# Respiratory infections in children 0-5 years- A guidebook for nursing students

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The most common respiratory infections included in this thesis were the common cold, influenza, pharyngitis, laryngitis, epiglottitis, pneumonia, bronchiolitis, obstructive bronchitis, and ear infection (otitis media). Most of the infections included are very common which might affect children 2-3 times a year under 5 years. There are many respiratory infections which might affect children, but the infections were found in most of the research done by authors which strengthens the reliability of the sources.

In nursing studies both theory and placement are equally important. As a registered nurse, nurses can work in different health sectors and pediatric nursing is one of them. Pediatric environment can be both rewarding and challenging as mentioned in this topic 0-5 years children cannot express their feelings. It is necessary to have basic knowledge about the infections while going to placement.

The purpose of this thesis was to provide a guidebook for the nursing students, which describes children's most common infections in the upper and lower respiratory tract. The aim was to help the nursing students to deepen their knowledge and to make them familiar with the respiratory infectious diseases in children aged 0-5 years. The authors used a co-creation method for guidebook development by sharing ideas with the authors peer group and focus group method is used for the data collection, guidebook evaluation and improvement of the thesis writing process and guidebook.

The guidebook was produced in English language for nursing students who have not been in paediatric placement. The guidebook was created based on the theoretical framework of the thesis. The guidebook includes introductory words, common symptoms, home treatment, and when to seek treatment. The guidebook was provided to the school in PDF and Word format as requested by the thesis supervisors and is attached as a PDF format in this thesis.

The guidebook could be beneficial to other students, new nurses, and parents if it is further forwarded to the hospital.

*Keywords: Respiratory infections, students' knowledge, children, guidebook*

Table of Contents

# 1 Introduction

One of the most common infections in children is a respiratory infection in which virus and bacteria are the most ordinary causes. The most conventional symptoms are nasal congestion, sore throat, cough, breathing difficulties, runny nose. A respiratory infection caused by Rhinovirus is quite common in children and is self-healing as well. Among the several respiratory infections, ear otitis is the one which appears easily in small children. In children, Respiratory syncytial virus (RSV) causes infection in airways of lungs which might require hospitalization in babies. (Terveyskylä 2018 A.) According to Terveyden ja hyvinvoinnin laitos (2020), 4,383 cases of RSV infection was confirmed in 2019 and 60% of RSV cases were reported in 0 - 4 years old age groups. According to Bergroth, Remes et al. (2012), there are many factors considered to be the cause of respiratory infections like day-care, parents with a history of asthma and smoking, lack of breastfeeding, older siblings.

In this thesis, the authors have gathered information about common respiratory infections in children 0-5 years old and included basic knowledge about the infections. The reason behind focusing on 0-5 years old children is, every child in those ages expresses and explains their symptoms in different ways, especially if they are in pain. It is difficult to diagnose the disease based on symptoms only in young children. For example, it is challenging to evaluate breathing difficulty in a young child and nearly impossible to hear fine crackles in constantly moving children. (Heiskanen -Kosma & Jalanko 2019.) Most of the respiratory tract infections (RTIs) are self-limiting viral infections which gradually disappear with supportive management and time. However, for health care professionals it is important to identify any RTIs which may have serious impacts on children as well as required intervention. Nurses play an important role to provide support to not only children but also to the parents who are worried about their child's symptoms. Providing education to parents as well about the prevention of infections might reduce the risk of RTIs. (Paul, Wilkinson & Routley 2014.)

At the beginning phase of pediatric placement, the authors felt the lack of knowledge about respiratory infections. Authors knew some of the common symptoms of the infections before the pediatric placement in the neonatal ward where most of the children were hospitalized due to respiratory infections and realised that it could be better to know more about the managing the symptoms and treatment of the infection before the placement. Authors were researching a tool that can help to fill the gap of the knowledge while doing this thesis, so authors decided to create a guidebook.

This thesis will act as a guidebook for Laurea nursing degree students who have not yet done paediatric placement. The English language is chosen by authors to create a guidebook so that international/exchange students can easily understand. The guidebook is based on evidence-based research which is from books, articles, and trusted websites such as käypä hoito, Mayo Clinic.

The purpose was to provide a guidebook about common respiratory infection for nursing students. The main aim of this thesis was to provide proper knowledge to nursing students which helps them to develop existing knowledge, skills about respiratory infections and guide them to manage the situation without any confusion before their paediatric placement.

# 2 Theoretical background

## 2.1 Children's common respiratory infection

Respiratory infection is divided into two groups: upper respiratory infection and lower respiratory infection. Acute respiratory infections are usually caused by the common cold, which commonly affects the sinuses, airways, or lungs. Symptoms of respiratory problems differ in the kinds of infection a child is suffering from. Some infections have minor symptoms, and some have severe symptoms. Usually, the respiratory infection starts with the runny nose, headache or sometimes fever. But those symptoms can be easily unseen in small children who are below two, as they can neither show nor explain the discomfort. This might lead to pneumonia for many children. (NHS 2018 A.)

The upper respiratory infection affects the upper respiratory tract of the body for both children and adults which includes the mouth, nose, throat, ears, sinuses, and trachea. Usually, children get an upper respiratory infection in winter. (Drugs.com 2020; emedicinehealth 2020.) The lower respiratory infection affects the airways below the larynx (Fletcher 2019).

According to The Finnish student health service (2019), 15 - 30% of children suffer from seasonal flu. Per year 3,5 - 4% of children under 5 years suffer from x-ray verified pneumonia. 50% of children under 5 years are treated in hospital suffering from pneumonia. (Heiskanen-Kosma & Jalanko 2019.) In 2014, more than 130,000 visits were made to health centres due to acute otitis media. Almost 70% of children under 2 years suffer from an ear infection at least once. (Käypä Hoito 2017.)

Authors have chosen below mentioned and described common upper respiratory and lower respiratory infections in children through different internet sources and previous thesis.

### 2.1.1 Upper respiratory infections

Upper respiratory infection includes common cold, ear infection, laryngitis, pharyngitis and epiglottitis (NHS 2018 A; Muhonen, Körkkö & Lehtinen 2018).

An ear infection is counted as an upper respiratory infection because the middle ear is connected to the upper respiratory tract by a tiny tube which is also called the Eustachian tube. Ear infection is a very common complication of other infections like common cold, influenza, pneumonia. (Mayo Clinic 2019 B.) An upper respiratory infection can be caused by many different viruses and most of these viruses are caught by touching the things that contain viruses. Upper respiratory tract infections are diagnosed by looking at the symptoms and treated according to the severity and cause of the infection. The symptoms of upper respiratory tract infections (URTIs) can be managed by providing enough liquids, having the child rest, clearing the mucus from the child's nose and by other methods too. The symptoms of common cold and influenza are similar due to which it is easier to get confused but the symptoms of influenza are severe than common cold. Some of the upper respiratory infections are treated using antibiotics. (Drugs.com 2020; Centers of disease control and prevention 2020.)

Majority of upper respiratory infections are caused by viruses where Rhinoviruses cause 25-30% of infection; respiratory syncytial viruses (RSVs), influenza virus, human metapneumovirus and adenovirus causes 25-35% of infections and others are unidentified viruses (Simones, Cherian, Chow et al., 2006).

#### 2.1.1.1 Common Cold

Common cold is a viral infection that affects the child's nose and throat. It is usually caused by a variety of viruses, among which Rhinoviruses are the most common. The child becomes immune to the virus, once infected, but since the common cold is caused by many viruses the child suffers from cold several times a year. Normally the common cold lasts up to 7-12 days. (Mayo Clinic 2019 A; Tunturi 2020.)

Symptoms of the common cold vary person to person. Most common symptoms that almost every child experiences are a blocked or runny nose, throat pain or pain while swallowing and coughing. Other symptoms may include nasal congestion, fever, sneezing and coughing, difficulty sleeping, and some might experience joint pain. The nasal discharge is mostly clear in the

beginning but might become thicken and turn yellow or green. (NHS 2017 A; Mayo Clinic 2019 A)

No medical cure has been introduced to treat common cold due to which every symptom is treated separately. Antibiotics do not help to cure the infection caused by viruses. Treatment involves easing the symptoms of a child by giving them enough liquid, making the child comfortable to breathe by keeping their nasal passages open and keeping the air moist. The medication of cough and cold should be avoided as much as possible since it is not safe for babies and young children. The child should be seen immediately by the doctor if a common cold lasts for more than 2 weeks and fever lasts for more than 3 days to make sure that any other illnesses are not present such as pneumonia or other serious illness especially in the case of new-borns, the child has breathing difficulty, difficulty in eating and drinking, and the infant less than 3 months old has a fever. (Mayo Clinic 2019 A; Tunturi 2020.)

The common cold is caused by a virus, due to which it spreads from person to person easily. The common cold is transmitted by germs from coughs and sneezes (NHS 2017 A). If the child is attending day-care, they should be staying home until the symptoms are gone and they can play normally as well be involved in activities in day-care without any special care (Terveyskylä 2018 B). Common cold can be prevented by good hand hygiene and using tissue while coughing and sneezing (NHS 2017 A).

#### 2.1.1.2 Influenza

Influenza is an upper respiratory infection but if not treated on time then it might affect lower respiratory systems which might cause serious infection. Influenza is the inflammation of the respiratory tract caused by influenza viruses. Influenza viruses are of three types A, B and C. A and B viruses cause epidemic illness which often leads to hospitalization whereas C virus causes mild respiratory illness. Often the virus spread from child to child through coughing and sneezing. The incubation period of infection is 1-3 days before the outbreak of symptoms. (NHS 2019; Terveyskylä 2018 C.) Children younger than 2 years old are at a high risk of developing serious complications related to influenza (Centers for disease control and prevention 2020).

It is difficult to distinguish influenza from other respiratory infections from the symptoms only due to which different laboratory tests are preferred. The symptoms of influenza normally last for a week but the child may still feel weak and cough for a longer time, normally 1-2 weeks. Symptoms include high fever, chills, muscle aches, joint pain, headache, runny or dry nose, coughing and sore throat. (Lumio 2020.)

