Correlation Between Parental Knowledge of Cigarette Smoke Exposure and Acute Breathing Infections (ARI) in Children in the Duren Sawit District Indonesia

Dameria Sinaga[1*], Donny Mahendra[2],
Mutiara Martini[3], Budi Setiawan[4]
Magister Program of Educational Administration, Universitas Kristen Indonesia[1*], Universitas Kristen Indonesia[2-3], Universitas Pendidikan Indonesia[4]
Corresponding author*: dr_dameria_sinaga@yahoo.com

Abstract

Children are at a higher risk of getting affected by cigarette smoke rather than adults. A child's immune system and respiratory system are still in development and are susceptible to various diseases, hence illnesses can spread quickly to the lungs. The type of research done in this paper is observational analytic research with cross sectional study approach. This research observed the correlation between parental knowledge of cigarette smoke hazards and acute breathing infection (ARI) incidents. The data collected in this paper are from 72 questionnaires collected from December 2016-January 2017. The results show that 79,2% of the children suffer from upper respiratory infections. Bivariate tests show no relation between the incidence of upper respiratory infection and parental knowledge of cigarette smoke exposure (p = 0.174), but there is a correlation between lack of parental knowledge and poor attitude towards smoking near children (p=0,035).

Keywords: Acute breathing infection, children, smoke, cigarette

INTRODUCTION

Acute Respiratory Infections (ARI) are acute infections that involve organs in the upper and lower respiratory system that are caused by viruses, fungi, and bacteria. ARIs will infect the host if the host's immune system weakens, in infants and children below the age of 5 years old are one of the age groups that have immune systems that are susceptible towards a number of diseases. In Indonesia, Acute Respiratory Infections (ARIs) are the number one cause of death in the infant and children below 5 years age group. Aside from that, ARIs are often found in lists of the 10 most common diseases in hospitals, and one of the causes are cigarette smoke (Berman & McIntosh, 2005).

ARIs are one of the most common causes of death in children below the age of five, usually because the disease has spread to the lungs. This state is usually called sudden pulmonary inflammation or pneumonia. Most commonly these circumstances occur because minor ailments (mild ARIs) get ignored. Usually it starts with coughs and common colds, but because children's immune systems are still weak, it makes it easier for diseases to travel to the lungs. If the disease has spread to the lungs and the child doesn't get adequate and proper care, the child may pass away. The care in question come in the form of dietary adjustments, creating a suitable environment as to not cause health related problems, avoiding triggers such as smoke and dust, as well as maintaining the child's hygiene (Silva, Alvarez & Nguyen, T. (2025).

Children are at a higher risk of getting negatively affected by cigarette smoke compared to adults. Children's immune system and respiratory tract are still developing and are more prone to diseases, which

manifest usually in coughs and colds, but because of their developing immune systems the disease can quickly spread to the lungs. A sore throat is the clinical manifestation of an infection in the upper third of the respiratory tract. Inflammation and obstruction are some of the results of the bronchioles swelling which causes inadequate expiration flow (U.S. Department of Health and Human Services, 2006).

Some factors that are tied with ARIs in children include age, malnutrition, incomplete immunization status, and poor living conditions such as ventilation systems that don't meet requirements, dense residential density, air pollution (smoke and dust) in and outside the home. Air pollution in the home comes from cigarette smoke, kitchen smoke, and from insect repellents that are used in the home, while air pollution outside the home comes from vehicle exhaust gas (United States Environmental Protection Agency, 2014).

There are two types of cigarette exposure, which are second hand and third hand smoke. Second hand smoke is the smoke that comes from the cigarette itself and the smoke that is exhaled by the active smoker. Third hand smoke is the smoke that sticks to clothes, carpets, curtains, and more. A point of concern is that there are 11,4 million children between the ages 0-4 have been exposed to cigarette smoke. Children become passive smokers and third hand smokers because family members are active smokers and or are in an unhealthy living environment (Department of Health and Aged Care, 2023).

ARIs are affected by the air quality in the home, air ventilation influences the occurrents of ARIs in children. Aside from that, air pollution from inside the home can be seen from cigarette smoke exposure that can cause children to inhale said smoke or excess smoke that sticks to clothes, especially on the mother or father. The habit of smoking in the home has negative effects on family members, especially in children. Cigarettes have dangerous effects on active and passive smokers, particularly in children who accidentally inhale the smoke. Nicotine, alongside thousands of other dangerous chemicals found in cigarette smoke, get into the child's respiratory tract and cause infections. Lack of ventilation in the home can cause lack of air circulation and inhalation of excess cigarette smoke (Rahman, Singh & Khatun, 2025).

To eliminate or reduce the chance of children getting infected by ARIs, there needs to be preventative actions. The first thing that can be done is to raise awareness about ARIs, to adjust dietary arrangements to fulfil the child's daily nutrient intake, creating a suitable environment as to not cause health related problems, avoiding triggers. Therefore, to achieve a good degree of public health, it needs to start from the family. The parents that should be able to avoid cigarette smoke exposure to children are the primary targets. Parents that have a negative role in maintaining the family's health are affecting the health figures of the family members, primarily the ones who are still children.

