratory infection and are admitted in the intensive care unit. The focus will be on nursing care, oxygen therapy and medication therapy while considering the coping mechanism of parents whose children are admitted in the intensive care unit.

Research questions

- What are the nursing interventions for (children 0-5) who have been admitted to the ICU because of respiratory infection?

4 METHODOLOGICAL STARTING POINTS

A descriptive literature review was done to raise awareness and educate regarding the importance of nursing interventions carried out for respiratory infected conditions in intensive care unit majorly focused on the age group of 0-5 years children while also dealing with the coping mechanism of parents.
A qualitative content analysis was done after screening out the most relevant article was found from reliable searching portals such as CIHNAL to write this thesis.
Based on the research question, “What are the nursing interventions for (children 0-5) who have been admitted to the ICU because of respiratory infection?” The review helped to surface out the relevant information and concepts that is retrieved by searching in appropriate databases.

4.1 Literature review

Published data regarding nursing intervention carried out in 0-5 years with respiratory tract infection in intensive care unit is brought up and reviewed. Despite simply reviewing the sources, a literature review followed an organisational framework that integrates analysis and summary. The key elements of the material as nursing intervention, respiratory infection, intensive care unit focusing on certain age group 0-5 years children, are outlined, however the result is a reorganising or rewriting of that information in overviewing informative summary in area of study from literature reviews. Literature evaluations provide readers with an overview or act as a starting point if constrained on time. (Research Guides: Library Services for Undergraduate Research: What Is a Literature Review? n.d.)

4.2 Literature search

According to evidence-based medicine, the most significant and vital component of maintaining the integrity of research is formulating the study question. Most

researchers utilise the specialised framework known as Population, Intervention, Comparison, and Outcome (PICO) to construct a study question and to streamline the literature review process. (Eldawlatly, Alshehri, Alqahtani, Ahmad, Al-Dammas, & Marzouk, 2018).

Based on thesis question, what are the nursing interventions for (children 0-5) who have been admitted to the ICU because of respiratory infection? PICO (Population, Intervention, Comparison and Outcome) was created to ease the searching process.

P: - Children 0-5 years old age group admitted in intensive care suffering from respiratory infections

I: - Nursing intervention focused on ICU including NICU and PICU including Nursing care, Oxygen therapy and Medication therapy.

C: - Intensive care given in NICU and PICU with different types of respiratory infections.

O: - Evaluation of the different types of nursing interventions carried out in intensive care unit to treat and prevent from respiratory infections.

4.3 Data research process

After the clarification of what to look for, validated searching portals such as CINAHL, EBSCO were used to discover evidence-based article that support the question on the basis of its interrater reliability. To increase the possibility of finding the relevant article which provides knowledge regarding the impact of respiratory infections on kids between the ages of 0 and 5 years old in ICU, PICO questioning terms were used. Extraction of the data were done after discussing with the partner based on the relevant terms such as (respiratory tract infection OR respiratory infection) AND (Intensive care unit OR ICU OR critical care) AND (pediatrics OR children), etc. and also limiting the age and year while searching the article in order to narrow down relevant articles and to be with in the relevant topic. (LibGuides: Systematic Reviews: Step 7: Extract Data from Included Studies, n.d)

4.4 Inclusion and Exclusion criteria

Every requirement a study needs to meet are known as inclusion criteria. Criteria for exclusion are things that would prevent a study from being included. So, the crucial step is to identify the research terms that to be included and excluded when searching for the relevant article.

On the basis of types of studies including suitable study design in certain timeframe of 10 years, participants as 0-5 years children, nursing care provided in intensive care unit focusing on Respiratory Infections with the intervention quality reliable on Nursing care, Oxygen therapy, Medication therapy with an outcome of Nursing intervention carried out for prevention, rule out the respiratory infections and also focus on the parents' coping mechanism to the situation. Academic, evidence-based articles were included.

As including criteria is narrowed down to the suitable contents it is also important to exclude the contents while screening as there is wide range of results available. Population group above 5 years old as the thesis question does not require and the article published before 10 years from current deadline is excluded as even though it may have the relevant articles, in order to have up to date with resources for the core information. Unlicensed medical practice for treatment therapy is excluded as it has no connection at all with the thesis question, and also the premature respiratory disease condition (proper in development of lungs etc). Articles in different languages, hypothetical based articles were excluded. (LibGuides: Systematic Reviews: Inclusion and Exclusion Criteria, n.d.)

The table in the appendix shows the example of searches that were conducted.