If the child is suffering from influenza, treatment can be done at home by keeping the room temperature cool to reduce the fever. Plenty of liquid containing salt and sugar such as juice can be given because a lot of fluid is wasted due to fever and vomiting. The child should be provided with enough liquid and the liquid consumption target depends on the child's weight. The focus of treatment is to give relief to a child from fever as the child usually has a high fever. But if fever is not down until the next day or in 2 days then the child should be taken to the hospital. Medical treatment includes antiviral medicines. The antiviral medications normally used to treat influenza are oseltamivir (Tamiflu®) but should be administered only with a doctor's prescription. (Terveyskylä 2018 C; Lumio 2020.)

The possible serious complications of influenza include dehydration, seizure, chest pain, and worsening of chronic disease. Otitis media is the most common complication which occurs in about 40% of children less than three years old. The child should be taken to hospital as soon as the signs of complications are seen. The child starts to shake, lose consciousness and the body becomes stiff if they start to have seizures due to which child should be placed in a safe environment to prevent injury. Any foreign object in the airways should be removed to prevent breathing difficulty. The consciousness of the child should be observed closely. Enough amount of liquid should be administered per oral or intravenously to manage dehydration. (Heikkinen 2020; World health organization 2013; Centers of disease control and prevention 2020.)

The child should be taken to be examined by health care professionals if they have high fever lasting for more than five days, the symptoms seem to reappear, the condition of the child looks worse than it was when the symptoms appeared and especially if the child is less than 3 months old (Terveyskylä 2018 C).

Influenza can be prevented by influenza vaccine which also provides protection from its secondary diseases including ear infection, bronchitis, pneumonia. The child aged between 2 to 6 years old receives a nasal spray influenza vaccine which provides 90% of protection to healthy children after two doses. (Lumio 2020; THL 2020 B.)

#### 2.1.1.3 Ear infection / otitis media

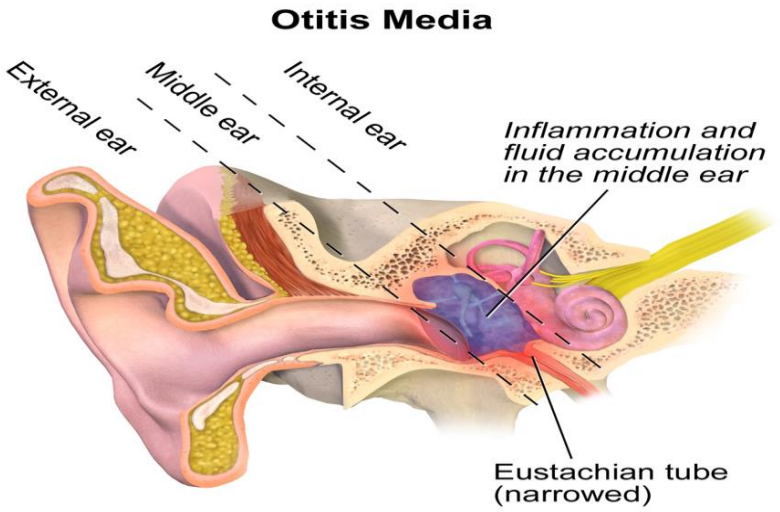


*Figure 1- Otitis media (BruceBlaus, CC BY-SA 4.0)*

An ear infection is also known as otitis media which is an infection in the middle ear which is very common in infants and young children. Ear infections which do not cure for a long time or come back frequently are chronic ear infections. It is mainly caused by bacteria or viruses. Pneumococcal, Hemophilic and Branhamella bacteria are the causes in 70-90% of ear infection cases. Ear infections are also caused by upper respiratory infections, common cold and influenza. Ear infections are most common in children aged 6-24 months where the peak incidence is at the age of 10-12 months. (Käypä hoito 2017.) According to Jalanko (2019 A), about 40% of children under 1 year and 70% until the age of 2 years have had at least one otitis media.

Rhinitis and cough are the same symptoms as common cold which occur in children with an ear infection. Every child might not get a fever as an ear infection symptom. Some children also have conjunctivitis of the eye, which means that the eyes become red and flaccid. Other symptoms of an ear infection include ear pain, trouble hearing or responding to sounds, drainage of fluid or pus-like secretion from the ear, trouble sleeping due to pain. The younger children may not be able to express the symptoms of ear infection, even if the ear is sore, they might show signs such as not touching their ear, being restless at night and irritability. (Jalanko 2019 A; Tarnanen, Heikkinen & Laukkala 2017.)

Usually, otitis media is diagnosed by physical examinations, medical conditions and inspecting the ear using an otoscope (pneumatic otoscope). Sometimes a small puff of air from the otoscopes is blown to check for blockages. (NHS 2018 B.)

The treatment depends on the individual child's general well-being, an ear infection might normally resolve without any antimicrobial treatment. The main priority of treatment is to ease ear pain and reduce fever. If a child is having a mild symptom then antibiotic treatment is not started first, the child will be closely monitored for a few days and a new medical examination is taken to see whether ear infection is healing or not. Antibiotics like amoxicillin or amoxicillin-clavulanic acid is recommended as the primary drug for the child. If a child is unable to swallow the medication or vomited, then antibiotics are given. Pain medications, anti-inflammatory drugs and ear drops are used for the treatment. It is recommended to administer pain medication to children with a doctor's prescription especially to a child < 3 months old. The pain medication usually has age and weight restriction. (Tarnanen, Heikkinen & Laukkala 2017.)

Ibuprofen and paracetamol are the common pain medication and Naproxen is a prescribed medicine for pain management. Paracetamol can be given 15mg/kg/dose 3-4 times a day in the interval of 6-8 hours. Ibuprofen can be given 10mg/kg/dose 3 times a day in the interval of 8 hours to children more than 3 months old and 5kg weight. Naproxen can be given 5 mg/kg/dose max 2 times a day to children more than 12 months old. Paracetamol may be combined with ibuprofen or naproxen to ease the symptoms, but ibuprofen and naproxen cannot be administered at the same time as it increases risk of side effects in gastrointestinal tract. (Käypä Hoito 2017; Terveyskylä 2018 C; Klockars, Ruohola, Heikkinen & Puhakka 2019; Drugs.com No Date.)

The surgical procedure is also indicated to treat AOM if otitis media occurs frequently, symptomatic eustachian tube dysfunction, approaching complication of AOM like facial paralysis, Labyrinthitis (inner ear disorder) and mastoiditis (a serious bacterial infection which affects mastoid bone around the inner and middle ear) and middle ear effusion for too long. The surgical treatment option includes Tympanocentesis, Myringotomy, Myringotomy with the insertion of tympanostomy tubes, Adenoidectomy, and Eustachian tube surgery. (DeRosa & Grundfast 2002.)

Once acute otitis media (AOM) is diagnosed, and treatment is started it is good to do the follow-up. The follow up helps to minimize the risk of possible complications. If not treated it might lead to damage of the middle ear, permanent hear loss, infection of the tissue surrounding the brain. (Käypä hoito 2017.)

The child should be taken to the doctor if AOM occurs frequently which is 3 times in 6 months or 4 times in 12 months, middle ear effusion for more than three months, pus secretion from the ear, swelling around-ear. The children having prior hear impairment might and children less than 3 months are at the high risk to develop complications due to which immediate contact

to health care professionals should be done as soon as the symptoms are seen. (Klockars, Ruohola, Heikkinen & Puhakka 2019.)

#### 2.1.1.4 Laryngitis

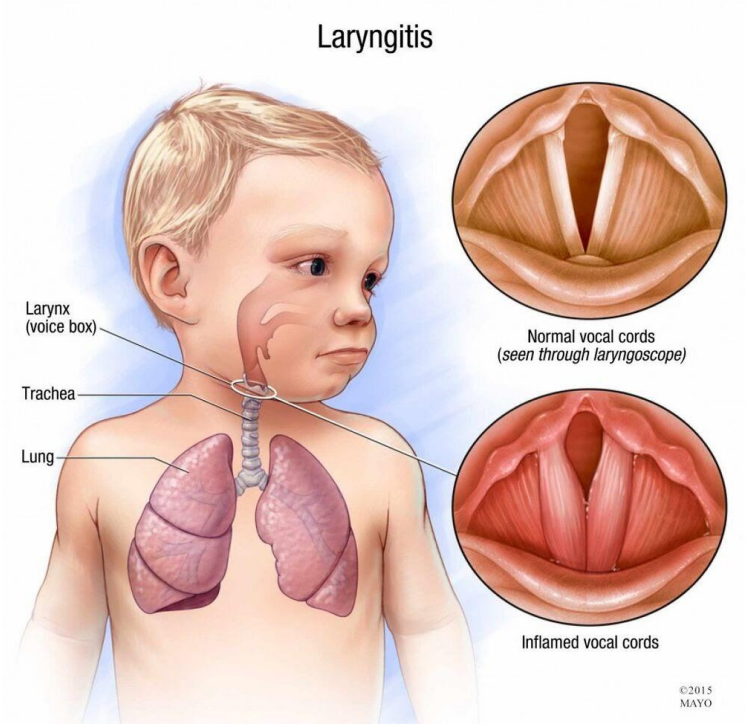


*Figure 2 - Normal and inflamed vocal cord (Used with permission of Mayo Foundation for Medical Education and Research, all right reserved)*

Laryngitis is an inflammation of the voice box or larynx that is often associated with the swelling of the mucous membranes and subglottic stenosis and causes the voice of the child to become rough or thick. It is a viral infection and due to some reason more common in boys than girls. Most of the cases of laryngitis are not serious and activated due to temporary viral infection. It may be acute or chronic and last about 2 weeks. (Mayo Clinic 2020 A.)

Children from 6 months to 3 years aged are likely to get laryngitis. Mostly about 5% of children are diagnosed with laryngitis during the second year of life. Laryngitis is often started with respiratory infection symptoms for 1 to 2 days and children might get difficulty breathing often at night-time. (Jalanko 2020 A.)

During laryngitis infection, children react differently. Some may only suffer a runny or blocked nose whereas others can get other serious symptoms such as hoarse voice, sore throat, losing their voice, fever. Laryngitis caused by influenza virus has more severe symptoms than usual;

some children rarely get breathing difficulty as a symptom. Coughing may continue for a few weeks to the children who have suffered from laryngitis. (NHS 2017 B; Vaasan keskussairaala 2020; Heiskanen-Kosma & Jalanko 2016.)

Laryngitis is caused by a virus, so it cannot be treated with an antibiotic. Most of the time laryngitis is treated at home. If the child is being treated at home, the important part is the elevated position and calming the crying child since crying increases the irritation of the larynx. Breathing cool air reduces the swelling and steam inhalation makes the breathing easier. The child should be brought to the hospital if they feel anxious, breathing difficulties. 85% of children have mild laryngitis and are treated at home. (Jalanko 2020 A.)

Child should be taken to the doctor if the child has difficulty breathing which continues for several hours and the child wheezes, cough and fever lasts for more than 3 days, the child's skin is turning pale and lips blue, the child is extremely tired. In the hospital, vaporized Adrenaline is administered as a first aid to reduce the swelling of the larynx and ease breathing. In addition, Cortisone is administered orally or intramuscularly according to the doctor's prescription. Almost 1–5% of children, who are having shortness of breath as a laryngitis symptom is admitted to the hospital for a few days to monitor. (Jalanko 2020 A.) In severe inspiratory difficulty, racemic adrenaline (0.5 - 1 mg/kg) can be administered over 10-15 min with nebulizer since the difficulty might recur after 1-2 hours. The doses depend on the child's weight and should be further diluted in 2-3ml of 0.9% NaCl before administering through a nebulizer. (Heiskanen-Kosma & Jalanko 2016.)

#### 2.1.1.5 Pharyngitis

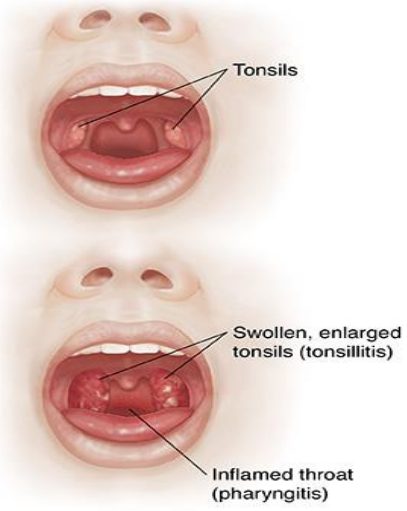


*Figure 3 - Normal tonsils vs Tonsillitis and Pharyngitis (Source: Mount Nittany health)*

*Figure 4 - Streptococcal Pharyngitis (Heilman James, CC BY-SA 3.0)*

*Figure 5 - Viral pharyngitis (Dake, CC BY-SA 2.5)*

Pharyngitis is redness, pain, and inflammation of the tissues in the throat which feels more painful while coughing and swallowing. Pharyngitis is caused by viruses or bacteria. Viral pharyngitis is caused by a virus-like cold or flu. Bacterial pharyngitis is caused by group A streptococcus (Streptococcus pyogenic) bacteria. Pharyngitis which is caused by the bacterium streptococcus is also known as angina. Actual pharyngitis is when throat pain and fever occur without other significant respiratory symptoms. It is transmitted through direct contact and by the droplet infection. (Jalanko 2020 B.)

It is easier to get confused between Pharyngitis and Tonsillitis as they both share common symptoms. However, when the pharynx between tonsils and voice box is affected it is pharyngitis and when the tonsils are affected it is tonsillitis. If the child has inflammation of pharynx and tonsils at the same time it is called Pharyngotonsillitis. (Boston children's Hospital No date.)

Pharyngitis is diagnosed by physical examination and with the signs and symptoms. However, a throat swab is taken to detect streptococcal bacteria. The symptoms of pharyngitis vary on the

cause. The symptoms include sore throat and pain while swallowing. The viral pharyngitis symptoms are red throat, dry cough, redness in eyes, diarrhoea, runny and stuffy nose while bacterial pharyngitis shows the symptoms like white spots on the tonsils, abdominal pain, headache, nausea vomiting, mandibular lymph nodes are enlarged and tender. (Harvard Medical School 2020; Jalanko 2020 B; Käypä hoito 2017.)

Pharyngitis is treated according to the cause; the viral infection usually doesn't require medical treatment. Pain medications like ibuprofen are prescribed as well as drinking warm water could help to relieve the pain and to ease the symptoms. The bacterial infection requires antibiotics for the treatment. A child has to Visit a doctor if a child gets a high fever and very strong throat pain, difficulty in breathing, if a family member has been diagnosed with the same infection and child gets high fever at the same time and also if antibiotics prescribed earlier do not lower the fever and reduce the pain. The commonly used antibiotic is Penicillin (66mg/kg/day) or amoxicillin (50mg/kg/day). Cephalosporin is used if the child is allergic to penicillin. The evidence has been found recently that 3-6 days of cephalosporin antibiotic treatment is as effective as long-term penicillin treatment. (Jalanko 2020 B; Harvard medical school 2020; Nokso-Koivisto & Mäkelä 2020.)

Good hand hygiene should be followed to prevent and minimize the transmission of pharyngitis. A child diagnosed with bacterial pharyngitis should not return to day-care or school until antibiotics are taken for over 24 hours and symptoms are improved. The child should not be sharing their food or toys. The pacifier and toys chewed or sucked by the toddler suffering from pharyngitis should be washed, disinfectant and rinsed. (Harvard medical school 2020.)

Child should be taken to health care professionals if the fever does not go away in three days after starting antibiotics, the child has breathing difficulty, sore throat which is the same or worse for more than 3 days, high fever and extreme throat pain but no other symptoms (Jalanko 2020 B).

#### 2.1.1.6 Epiglottitis

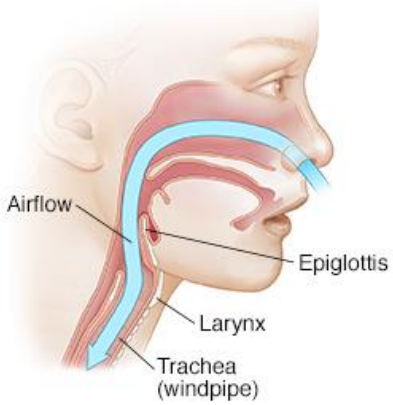


*Figure 6 - Normal epiglottis (Source: Lakeland ear, nose and throat)*

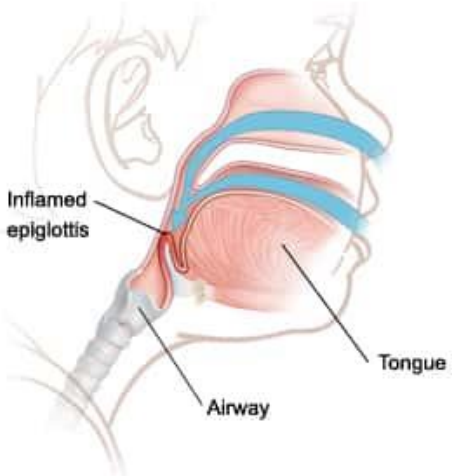


*Figure 7 - Inflamed epiglottitis (Source: Nurselab)*

Epiglottitis is the inflammation and swelling of the epiglottis, which is a small cartilage covering the windpipe to prevent food from entering the airways while eating. It is a life-threatening condition as the tissue in the epiglottis blocks the airways when it is infected and swells. It is usually caused by bacteria called Haemophilus influenzae type B (Hib) or can also be the result of the injury. (NHS 2018 C; Mayo Clinic 2020 B.)

Symptoms of epiglottitis usually develop rapidly and worsen abruptly. The main symptoms young children have breathing difficulties, stridor and a hoarse voice, other Symptoms include severe sore throat, pain and difficulties while swallowing, high fever, difficulty speaking, drooling and anxious, restless behaviour. (NHS 2018 C.) If the epiglottis is suspected, checking the

child's breathing and oxygen saturation is the priority. It is diagnosed by throat examination, neck x-rays, blood test and throat cultures. (Mayo Clinic 2020 B.)

Epiglottitis cannot be treated independently at home and should be taken to the hospital as soon as epiglottitis is suspected to prevent possible complications. A child must be put in the position he or she prefers but the child should not be lied down as it might aggravate the suffocation feeling. Children are admitted to the hospital to treat epiglottitis where priority is to secure the airways. Children are delivered oxygen if needed through an oxygen mask, intubation. Antibiotics like Ceftriaxone are mainly used to treat, and fluids are given through the IV line to prevent dehydration. A child might feel better or help in breathing when sitting up or leaning forward. (Klinik 2020; Terve Media oy 2013.)

Epiglottitis can block the airways completely, causing complications like spreading an infection to other parts of the body, respiratory failure. If the child goes into respiratory failure, the child shows the symptoms like rapid breathing, breathing difficulty, confusion, cyanosis (bluish skin colour, fingertips and lips). The aim of treatment acute respiratory failure is to ensure sufficient gas exchange in the body. The treatment option includes oxygen therapy by using venturi mask or nasal cannulas, mechanical ventilation, continuous positive airways pressure (CPAP), intubation and invasive respiratory treatment. (Mayo Clinic 2018 B.)

In Finland, children have been vaccinated against (DTaP-IPV-Hib) since 1993. The vaccine is part of the national vaccine which is given at the clinic when a child is 3, 5 and 12 months of age. If a child is not born in Finland and if he/she has good enough doses of other vaccination, then separate Hib vaccination is provided to children under 5 years age. Epiglottitis is currently low in Finland, but it can be still found especially among immigrants and unvaccinated Finnish children. (THL 2020 A; Klinik 2020.)