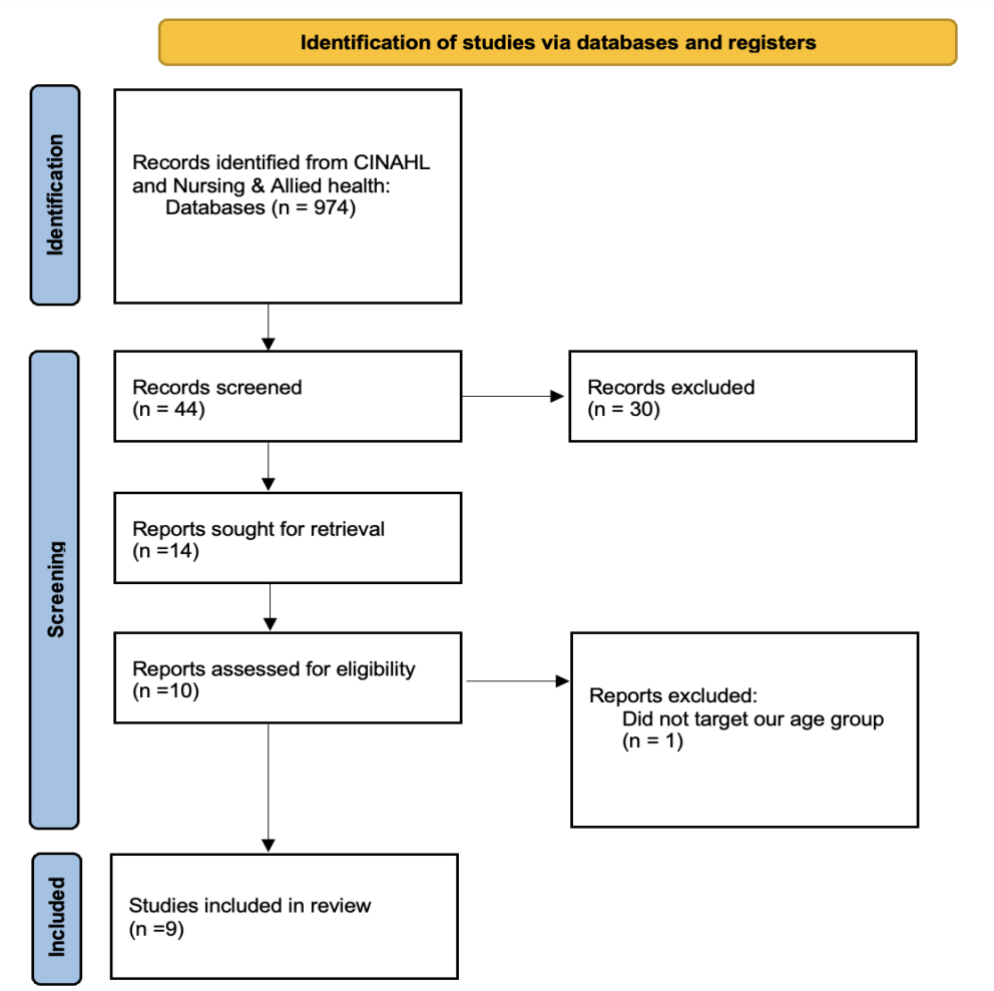

Figure 1. Diagram flow gram for search. (Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372: n71. doi: 10.1136/bmj. n71)

5 Findings

Following the completion of the data analysis procedure, the pieces of information obtained from the 9 articles were examined to see whether they addressed the research questions of the thesis or not. The Major headings were Nursing care, Respiratory Therapy and length of stay in the hospital with those the patient overall health can improve.

5.1 Nursing Care

Five major areas needed improvement for the management of respiratory tract infections in children, which was guidance treating RTIs in young children, factors affecting the use of antibiotics, the parent's worry, differential guidance, and systems challenges (8). The main objective of using pews is to assess the effect of nursing intervention on paediatric patient (1). PEWS consisted of three components: behavioural, cardiovascular, and respiratory. It provides reliable information for clinical nurses to assess the well-being of children quickly, fairly, and accurately (1). Also, PEWS-based nursing interventions, have an opportunity to significantly improve patient satisfaction with medical care and nursing efficiency (1). Nurses play important role in patient monitoring and comfort, and their feedback on is essential for ensuring optimal care (9). (4) During patient stays at the hospitals due to respiratory infection, nurses used play as a way of intervention to help patient cope with the new environment and to also help them relieve stress and anxiousness. It is of the utmost importance to engage in open dialogue with the parents, as this can significantly impact the patient's health outcomes (8).