### 2.1.2 Lower respiratory tract infections

Lower respiratory infection usually occurs in the lungs and in the airways. Lower respiratory infection includes Bronchitis, Bronchiolitis, and Pneumonia. Viruses are the most common cause of lower respiratory tract infections. The main viruses that cause lower respiratory infection in children are rhinovirus, RS virus (respiratory syncytial virus). Children who are under 1 year the main cause of the infection is RS virus and children over one-year is rhinovirus. The common symptoms of lower respiratory infections are wheeze, cough, fever, sore throat, breathlessness. It is treated according to the cause of infection by antibiotics or antiviral drugs. The lower respiratory infection lasts longer and can be more serious than upper respiratory infection. (NHS 2018 A.)

#### 2.1.2.1 Obstructive bronchitis

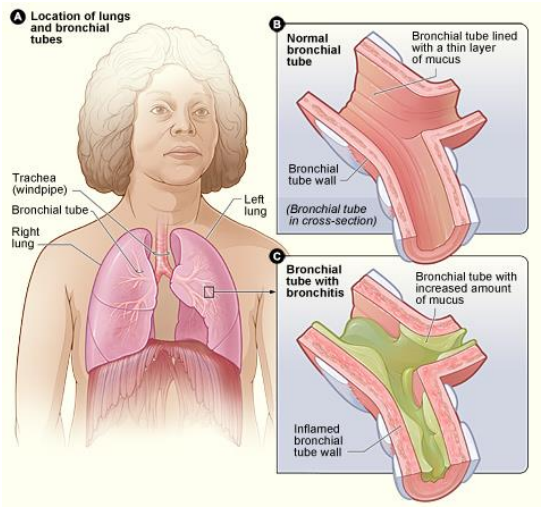


*Figure 8 - Normal bronchial tube and increase in bronchial mucus (Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services)*

Obstructive bronchitis is a viral infection which is most commonly caused by rhinovirus and respiratory syncytial virus. Obstructive Bronchitis causes inflammation of the large breathing tubes in the lung which is known as bronchi. The children who suffer from bronchitis, their bronchial mucosa swells and causes difficulty in exhalation. Obstructive bronchitis is mostly referred to as an exhalation difficulty in children 1 - 3 of year's age which is triggered by an acute viral infection. It can be developed if a child has an upper respiratory infection. Sometimes obstructive bronchitis might progress to asthma. Children under 2 years of age have less risk 25 %- 30 % of developing asthma whereas, 3 or above has more risk it is about 50% later on age due to obstructive bronchitis. (Käypähoito 2015; Peiser 2012; Terveyskylä 2018 D.)

Symptoms of obstructive bronchitis include coughing, breathing sounds, whistling, or wheezing, difficulty exhaling, fever, flu. It is diagnosed by doing a physical examination, chest X-ray, chest CT scan, pulmonary function tests; the test includes the measurement of gas exchange, lung volume, capacity, and rate of flow. (Terveyskylä 2018 D.)

When a child starts showing the symptoms, home treatment can be started which includes plenty of rest, relieving blocked nose with nose drop (saline nasal spray or drop), positing the children in the way that breathing is easier. Honey can be used to alleviate the cough. Rubber suction bulbs can be used to clear the mucus. The treatment varies according to the cause, symptoms, age, general health condition and severity. Obstructive bronchitis is mostly caused by viruses and cannot be treated by antibiotics. In some cases, the cause might be bacteria

too. If it is caused by bacteria then an antibiotic is given. Otherwise, primary medicine such as paracetamol, ibuprofen is given. If the child has shortness of breath, drugs are administered using a nebuliser to relieve the condition of the child. Salbutamol inhalation eases the acute expiratory difficulty caused by viral infection to children less than 2 years. (Terveyskylä 2018 D; Jalanko 2019 B.)

The child should be seen by doctors immediately if they have breathing difficulty, breathing is dense and laborious, the child coughs blood, difficulty in eating and drinking, wheezing breath and whistling sound while breathing. If the child is having mucus cough that lasts for several weeks although the child is receiving antibiotic treatment. It is very important to take the child to the hospital for follow up after the antibiotic is started. In some of the cases, asthma medicine is also prescribed which helps to stop cough within a few days. (Terveyskylä 2018 D; Jalanko 2019 B.)

#### 2.1.2.2 Bronchiolitis

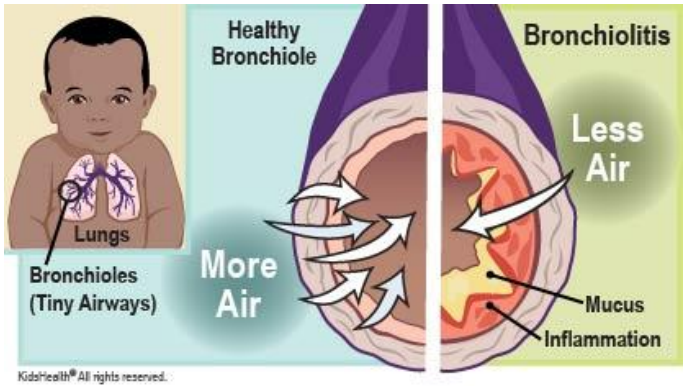


*Figure 9 - Healthy bronchiole and bronchiolitis (© 1995-2020. The Nemours Foundation/KidsHealth®. Reprinted with permission.)*

Bronchiolitis is the most common infection in Finland, which leads to approximately 3 % of children hospitalized. Bronchiolitis is inflammation of small airways which branch off to bronchi. It is a common respiratory infection in children under 1 year of age which is caused by a respiratory syncytial virus (RSV). Other causes are rhinitis- and enteroviruses and metapneumovirus. Bronchiolitis usually begins as an upper respiratory tract infection but in a few days, it affects lower respiratory tract infection and can be life-threatening if not treated on time. (Terveyskylä 2018 E; Korppi & Eskola 2012; Käypä hoito 2015.)

The first symptoms that are seen in bronchiolitis are quite similar to common colds such as a runny nose and a cough. Other symptoms which develop slowly include coughing, increased heart rate, too tired to eat food, excessive mucus production, shortness of breath, shallow breathing, wheezing sound. Bronchiolitis is transmitted very easily but can be controlled or prevented by good hand hygiene. (NHS 2018 D; Terveyskylä 2018 E.)

Bronchiolitis is usually identified by observing a child and listening to the lungs with a stethoscope. Child under 1-year-old bronchiolitis is diagnosed by looking for symptoms such as the child is tired and eats poorly. (Korppi & Eskola 2012.)

There is no specific medical treatment to treat bronchiolitis. The child should be taken to hospital if they have breathing difficulty, the breathing is laborious and wheezing, difficulty while eating and drinking, the skin is turning pale and lips blue and children less than 3 months old have a high fever. During the hospital care, the condition is relieved by administering humidified oxygen to maintain the oxygen level, enough fluid is provided peroral or intravenously to prevent dehydration, excessive mucus from nose is sucked out using rubber suction bulb to prevent the blockage. The infection usually heals within 1-2 weeks without the medical treatment at home with supportive care, but the child is recommended to be hospitalized as it infects very little children. (Terveyskylä 2018 E; Käypä hoito 2015.)

#### 2.1.2.3 Pneumonia

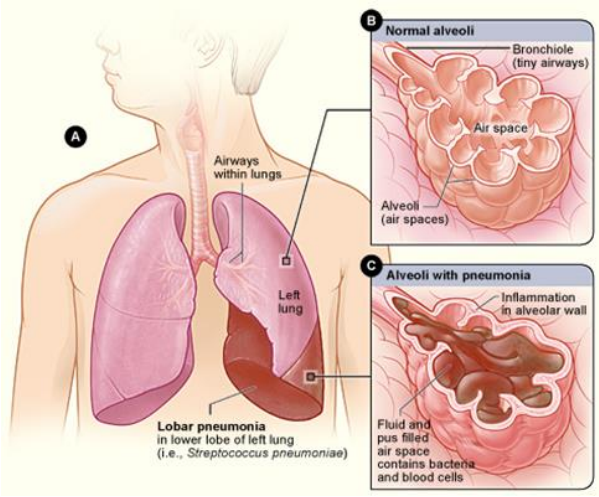


*Figure 10 - Figure A shows affected part of lungs, B shows healthy alveoli sac and C shows alveoli filled with mucus when infected by pneumonia (Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services)*

Pneumonia is a very common infection of lungs caused by bacteria, virus or fungi. The alveoli, small sacs in the lungs are filled with fluid and pus if the person is suffering from pneumonia. The most common bacterial causes of pneumonia are Streptococcus pneumonia and mycoplasma pneumonia, the viral causes are rhinovirus, respiratory syncytial virus. In Finland, less than 4% of children suffer from pneumonia each year. (Käypä hoito 2015; Jalanko 2019 C.) According to the World Health Organization (2019), almost 15% of children under 5 years old have died in 2017.

The symptoms of pneumonia are almost the same as for other respiratory tract infections. The symptoms of viral pneumonia can be more than that of bacteria. Signs and symptoms vary according to the cause, age. New-borns and infants might not show a sign of infections. Common symptoms include fever, cough, tiredness, shortness of breath, chest pain while coughing, nausea, vomiting, and diarrhoea. Pneumonia may spread via air-bone droplets and through blood during or shortly after birth. Pneumonia can be diagnosed by assessing the breathing, presence of fast breathing, chest wall retracts while inhaling or by taking chest x-ray of the child. A blood test is done to see the infection level. (Jalanko 2019 C; World Health Organization 2019.)

Children are usually hospitalized to treat pneumonia and antibiotics are administered intravenously if the child's condition is severe and is less than 2 months old. Oral antibiotics with the home treatment are safe if the child is more than 6 months old and the condition is stable. Penicillin or amoxicillin is the first preferred antibiotic for the treatment of children with pneumonia. If the child is suspected to suffer from Mycoplasma pneumonia, then macrolide is added in the antibiotic treatment. If the child does not get better in 48 hours after the antibiotic treatment is started, then the child is suspected to suffer from complications of pneumonia. (Käypä hoito 2015, Jalanko 2019 C.)

The children should be taken to hospital if parents suspect that the child is tired, fever and cold continues for more than five days or gets worse, has breathing difficulty, the skin starts to turn pale or lips are blue (Terveyskylä 2018 F).

In Finland, a vaccine against pneumococcus has been given to children since 2010. Small children under 5 years of age are more susceptible to pneumococcal disease that is why they are offered a 10-valent conjugate vaccine (Synflorix) as part of a national vaccination program in Finland. After vaccination has been developed the number of positive pneumococcal infections has been reduced in children under 5 years. Good hygiene and keeping children away from a common cold can also help to prevent children from pneumonia. (Käypä hoito 2015; THL 2019.)

## 2.2 Nursing students and pediatric placement

The main targeted group of this thesis is degree nursing students, especially those who are about to go to their paediatric placement. Before going to the paediatric placement, some theory lessons and some workshops are held in school which provide basic knowledge to the students about some respiratory problems.

In nursing studies, theory and placement are both the most important. As being registered nurses, nurses can work in different health sectors and paediatric nursing is one of them. The practice of nursing in the paediatric environment can be both rewarding and challenging. The paediatric placement of nursing students is a large and important part of nursing student training for the development of knowledge, skills and change of attitudes and behaviour regarding the care of children and family members. Placement teaches students a new set of skills and knowledge and ultimately gives an experience that a student won't know by struggling in the classroom. Before placement theory studies are very important to know the basic knowledge about children's health. (Dafogianni, Alikari et al., 2015.)

Nursing student knowledge should be up to date before entering the practice placement. Theory knowledge helps to develop the abilities to learn, deepen their knowledge and to meet the requirements of the practice placement. The ways of learning are different depending on the learner's ability to learn and to become a balanced learner. Nursing students must be able to learn by act as well as broaden their knowledge theoretically to meet the requirements of the nursing profession. (Holmberg, Stisen, Grau & Neilsen 2018.)

Authors are hoping that the guidebook may not only make the nursing students more prepared for the paediatric placement but also enable nurses to make the parents aware of the vaccinations and infections in children if needed. Among several viral respiratory infections, only influenza can be treated by antiviral medication and protected by vaccines (Terveyskylä 2018.) The authors believe that the guidebook will be very helpful to make nursing students obvious and less anxious before their paediatric placement. The guidebook includes basic knowledge about the necessary information in simple and understandable languages and sentences for everyone who chooses this guidebook to study but authors are more focused on international degree nursing students.

## 2.3 Guidebook

A guidebook can be in a different format such as, online book or app, small book and PDF format which gives useful information about a particular subject and answers the questions of the target group. A good guidebook should define who the guidebook is being made for, short and

useful information that is easy for the reader to identify with, up to date information about the subject and valid link to find out further information about the subject if needed. (Oiva 2017.)

# 3 Purpose and aim

The purpose of this thesis is to provide an English guidebook to the nursing students of Laurea degree program about common respiratory infections in children age between 0-5 years using simple and understandable language.

The aim is to provide evidence-based information for nursing students to help them increase their knowledge about respiratory infections, which also helps to be familiar with the assessment, treatment and severity of the respiratory infection and other actions needed to be taken when a child suffers from an acute respiratory infection. This guidebook will also suggest the nursing students gain the proper knowledge related to children's respiratory infections before going to the paediatric placement and reduce the confusion and anxiety about the situation of children.

# 4 Research method

Research is all about finding the answers to the questions and the facts by experiment, comparison, and observation. Research is done to understand and identify the social and physical phenomena as well as increase the knowledge in a related field. Research is a process to gather information, examine problems, organize, and evaluate data. Research is a scientific method to gain the exact information. (Kumar 2011.)

The authors used a co-creation method for guidebook development by sharing ideas with authors per group and focus group method is used for the data collection, guidebook evaluation and improvement of the thesis and guidebook writing process.

## 4.1 Co-creation method

Co-creation method is defined as the collaborative development of new concepts together by customer and service providers. The co-creation follows the approach of involving different perspectives, and materials, activities, processes, or strategies which are collaboratively designed. (Tong, Zhang, Demirel et al., 2015; Feichtinger, Schrammel 2018). Co-creation is a tool to promote innovation and improve customer satisfaction. It recognizes that the success of any business depends not only on the service provider’s assets, core capabilities and expertise, but

also on the target customer's knowledge and perspectives. It brings people from different backgrounds and expertise to make creative output. (Makhni 2017; Westen & Dijk 2015.)

Co-creation method in this thesis is presented in this way. The authors first created and presented the guidebook as a draft for the authors' peer group and lecturers at a thesis seminar. Feedback was provided during the seminar, based on which the authors created a final version. During the thesis seminar, nearly 10-15 participants were present among which two were thesis supervisors and others were nursing students. 5 or 6 nursing students including supervisors provided feedback about the guidebook. Most of the students were in their final year of study and some were in their second year. Feedback received from students was some correction in language, medicine name, many said the guidebook looks informative. Among the feedback giver two had already been to their pediatric placement who shared their own experience and suggested adding a bit more information on infections and medicine. After these comments and feedbacks authors did the correction on language, added more information about infections and recommended doses which can be administered without doctor's prescription at home. This final version was shared with the thesis supervisors and peers again. One written feedback from a peer and comments were received from thesis supervisors on final revisions. In addition, the guidebook was given to non-nursing field readers to comment on the language used in the guidebook. Feedback received from non-medical readers as the guidebook is informative, easy to read and understable language. The final guidebook was developed based on these final revisions.

## 4.2 Data collection method

In nursing research, focus groups have been increasingly used as data collection tools. Active interaction between participants to analyse their thoughts and opinions is the main feature of focus groups. Obviously, focus groups were originally created and implemented as one of the main qualitative methods. (Jayasekara 2012). The reason for choosing the focus group method is to collect effective and necessary information for the thesis by exploring the ideas and opinions of the participants in the same background. While doing this thesis, authors have analysed some previous thesis to collect information related to common acute respiratory infections where different guidelines were developed for different topics, articles, and different trusted internet resources. During the seminar, feedback from students was collected to understand their opinions if the guidebook is useful for students who have not gone to pediatrics. The feedback was used to improvise the guidebook.

Authors have collected data from different trustable sources to acquire the necessary information about the respiratory infections as well as the importance of having sufficient infor-

mation or knowledge on it before the paediatric placement. By writing trustable sources authors mean that sources are used nationally in Finland and updated recently by professionals. Most of the references used in the thesis are updated lately in 2020 and used nationally in Finland such as terveysportti, käypä hoito, terveyskylä. All the sources used are published between 2002-2020. This thesis includes evidence-based knowledge, a good solution for the problem, good guidelines in simple and understandable sentences

Data collection should be effective, reliable, direct, interesting and brief, which helps to directly achieve research goals and provide complete and accurate information. This thesis includes evidence-based knowledge, good methods for solving problems, and a good guidebook for simple and understandable sentences. One of the questions discussed with nursing students in the seminar was: "How important is it to understand respiratory infections before going to the pediatrics placement?" The guidebook contains a title, a table of contents, and information about infections, such as symptoms, assessment, prevention and solutions/treatments. The author uses the website provided by the university to collect data such as ProQuest central, which comes from LaureaFinna, such as terveysportti. Since there is a lot of information on the internet, authors will be narrowing the searches on some specific websites like käypä hoito, Duodecim, terveyskirjasto, research gate, etc., especially for the required treatments.

### 4.3 Development of guidebook

The guidebook connected to this thesis was written in easily understandable language which means the words used should match the topic and be understandable by the target group. The content and sentences have to be structured in the correct order. The instructions and advice given in the guidebook should be beneficial to the nursing student who will be using the guidebook. Content alone does not make a good guidebook, for clarity and understanding, there needs to be good structure and order (Hyvärinen 2005.)

For the initial development, research on the topic was conducted and materials were collected. Based on this material the draft guidebook was created. The process from the draft to the final guidebook is outlined in section 4.1.

### 4.4 Evaluation and reliability

The authors used a focus group method to evaluate the work. Focus group methods have become increasingly popular in health and social studies as it shows strong communication between persons who have similar experiences. Focus group discussion is one of the most suitable methods for determining deliberation to get meaningful outlook, feedback, and suggestions. Focus groups can be used to find out the new opinions and values as well as to gain new ideas.

(Jayasekara 2012.) Authors have also used many other sources such as old thesis samples, articles, and some books to find out for the collection of information needed during creating a guidebook. Authors got one unexpected written feedback from students and oral feedback from teachers and students from Laurea UAS during the thesis seminar to evaluate and finalize their Guidebook.

Reliability defines the internal validity which ensures that the study is actually intended, and sources are real. Reliability indicates how well a method, technique or test measure something like if the results are consistently the same while doing different research then the measurement is considered reliable. (Middleton 2019.) Reliability was considered throughout the data collection process by ensuring that the results are accurate, stable, and common. During the thesis work, common information and same authors were found in different research/websites that authors of the thesis did which strengthens the reliability of the sources.

The authors believe that they will be able to deepen their knowledge about common respiratory infection in children while writing this thesis. Authors will be using research-based articles, books and reliable websites like käypähoito, mayo clinic, terveysportti to find the information while developing the guidebook. This thesis does not include all the respiratory infectious diseases that the children can suffer from during their 5 years of life. Authors have selected only the most common infectious diseases based on the research.

# 5 Ethics

According to the Finnish Advisory Board on Research Integrity TENK, the authors of the thesis must do his / her research conscientiously and honestly with prime interest in the subject and while gathering the information. The authors will be following the guideline of Finnish advisory board integrity while writing this thesis. (TENK 2012.)