5.2 Length of stay

Pews Reduced the rate of unplanned admissions, the probability of disease worsening, the average number of hospital days, and hospital costs in the paediatric intensive care unit (1). the PEWS-based nursing intervention enhanced the recovery process of paediatric patients in the respiratory unit. Children that received play as intervention during their hospitalisation had lower

length of hospitalisation than the one, who did not receive it (4). (6) Knowing what types of viral infection, the patient has can help with shortening the length of stays in the ICU. Nebulised hypertonic saline helped in diminish the patient stays in the ICU (3).

5.3 Respiratory therapy

Flexible fiberoptic bronchoscopy is a useful diagnostic tool and guides interventions in intensive care units without ventilation (5). Oxygen uptake and hemodynamics changed during the procedure, but these changes were short-lived (5). During the patients stays in the intensive care unit 12.5% required Non-invasive ventilation and half of the patients needed High flow oxygen therapy with twenty-seven patients (33.7%) being intubated (6). One nurse monitored and documented oxygenation and hemodynamic parameters, while another administered drugs and normal saline (0.9%) for bronchoalveolar lavage (BAL) (5). 258 hospitalisations involved mechanical ventilation, either invasive or non-invasive. Of the children receiving treatment, 150 were diagnosed with pneumonia, 51 with bronchiolitis, 40 with a presumed nosocomial respiratory infection, and 17 with undefined LRTI (7).

Of the children who received positive airway ventilation, 24% were continuously positive airway pressure, while the next most common forms were bilevel positive pressure (4.3%), high-frequency oscillatory ventilation (4.3%), and synchronised intermittent mechanical ventilation (1.2%) (7). The use of hypertonic saline decreased the need of respiratory support (3). A total of 12.5% of patients underwent non-invasive mechanical ventilation, while 57.5% of patients were treated with high-flow oxygen therapy (6). Non-invasive techniques were required to intubate 33.7% patients due to inadequate ventilation. A total of 34 viral pathogens were identified in the 27 intubated patients (6).

5.4 Medication Therapy

The administration of antibiotics is primarily guided by the parents' expectations regarding the medication's outcomes (8). Many practitioners felt pressured by

parent to prescribe antibiotic to their young sick children (8). The medication used during the patient stays in the ICU was Nebulised hypertonic saline, this helped in preventing further complication (3). A strategy of diagnostic testing and cessation of antibiotic treatment may help to reduce antibiotic resistance, the financial burden of treatment in intensive care units (6).

Immunization

Nurses are in a good position to spot children who might not have finished their vaccination schedule and to persuade parents to increase vaccination uptake prior to hospital discharge. The easiest way to do this is to clarify the advantages and remove any misconceptions or assumptions that parents might have (2). Palivizumab prevents RSV bronchiolitis passively in children from high-risk groups who have an underlying medical condition. This lowers likelihood of getting hospitalized due to bronchiolitis and it related morbidities, but it does not stop an active RSV infection (2).

6 Ethics and reliability

According to the Finnish National Board on Research Integrity (TENK) released a new version of guidelines on good scientific practice and research integrity in March 2023. The guidelines are essential for all research organizations, including universities and research institutes, ensuring adherence to ethical standards across all scientific disciplines. The basic goal is to create a trustful environment, accountability in research, benefiting researchers, their institutions, society at large. Committing to these guidelines ensures integrity in all scientific endeavours. (RI 2023 guideline published in three languages, n.d.)

The European Code of Conduct for Research Integrity outlines four basic principles: reliability is ensured with quality of research, reflected in the design, methodology, the analysis and the use of resources, developing honesty by undertaking, reviewing, reporting and communicating research in a transparent, fair, full and unbiased way and respecting colleagues, research participants schedule, and the environment and taking accountability for the research articles screened out from publication, for managing and organizing, for participating in training, supervision and mentoring, and for its wider impacts. Adhering to these principles is essential for maintaining research integrity (RI) throughout the research process. Good research practices was carried out while working on thesis focusing on research environment which was promoted by creating awareness of RI guidelines, sharing resources for data management, and handling violations fairly, safeguarding with prior ethical approvals and being transparent about funding sources if any, and discussing conflicts of interest, data practices and management, protection, and openness was established among research partners, and Publication.(Finnish National Board on Research Integrity TENK & Aittasalo, 2023)

DISCUSSION

Literature review is carried out to provide an overview and educate more about the nursing interventions that has to be carried out in Intensive care unit focused with neonatal intensive care unit and paediatric intensive care unit because of the age group prioritize 0-5 years old children suffering from respiratory tract infections, focusing on nursing intervention for parents coping mechanism because of the age group.