Ethics has been taken into consideration throughout the thesis and guidebook work. The methods and sources which are used while writing the thesis are ethically accepted, reliable, quite versatile, up-to-date and of high quality. Websites used to collect information that is used in this thesis is up-to-date and updated by professionals such as doctors, medical researchers and most of them are used nationally in Finland. Websites and articles from 2002 - 2020 are used. A research permit was not needed as authors were not interviewing or doing a survey, however, feedback for the guidebook was collected from nursing students as well as from teachers in the thesis seminar.

The images that are used in the guidebook and thesis are taken from different websites in which some of them are copyrighted. Permission to reuse the images was asked through email which has been granted by the authors of the image. Out of all the pictures used, three of them neither had information about copyright nor the response were received about the reuse of the images. However, the images are used in the guidebook. If the images have any copyright issues, the images will be removed from the guidebook as well as thesis.

# 6 Conclusion

The research intended to create a guidebook for nursing students. The guidebook was created based on the theoretical framework of the thesis. The guidebook includes introductory words, common symptoms, home treatment, and when to seek treatment. In this thesis, authors have explained the common respiratory infectious diseases which are commonly found in different websites.

After being in the pediatric placement, the authors found the topic of the thesis interesting which gave motivation for the further thesis writing process. Both authors had some knowledge about respiratory infectious diseases in children aged between 0-5 years, but neither of the authors had a deep understanding of the subject. In the process of writing a thesis, the authors learned more about respiratory infectious diseases, medical treatments, when to seek doctor, prevention method and guidebook writing process.

While doing this thesis different sources are used, and similar information found in different sources are mostly considered in the theoretical parts to support the reliability of the thesis. Most of the references used in the thesis are updated lately in 2020 and used nationally in Finland. Finnish national websites, websites that are updated by professionals, books, and articles which were published in trusted websites in between 2002 - 2020 are used to get evidence based information.

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Figures

Appendices

Appendix 1: Guidebook

AMMATTIKORKEAKOULU
University of Applied Sciences

# Common respiratory infection in children 0-5 years

## Guidebook for degree nursing students

Aakriti Kharel and Bindhu Bhandari

Laurea UAS, 2020

AMMATTIKORKEAKOULU
University of Applied Sciences

Table of Contents

## Introduction

### Respiratory infection

Respiratory infectious diseases are mainly caused by viruses and bacteria. Almost every child suffers from one or two respiratory infections during their first few years due to various reasons. The most conventional symptoms are nasal congestion, sore throat, cough, breathing difficulties, runny nose. Respiratory infections are divided into two groups Upper and Lower respiratory infections. Majority of upper respiratory infections are caused by viruses where Rhinoviruses cause 25-30% of infection; respiratory syncytial viruses (RSVs), influenza virus, human metapneumovirus and adenovirus causes 25-35% of infections and others are unidentified viruses. The most common causes of lower respiratory infection are RSVs. Among the several respiratory infections, ear otitis is the infection that infects a child easily as it is caused as a sequel to another respiratory infection.

Respiratory infections are mainly diagnosed with physical examinations, signs, symptoms, and assessing the breathing for example, breathing sounds, wheezing. Sometimes if the sign and symptoms last for several weeks and children have breathing difficulty then x-rays of the neck, lung, and chest may be taken. Blood tests and tests of respiratory secretions are rarely taken.

### About guidebook

This guidebook presents the common respiratory infections in children aged 0-5 years. The purpose is to provide basic knowledge about respiratory infection to degree nursing students before going to their paediatric placement. The guidebook is written in English to provide knowledge to degree nursing students as well as exchange students at Laurea University of applied science. The information provided in the guidebook is based on research articles, trusted websites like; terveysportti, Mayoclinic, NHS, käypä hoito.

### Disclaimer of information

The information provided in the guidebook is for informational purpose only and does not replace the advice provided by doctors or health care professionals. The information is gathered from reliable sources.

**Respiration pattern**

The normal respiration pattern is easy, relaxed which rate depends on age of child and the activity. The respiration rate, pattern, efforts and sound of breathing of the children having respiratory problems should be observed and recorded as well.

The respiratory rate is the number of breaths per minute which is measured when the person is on rest and counting the number of breaths for one minutes or 30 seconds. The respiratory rate of children depends according to their age, unlike adults.

| Age | Respiration rate |
|---|---|
| < 1 year | 30 - 40 |
| 1 – 2 years | 25 - 35 |
| 2 – 5 years | 25 - 30 |
| 5 – 12 years | 20 - 25 |
| >12 years | 12 - 20 |

## Upper respiratory Infections

### Common cold

Common cold is a viral infection that affects the child's nose and throat. It is usually caused by a variety of viruses, among which Rhinoviruses are the most common. The child becomes immune to the virus, once infected but since the common cold is caused by many viruses the child suffers from cold several times a year. Normally the common cold lasts up to 7-12 days.

**Symptoms:**

- Runny or blocked nose
- Nasal congestion
- Fever
- Sneezing and coughing
- Difficulty sleeping

The nasal discharge is mostly clear in the beginning but might become thicken and turn yellow or green.

**Treatment:**

There is no cure for the common cold due to which every symptom is treated separately. Antibiotics do not help to cure the infection caused by viruses.

Treatment involves easing the symptoms of a child by giving them enough liquid, making the child comfortable to breathe by keeping their nasal passages open and keeping the air moist. Very young children must see a doctor if common cold last for more than 2 weeks and fever lasts for more than 3 days to make sure that any other illnesses are not present such as pneumonia or other serious illness.

Medication of cough and cold should be avoided as much as possible since it is not safe for babies and young children.

The child should be seen immediately by the doctor if the child has breathing difficulty, difficulty in eating and drinking, and the infant less than 3 months old has fever.

**The child should be seen by health care professionals if:**

- the cold lasts for more than 2 weeks,
- the child has a high fever for more than 3 days
- In the case of new-borns, health care professionals should be contacted as soon as the symptoms are seen to make sure other illnesses are not present such as pneumonia or other serious illness.

Immediate medical attention should be provided if a child has breathing difficulty, difficulty in eating and drinking and the infant less than 3 months old has fever.

## Influenza (Influenssa)

Influenza is the inflammation of the respiratory tract caused by influenza/flu viruses. Influenza viruses are of three types A, B and C. A and B viruses cause epidemic illness which often leads to hospitalization whereas C virus causes mild respiratory illness. Often the virus spread from child to child through coughing and sneezing. Often the virus spread as a droplet infection through coughing and sneezing or direct contact i.e. touching.

It is difficult to distinguish flu from other respiratory infections from the symptoms only due to which different laboratory tests are preferred. The incubation period of the virus is 1-2 days after the infection.

**Symptoms:**

- High fever
- Chills
- Muscle aches, joint pain
- Headache
- Runny or dry nose which can make breathing difficult while sleeping
- Coughing
- Sore throat

The symptoms of flu and fever normally last for a week but the child may still feel weak and cough for a longer time, normally 1-2 weeks.

**Treatment**

The treatment depends on the child's symptoms and age which mostly focuses on the relief from fever as the child has a high fever. Medical treatment includes antiviral medicines. The antiviral medications normally used to treat influenza is oseltamivir (Tamiflu®).

Flu is usually cured at home with enough rest and drinking liquids.

The liquid consumption target for childs depends on their weight. In the table below, recommended liquid consumption is provided.

| Weight | Minimum amount/day |
|---|---|
| 0-10 kg | 100ml/kg/day |
| 10-20 kg | 1000-1500ml/day |
| 20-40 kg | 1500-2000/day |
| >40 kg | 2000-2500/day |

Influenza can be prevented by influenza vaccine which also provides protection from its secondary diseases including ear infection, bronchitis, pneumonia. Nasal spray vaccine is provided to children from 2-6 years old.

**The child should be seen by health care professionals if:**

- high fever lasts for more than 4 days.
- the symptoms reappear after the signs of recovery
- the conditions of a child are worse than when the symptoms appeared
- infants less than 3 months old have a fever
- the child has breathing difficulty

The serious complication of influenza when the children should get immediate medical attention includes:

- Seizures
- Chest pain
- Trouble breathing
- Worsening of chronic medical conditions
- Dehydration

Immediate medical attention should be provided if the child is experiencing any of the signs mentioned above. If the child starts to have a seizure, they start to shake, lose consciousness and the body usually becomes stiff. The child should be placed in a safe environment to prevent any accidental injury, should be positioned on their side or stomach to prevent choking as well as remove any object from the mouth if there is any.

The child might have cardiac problems in rare cases if they are experiencing chest pain, as it is caused by different causes including flu. If the child is experiencing chest pain, they should be closely observed including vital signs, consciousness, general appearance. Dehydration can be managed by administering liquid to a child through oral or intravenously according to doctors' order. The weight of a child matters a lot to calculate the volume of liquid to be given, so it is necessary to measure the weight of the child.

Breathing trouble can be the cause of infection, illness, foreign objects in the airways, blocked nose because of mucus. The oxygen saturation of the child should be measured, mouth and nose should be checked to remove any blockage in the airways. If the oxygen saturation is <90% then oxygen should be given to the child unless they can maintain saturation > 90% in normal room air or according to doctor's order.