While conducting this literature review core role of nursing care is clearly visible and how important it is for treatment process for such a vulnerable age group with respiratory tract infections with, also dealing with the parents' concerns found out to be a very tough job for nurses in ICU (NICU and PICU). Based on scientific findings, nursing interventions attempt to improve a child's health problems by enabling nurses in planning, implementing, and evaluating nursing care while maintaining that the child's environment is safe and stress-free. (Monteiro et al., 2007.)

The results highlight the vital role that nursing interventions have enhancing patient outcomes. The complexity of paediatric care is highlighted by the identification of five major areas for improvement in the management of RTIs: treatment guidance, variables influencing medication use, parental concerns, differential guidance, and systemic issues. An excellent illustration of how structured evaluation tools can improve overall patient satisfaction, prevent hospitalisations, and facilitate early intervention is the implementation of the Paediatric Early Warning Score (PEWS). The quality of care provided to paediatric patients may be significantly enhanced through the incorporation of technology like this into standard nursing practice. (Huang, Cheng, Sun, Nian, Tao, Wu, & Ye, 2022).

In paediatric patients suffering from respiratory conditions for effective management key monitoring techniques and therapeutic interventions are required. Non-invasive method as assessing arterial oxygen saturation (SaO_2) is crucial for monitoring the oxygen level to rule out the diagnostic information and to guide making clinical decisions. (Perretta, 2014). Whereas Peak Expiratory

Flow Rate (PEFR) evaluates the airway function while regular monitoring can indicate the changes in respiratory status (Dixon, et.al, 2009.). Which indicate the administration of oxygen therapy for cellular respiration and prevent hypoxia related damage. As per the individual preferences and tailoring approach oxygen delivering devices can be allocated. (Friedman, et.al.,2018) According to oxygen therapy research, advanced techniques like flexible fibreoptic bronchoscopy can be used efficiently in critical care settings. In accordance with the study, thorough nursing staff continuous monitoring ensures patient safety and effectiveness regardless of the technique may temporarily alter haemodynamic and oxygenation parameters (Sachdev et.al 2023). The widespread use of various breathing techniques, particularly continuous positive airway pressure, further emphasises the importance of tailored respiratory aid according to each patient's diagnosis. According to the data, collaboration between departments is vital to improve patient outcomes in critical care settings, especially among nursing and respiratory therapy teams. (Şık et al., 2020)

Additionally, the review emphasizes the importance of non-invasive ventilation strategies, including High-Flow Nasal Cannula (HFNCO2) and Continuous Positive Airway Pressure (CPAP). These modalities have been shown to improve oxygenation and decrease respiratory effort in pediatric patients, thus mitigating the need for invasive mechanical ventilation (Friedman et al., 2018; Sachdev et al., 2023). The data suggest that tailored respiratory therapies, guided by individual patient needs and underlying conditions, significantly enhance recovery rates and patient comfort.

Another critical aspect of the discussion involves the role of nursing care in addressing parental concerns during hospitalizations. The emotional and psychological stress experienced by parents can profoundly impact their children's recovery (Monteiro et al., 2007). Effective communication and education about the child's condition and treatment plan are essential nursing interventions that foster trust and alleviate anxiety. By providing support and clear guidance, nurses can help parents navigate the challenges of hospitalization, thereby improving the overall care experience.

Our study is limited by the unavailability of medication therapy. It will be great to have further research about this specific topic, since it is about a vulnerable age group. Airway clearance therapy on the other hand was present in all of the

articles found. According to (Corton et.al,2020,) even though airway clearance therapy is used clinically for the management of LRTI, there is still not proper evidence about the safety and effectiveness on the use of it to this group age. To improve results for this vulnerable population, the review highlighted the importance of developing strategies based on evidence.

Bruce et al. (2017) stated that Hospitalization, morbidity, and potentially death in younger children with respiratory infection have greatly decreased since the introduction of many vaccinations, including pneumococcal and Haemophilus influenzae type B (Hib). The Hib vaccine has greatly decreased the incidence, but it should still be taken into consideration in cases of very ill children who are not vaccinated or who are recent immigrants, as the vaccination schedule and available vaccines may differ from countries.