**Common cold vs flu symptoms**

The symptoms of cold and flu are similar, due to which it is difficult to differentiate between them on the basis of symptoms only. In most cases, special tests should be done to find if the child has the flu such as; nasal swab sample. The symptoms of common cold are milder than the flu.

| Symptoms | Common cold | Flu |
|---|---|---|
| Headache | Sometime | Always |
| Muscle ache | Slight | Often severe |
| Fever | Temperature less than 37.7°C. Mild fever | Temperature more than 37,7°C which lasts for 3-4 days. High fever |
| Sore throat | Always | Sometimes |
| Chest discomfort, cough | Mild to moderate; hacking cough | Can be severe |
| Sneezing | Always | Sometimes |
| Stuffy nose | Always; runny nose | Sometimes; clear nose |
| Weakness | Sometimes, usually normal energy level | Common; extreme weakness |

**Ear infection (otitis media/korvatulehdus)**

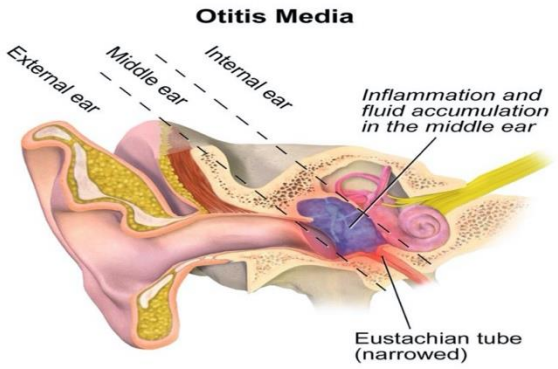



**Fig 1: Otitis media** *(BruceBlaus, CC BY-SA 4.0)*

An ear infection is also known as otitis media which is an infection in the middle ear which is very common in infants and young children. Ear infections which do not cure for a long time or come back frequently are chronic ear infections. It is mainly caused by bacteria or viruses. Ear infections are caused by upper respiratory infections, common cold and influenza. Usually otitis media is diagnosed by physical examinations, medical conditions and inspecting the ear using an otoscope (pneumatic otoscope).

**Symptoms**

- Ear pain, trouble hearing or responding to sounds
- Drainage of fluid or pus-like secretion from ear
- Trouble sleeping
- Headache
- Fever,
- Restlessness,
- Irritability,

**Treatment**

The treatment depends on the individual child's general well-being, an ear infection might normally resolve without any antimicrobial treatment. The main priority of treatment is to ease ear pain and reduce fever.

After the diagnosis of acute otitis media (AOM) and once the treatment is started it is good to do the follow up. The follow up helps to minimize the risk of possible complications. If not treated it might lead to damage of

the middle ear, permanent hear loss, infection of tissue surrounding the brain. The effusion might continue for several weeks after AOM which will cure once the middle ear effusion disappears.

Surgical procedure is also indicated to treat AOM if otitis media occurs frequently, symptomatic eustachian tube dysfunction, approaching complication of AOM like facial paralysis, Labyrinthitis ( inner ear disorder) and mastoiditis (serious bacterial infection which affects mastoid bone around inner and middle ear) and middle ear effusion for too long. The surgical treatment option includes: Tympanocentesis, Myringotomy, Myringotomy with insertion of tympanostomy tubes, Adenoidectomy, and Eustachian tube surgery.

Pain medications, anti-inflammatory drugs and eardrops are used for the treatment. It is recommended to administer pain medication to children with a doctor's prescription especially to a child < 3 months old. Pain medications can be used as mentioned in the table below according to the doses recommended by Terveyskylä.

| | |
|---|---|
| Paracetamol | 15mg/kg x 3-4 times per day **suitable for all ages** (Minimum dose interval: 6-8 hours) |
| Ibuprofen | 10mg/kg x 3 times per day to child **> 3 months old and > 5kg weight** (Minimum dose interval: 8 hours) |
| Naproxen (prescription medication) | 5mg/kg x 2 times per day to child **> 12 months old** (Minimum dose interval: 12 hours) |

**Paracetamol can be combined with Ibuprofen or Naproxen to ease the symptoms.**
If the antibiotics are started, then the first-choice antibiotics according to Finnish current care guidelines is **Amoxicillin 40mg/kg/day.**

**The child should be seen by health care professionals if:**

- there is recurrence of AOM frequently such as > 3 times in 6 months or > 4 times in 12 months.
- the child has pre-existing hear impairment
- middle ear effusion for more than 3 months
- child is less than 3 months old
- pus secretion from ear
- swelling around the ear, the child is suspected to have change in hearing

**Laryngitis (Kurkunpään tulehdus)**

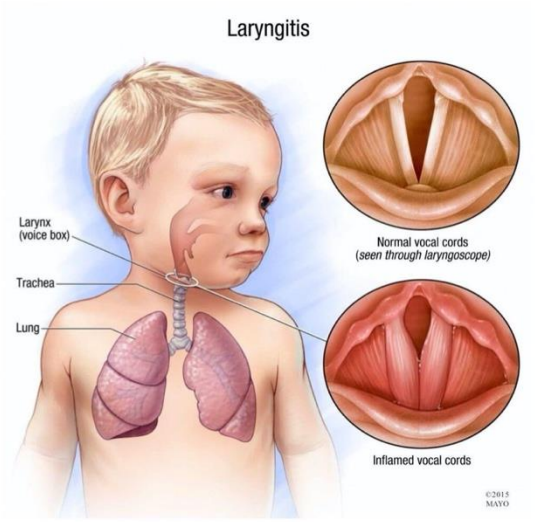



**Fig 2: Normal and inflamed vocal cord** *(Used with permission of Mayo Foundation for Medical Education and Research, all right reserved)*

Laryngitis is a common upper respiratory infection in children and due to some reason more common in boys than girls. It is a viral infection which involves inflammation of the larynx, commonly called vocal box or vocal cord. It is common in children ageing 6 months to 36 months.

**Symptoms**

- Hoarse voice
- Sore throat
- Losing the voice
- Fever
- Breathing difficulty (rare)
- Hollow and barking cough

**Treatment**

Most of the time laryngitis are treated at home. If the child is being treated at home, the important part is the elevated position and calming the crying child since crying increases the irritation of the larynx.

Breathing cool air reduces the swelling and steam inhalation makes the breathing easier. The child should be brought to hospital if they feel anxious, breathing difficulties.

In hospital, vaporized Adrenaline is administered as a first aid to reduce the swelling of the larynx and ease breathing. In addition, Cortisone is administered orally or intramuscularly according to the doctor's prescription. Glucocorticoids provides symptomatic relief in laryngitis, dexamethasone, betamethasone, or inhaled budesonide may be given according to prescription. In severe inspiratory difficulty, racemic adrenaline (0.5 - 1 mg/kg) can be administered over 10-15 min with nebulizer since the difficulty might recur after 1-2 hours.

**Dosage of racemic Adrenaline (22.5mg/ml) to be administered to treat laryngitis according to Terveysportti.**

| Weight of child | Inhalation solution 2.25% (diluted) |
|---|---|
| ≤ 5 kg | 0.2ml (4.5 mg) |
| 6-7 kg | 0.3ml (6.8 mg) |
| 8-9 kg | 0.4ml (9mg) |
| ≥ 10 kg | 0.5 ml (11mg) |

**The doses provided are further diluted in 2-3ml of 0.9% saline solution before administering with a nebulizer.**

**The child should be seen by health care professionals if:**

- cough and fever continue for 3 days
- the child has breathing difficulty and lips starts to turn blue
- child has difficulty in swallowing and not able to eat anything
- the child's wellbeing is bad and is extreme tired

**Pharyngitis (Nielutulehdus)**

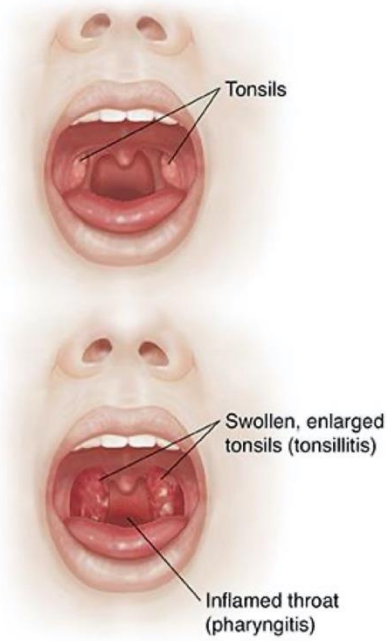



**Fig 3: Normal tonsils vs Tonsillitis and Pharyngitis** *(Source: Mount Nittany health)*

**Fig 4: Streptococcal Pharyngitis**

*(Heilman James, CC BY-SA 3.0)*

**Fig:5 Viral pharyngitis** *(Dake, CC BY-SA 2.5)*

Pharyngitis is redness, pain, and inflammation of the tissues in the throat which feels more painful while coughing and swallowing. Pharyngitis is caused by viruses or bacteria. Viral pharyngitis is caused by a virus-like cold or flu. Bacterial pharyngitis is caused by group A streptococcus (streptococcus pyogenes) bacteria.

It is easier to get confused between Pharyngitis and Tonsillitis as they both share common symptoms. However, when the pharynx between tonsils and voice box is affected it is pharyngitis and when the tonsils is affected it is tonsillitis. If the child has inflammation of pharynx and tonsils at the same time it is called Pharyngotonsillitis.

It is diagnosed by physical examination and with the signs and symptoms. However, throat swab is taken to detect streptococcal bacteria.

**Symptoms**

The symptoms of pharyngitis vary on the cause.

- Sore throat,
- Red throat with white coating on the tonsils
- Difficulty in swallowing and breathing,
- Fever, headache
- Coughing,
- Poor eating as well as drooling
- Mandibular lymph nodes are enlarged and tender
- Abdominal pain and vomiting

It is transmitted through direct contact and by the droplet infection.

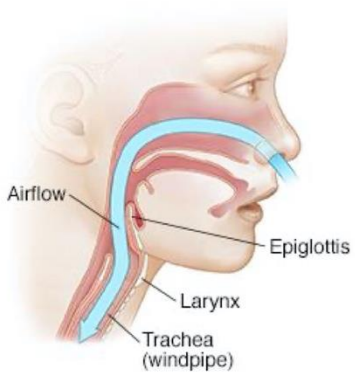
**Treatment**

Pharyngitis is treated according to the cause the viral infection usually does not require medical treatment. To ease the symptoms, drinking warm water and over-the-counter medication can be used like ibuprofen.
The bacterial infection requires antibiotics for the treatment. The commonly used antibiotic is **Penicillin (66mg/kg/day) or Amoxicillin (50mg/kg/day)**. If the child is allergic to Penicillin, Cephalosporin can be used.