CONCLUSION

In summary, the research highlights how administration of medications, ventilation therapy, and nursing care are all interrelated in improving the treatment of paediatric respiratory tract infections. Together with advanced respiratory treatments, proactive communication with families and attentive medicine administration, the use of structured assessment tools such as PEWS can greatly enhance patient results and. Future studies should keep exploring these topics, prioritising evidence-based pharmaceutical methods, innovative nursing techniques, alongside effective ventilation techniques to ensure that that children receive quality treatment. In order to enhance the general level of care for this sensitive group, it will be crucial to address the previously identified shortcomings in practice and develop collaboration among professionals.

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APPENDICE

Date	Database	Bolean Search	Limitations	Results
15.4.2024		(Respiratory tract infection or respiratory infection AND intensive care unit or icu or critical care ANDpediatrics or children.	**Limiters** - Publication Date: 20140101-20241231 Narrow by Subject Major: - bronchopulmonary dysplasia - pediatric care - treatment outcomes - intensive care units, neonatal - severity of illness - pneumonia, viral - virus diseases - bronchiolitis - intensive care units, pediatric - respiratory tract infections - respiratory syncytial virus infections Narrow by Age: - child, preschool: 2-5 years - infant: 1-23 months	180
22.9.2024	CINAHL (Ebsco)	"Respiratory Tract Infections" AND paediatric or children or infants or toddlers AND nursing interventions or nursing care or nursing support or best practice or nursing treatments	peer reviewer. English language all infant 2-5years, preschool date: 2018-2024	130
4.10.2024	CINAHL (Ebsco)	Respiratory infections OR Respiratory health OR Respiratory illness AND Paediatric OR Child OR Children OR Paediatric OR Paediatrics and Nursing interventions or Nursing care or Nursing support or best practice	Limiters - Publication Date: 20140101-20241231. English Language. Peer Reviewed Age: - child, preschool: 2-5 years Narrow by Subject Age: - infant: 1-23 months	60

4.10.2024	CINAHL (Ebsco)	‘’Intensive Care Units’ ‘OR "Intensive Care Units, Pediatric" OR "Respiratory Care Units OR "Respiratory Tract Infections OR Pediatric Critical Care Nurses’’ OR "Pediatric Critical Care Nursing" OR "Intensive Care Units, Neonatal" OR "Respiratory Care AND respiratory tract infection or rti or respiratory infection AND pneumonia or respiratory tract infection AND icu or intensive care unit or critical care) NOT’’ covid-19 or coronavirus or 2019-ncov or sars-cov-2 or cov-19 or pandemic ‘’ NOT influenza	Date: 20140101-20251231; Peer Reviewed; Language: English; Age Groups: Infant: 1-23 months, Child, Preschool: 2-5 years	92
5.10.2024	CINAHL (Ebsco)	Respiratory Tract Infections" AND (peadiatric or child or children or pediatric or pediatrics) AND (treatment or intervention or therapy)	Date: 2014- 2025. English Language Peer Reviewed infant child, preschool: 2-5 year	315
5.10.2024	Nursing & allied health database (ProQuest).	title(respiratory tract infection OR respiratory infection) AND (intensive care unit OR icu OR critical care) AND (pediatrics OR children OR infants) AND(infections OR respiratory syncytial virus OR viruses OR pediatrics OR respiratory tract infection OR mortality OR pneumonia OR children OR viral infections OR antibiotics OR respiratory diseases OR epidemiology OR respiratory tract OR hospitalization OR infants OR morbidity OR intensive care OR systematic review OR ventilators OR medicine OR ventilation)	NOT (influenza AND coronaviruses AND covid-19 AND respiratory tract diseases AND pandemics AND severe acute respiratory syndrome coronavirus 2 AND adults AND lung diseases AND epidemics AND older people AND bronchitis AND bronchopneumonia).	197