**The child should be seen by health care professionals if:**

- the child has a sore throat if it does not go away in a few days.
- the child has high fever and extreme throat pain without any other symptoms
- the child has breathing difficulty or unclear speech
- the fever does not go away in 3 days after the antibiotic treatment is started.

**Epiglottitis (Epiglottiitti/kurkunkannen tulehdus)**



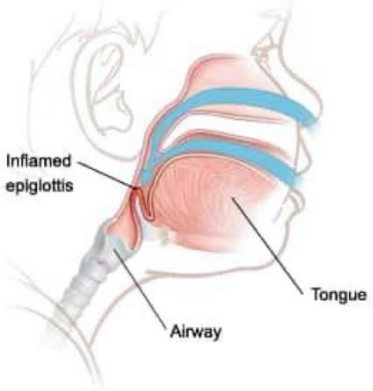




**Fig 6: Normal epiglottis**
*(Source: Lakeland ear, nose and throat)*

**Fig 7: Inflamed epiglottitis** *(Source: Nurseslabs)*

Epiglottitis is the inflammation and swelling of the epiglottis, which is a small cartilage covering the windpipe to prevent food from entering the airways while eating. It is a life-threatening condition as the tissue in the epiglottis blocks the airways when it is infected and swells. It is usually caused by bacteria called Haemophilus influenzae type B (HIB) or can also be the result of injury.
If the epiglottitis is suspected, checking the child's breathing and oxygen saturation is the first priority. It is diagnosed by throat examination, neck x-rays, blood test and throat cultures.

**Symptoms**

Symptoms of epiglottitis usually develop rapidly and worsen abruptly. Symptoms include

- Severe sore throat,
- Pain and difficulties while swallowing,
- Difficulty in breathing,
- High fever
- Difficulty speaking
- Drooling
- Anxious, restless behaviour

**Treatment**

Children are admitted to the hospital to treat epiglottitis where priority is to secure the airways. Childs are delivered oxygen if needed through oxygen mask, intubation. Antibiotics like Ceftriaxone are mainly used to treat, and fluids are given through the IV line to prevent dehydration. A child might feel better or help in breathing when sitting up or leaning forward.

If the child is suspected to have epiglottitis, they should be seen by doctors or medical professionals immediately.

In Finland, children are provided DTaP-IPV-Hib vaccine to be prevented from the disease caused by not only Hib bacteria but also diphtheria, polio and whooping cough. Separate Hib vaccination is provided to children under 5 years if they have good enough doses of other vaccination.

Epiglottitis can block the airways completely, causing complications like spreading infection to other parts of the body, respiratory failure. If the child goes into respiratory failure, the child shows the symptoms like rapid breathing, breathing difficulty, confusion, cyanosis (bluish skin colour, fingertips and lips). The aim of treatment of acute respiratory failure is to ensure sufficient gas exchange in the body. The treatment option includes oxygen therapy by using venturi mask or nasal cannulas, mechanical ventilation, continuous positive airways pressure (cpap), intubation and invasive respiratory treatment.

**Lower respiratory infections**

**Pneumonia (Keuhkokuume)**

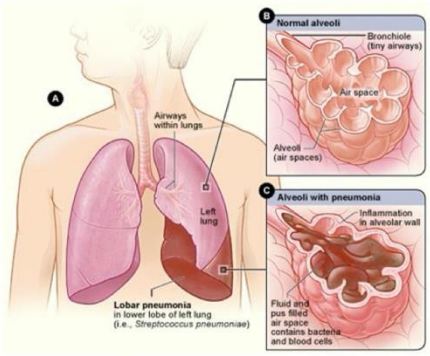



**Fig 8: Figure A shows affected part of lungs, B shows healthy alveoli sac and C shows alveoli filled with mucus when infected by pneumonia** *(Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services)*

Pneumonia is a very common infection of lungs caused by bacteria, virus, or fungi. The alveoli, small sacs in lungs are filled with fluid and pus, if the person is suffering from pneumonia. The most common bacterial causes of pneumonia are streptococcus pneumoniae and mycoplasma pneumoniae, the viral causes are rhinovirus, respiratory syncytial virus.

The pneumonia may spread via air-bone droplets and through blood during or shortly after birth.

**Symptoms**

The sign and symptoms vary according to the cause, age. New-borns and infants might not show the sign of infections. Common symptoms include:

- Fever
- Cough
- Tiredness
- Shortness of breath,
- Chest pain while coughing
- Nausea, vomiting, diarrhoea

**Treatment**

Pneumonia can be diagnosed by listening to the lungs or by taking chest x-ray of the child. Blood test is done to see the infection level.

Children are hospitalized and antibiotics are administered intravenously if the child's condition is severe and if less than 2 months old. Oral antibiotics with the home treatment are safe if the child is more than 6 months old and the condition is stable. Penicillin or amoxicillin is the first preferred antibiotic for the treatment of children with pneumonia. If the child is suspected to suffer from Mycoplasma pneumonia, then macrolide is added in the antibiotic treatment. If the child does not get better in 48 hours after the antibiotic treatment is started, then the child is suspected to suffer from complications of pneumonia.

In Finland, a vaccine against pneumococcus has been given to children since 2010. Good hygiene and keeping children away from a common cold can also help to prevent children from pneumonia.

**The child should be seen by health care professionals if:**

- fever and cold continues for more than 5 days or gets worse
- the child is tired than usual and have high fever
- the child has breathing difficulty
- the color of lips starts to turn blue or skin color is pale

**Obstructive bronchitis (ahtautava keuhkoputkentulehdus / obstruktiivinen bronkiitti)**

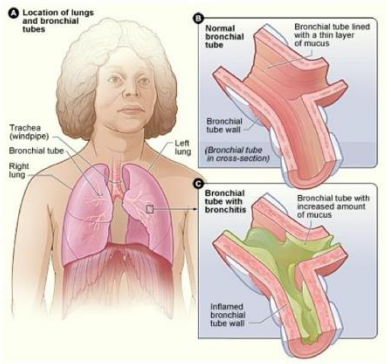



**Fig 9: Normal bronchial tube and increase in bronchial mucus** *(Source: National Heart, Lung, and Blood Institute; National Institutes of Health; U.S. Department of Health and Human Services)*

Obstructive bronchitis is a viral infection which is commonly caused by rhinovirus and respiratory syncytial virus. Obstructive Bronchitis causes inflammation of the large breathing tubes in the lung which is known as bronchi. The children who suffer from bronchitis, their bronchial mucosa swells and causes difficulty in exhalation. It can be developed if a child has an upper respiratory infection. It is diagnosed by doing physical examination, chest X-ray, chest CT scan, pulmonary function tests (the test includes the measurement of gas exchange, lung volume, capacity, and rate of flow).

**Symptoms:**

- Coughing
- Breathing sounds, whistling, or wheezing
- Difficulty exhaling
- Fever
- Flu

**Treatment**

The treatment varies according to the cause, symptoms, age, general health condition and severity. Obstructive bronchitis is mostly caused by viruses and cannot be treated by antibiotics. In some cases, the cause might be bacteria too.

The home treatment includes plenty of rest, relieving blocked nose with nose drop (saline nasal spray or drop), positing the children in the way that breathing is easier. Rubber suction bulbs can be used to clear the mucus. Ibuprofen can be given for mild fever according to doctor's prescription.

If the child has shortness of breath, drugs are administered using nebuliser to relieve the condition of the child. Salbutamol inhalation eases the acute expiratory difficulty caused by viral infection to children less than 2 years.

**The child should be seen by health care professionals if:**

- the child has mucus cough that lasts for weeks
- the breathing is dense and laborious breathing for several hours
- Shortness of breathing
- Increase amount of mucus excretion for over a week
- the child has drinking and eating difficulty
- cough that raises green mucus or the child coughs blood
- wheezing breathes with whistling sound

**Bronchiolitis (Ilmatiehyttulehdus/bronkioliitti)**

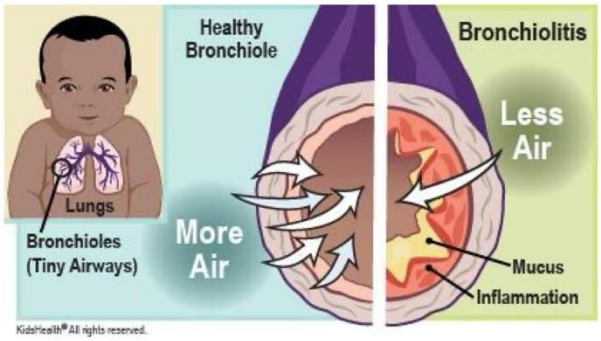



**Fig 10: Healthy bronchiole and bronchiolitis** *(© 1995-2020. The Nemours Foundation/KidsHealth®. Reprinted with permission.)*

Bronchiolitis is inflammation of small airways which branch off to bronchi. It is a common respiratory infection in children under 1 year of age which is caused by respiratory syncytial virus (RSV). It is transmitted very easily but can be controlled or prevented by good hand hygiene.

**Symptoms**

- Coughing,
- Increased heart rate,
- Too tired to eat food,
- Excessive mucus production
- Shortness of breath
- Shallow breathing, wheezing sound

For the first few day's symptoms are like a common cold, which are runny nose, cough, stuffy nose.

**Treatment**

The infection usually heals within 1-2 weeks without the medical treatment at home with supportive care but the child is recommended to be hospitalized as it infects very little children.

There is no specific medical treatment to treat bronchiolitis. During the hospital care, the condition is relieved by administering humidified oxygen to maintain the oxygen level, enough fluid is provided per oral or intravenously to prevent dehydration, excessive mucus from nose is sucked out using rubber suction bulb to prevent the block-age.

**The child should be seen by health care professionals if:**

- the child has breathing difficulty
- the breathing is laborious with wheezing sound
- refuses to eat and drink and breathing is fast with eating or drinking
- skin is turning pale or lips blue

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