Table 1. Our searches

Articles used for review

Articles	author&year	Purpose	Method study	Results
1. Effective Evaluation on Nursing Intervention Based on Pediatric Early Warning Score for Pediatric Patient in the Respiratory Department.	Huang, L., Cheng, L., Sun, Y., Nian, F., Tao, T., Wu, J., & Ye, H. 2022.	Based on paediatric patients' PEWS scores, this study assessed the effects of nursing interventions.	retrospective analysis	The control group showed an increased incidence of unplanned PICU admissions, exacerbations, mean hospital days and hospital costs when compared to the observation group. The observation group exhibited reduced nursing time and a diminished error rate in nursing record completion when compared to the control group. Furthermore, satisfaction and assessment accuracy were significantly higher in the observation group.
2. Managing acute respiratory tract infections in children.	Bruce, C. S., Hoare, C., Mukherjee, A., & Paul, S. P. 2017.	To manage respiratory infection appropriately		Appropriate assessment and early diagnosis will guarantee that children with respiratory tract infections receive rapid treatment and have better overall results.
3. Nebulized hypertonic saline in children with bronchiolitis admitted to the pediatric intensive care unit	Stobbelaar, K., Kool, M., Kruijf, D., Van Hoorenbeeck, K., Jorens, P., De Dooy, J., Verhulst, S., & de Kruijf, D. 2019	To check the positive effect nebulised hypertonic saline had on children admitted to the PICU due to bronchiolitis.	A retrospective study	A total of 104 children admitted to the PICU for bronchiolitis were included, with an average age of 3.4 months. In patients with respiratory syncytial virus (RSV), using nebulized HS reduced the duration of respiratory support and length of stay.
4. Play Effects on Hospitalized Children with Acute Respiratory Infection:	Liu, M.-C., & Chou, F.-H. 2020.	To create therapeutic play that would lessen the stress reactions of young patients admitted to the hospital with severe respiratory infections.	Experimental design	The experimental group's children received therapeutic play, whereas the control group's children received standard nursing care. Compared to the control group, children in the experimental group had considerably larger decreases in their behavioural, psychological, and physiological stress responses.

5. Flexible Fiberoptic Bronchoscopy in Non-ventilated Children in Pediatric Intensive Care Unit	Sachdev, A., Gupta, N., Khatri, A., Jha, G., Gupta, D., Gupta, S., & Menon, G. R. (2023)	To analyze children adopting respiratory assist devices, the benefits of flexible fiberoptic bronchoscopy (FFB), and the effect of FFB on oxygenation and hemodynamics. research.	retrospective study	An efficient diagnostic and intervention-guiding tool in non-ventilated pediatric intensive care units (PICUs) is flexible fiberoptic bronchoscopy. Both oxygenation and hemodynamics showed notable but fleeting changes with no major consequences.
6. Viral Infections Among Patients with Acute Lower Respiratory Tract Infections in the Pediatric Intensive Care Unit.	Şık, G., Demirbuğa, A., Annayev, A., Cabiri, A., Deliceo, E., & Çıtak, A. 2020.	To determine the clinical features and viral pathogen frequency of patients admitted to the paediatric intensive care unit with an acute lower respiratory tract infection diagnosis.	Retrospective study	Children in pediatric intensive care units (PICUs) with severe illnesses usually have viral infections. When there is an underlying chronic disorders or co-occurring infections there is a high chance of increased hospital length of stay, morbidity, and death. Antibiotic usage that is not essential is reduced when viral infections are diagnosed early.
7. Use of airway clearance therapy in children hospitalized with acute lower respiratory tract infections in a South African paediatric hospital.	Corten, L., & Morrow, B. M. (2020).	to describe the characteristics and outcomes of children hospitalised with lower respiratory tract infections (LRTIs) and to investigate the role and impact of artemisinin-based combination therapy (ACT) in these children.	Retrospective review	Most of the children were admitted to ICU to treat broncholitis. 52.6% of patients had comorbidities at least once while during their stays in ICU. The airway therapy was done frequently. One child experienced lobar collapse an hour after therapy, and six children experienced transient oxyhaemoglobin desaturation. After that no other negative outcomes were mentioned.
8. Management of respiratory tract infections in young children.	Biezen, R., Brijnath, B., Grando, D., & Mazza, D. 2017.	The aim of the study is to explore the management of respiratory tract infection in children using a multidisciplinary approach.	Qualitative research	The study found that, the reason why primary care practitioner mostly failed to follow the guidelines, is because it was time constraining, the parents' concerns, the doctor's belief regarding the parents demands and expected pressure from parent and avoidance of patient loss.

9. Modified high-flow nasal cannula for children with respiratory distress.	Itdhiamornkulchai, S., Preutthipan, A., Vaewpanich, J., & Anantasit, N. 2022.	The purpose for this study is to evaluate the modified system's efficacy, safety, and nurse endorsement in comparison to the conventional commercial HFNC. .	Prospective comparative study	35 patients were placed in the commercial group, while 39 patients were placed in the modified group. There was no discernible difference in the two groups' intubation rates or adverse events. Nonetheless, nurses' satisfaction ratings were greater in the commercial group than in the modified group.