Based on the number of ARIs in children, the lack of awareness in parents who still smoke near children along with the fact that they do not understand the hazards of cigarette smoke exposure towards children. 80 out of 100 families still have a parent that smokes near children and there are still some who, after smoking, go see their child and causes the excess smoke to be inhaled by the children and may cause harm to them. Therefore, the researchers are interested to research this subject with the hope that parents will better understand the dangers of cigarette smoke exposure towards children (Çolak, Yılmaz & Demir, 2025).

Respiratory tract infections, especially upper acute respiratory infections (upper ARIs), continue to pose a significant health challenge for children. Exposure to cigarette smoke is a significant preventable risk factor that can compromise respiratory function and heighten vulnerability to infections in early life. In domestic environments, children frequently encounter cigarette smoke from relatives, particularly when smoking transpires indoors and in inadequately ventilated areas. This issue may worsen when parents possess insufficient awareness regarding the hazards of cigarette smoke exposure and its effects on children's respiratory health.

Parental awareness significantly influences health habits in the home environment. Parents cognizant of the hazards associated with tobacco smoke exposure are more inclined to implement protective measures,

including forbidding indoor smoking, refraining from smoking in proximity to children, and enhancing home ventilation. A deficiency in parental awareness may result in lenient attitudes on indoor smoking and inadvertent exposure of children to cigarette smoke, thereby elevating the occurrence of upper respiratory infections. Consequently, analyzing the correlation between parental awareness of the hazards of cigarette smoke and the prevalence of upper respiratory infections in children is crucial for devising effective preventive measures.
Alongside knowledge, the practice of smoking indoors is a significant behavioral element that may directly lead to children's exposure to cigarette smoke. Examining the relationship between indoor smoking practices and the occurrence of upper respiratory infections in children can yield empirical data to bolster home health promotion and environmental health initiatives. This study aims to ascertain the relationship between parental knowledge and smoking practices in the household and the incidence of upper respiratory infections in children.

This research may serve as a reference for educational institutions, especially in health and public health sectors, and establish a basis for future studies concerning tobacco exposure and respiratory health in children. The findings are anticipated to provide the public with a deeper understanding of the hazards associated with cigarette smoke exposure, highlighting the significance of environmental and domestic health for children. This study aims to enhance the researcher's comprehension of the factors influencing the prevalence of upper acute respiratory infections, particularly those associated with parental knowledge and smoking behavior within the home environment.

LITERATURE REVIEW

Cigarettes can be defined as the final processed product of tobacco that is wrapped in a paper-like film, made from the *Nicotiana tabacum*, *Nicotiana rustica*, and other plant species or a synthetic equivalent that contains nicotine and tar with other additives.

Cigarette Contents

When the cigarette is smoked, the composition of the cigarette itself is broken down into its other components, for example one of its components that evaporates easily will become smoke in unison with its other components become condensed. That being so, the components of the cigarette smoked by a smoker is comprised of the gas component (85%) and particulate matter (15%) (Talhout et al., 2011; Goniewicz & Gawron, 2016). Cigarettes contain more or less 4.000 types of chemicals, with 40 out of the aforementioned 4.00 being carcinogenic (may induce cancer), and at least 200 of the chemicals are dangerous towards health. The main toxins in a cigarette are as follows:

1. Nicotine
   The most abundant component in a cigarette, the amount contained within one cigarette is between 0.5-3mg of nicotine and all of it is absorbed, resulting in the nicotine amount in blood or plasma to be about 40-50 ng/ml. Nicotine is an alkaloid that acts as a stimulant and, in high doses, is toxic. This substance is only found in tobacco, is very active, and affects the brain or the central nervous system. Nicotine also has characteristic addictive and psychoactive properties. Long term usage of nicotine results in the suppression of the brain to experience pleasure, thus a smoker will always need an escalating amount of nicotine to satiate their needs. Nicotine can poison the nerves, raise blood pressure, constrict peripheral blood vessels, and cause addiction towards its users (Saini & Saini, 2015).
2. Carbon Monoxide (CO)
   Carbon monoxide is an odorless gas. This component is the result of the imperfect combustion of carbon. Carbon monoxide is a toxin that works opposite of oxygen in its transport and usage. CO produced from a cigarette can reach up to 3-6%, while the lowest CO that is inhaled by a smoker is minimally at 400ppm (parts per million) can increase the amount of carboxyhemoglobin in the blood by 2-16% (UCLA Health, 2024).

3. Tar
   Tar is a component that remains after nicotine and water vapor are put aside. Tar is an aromatic polyclinic hydrocarbon particle that is carcinogenic. Tar can damage lung cells because it can stick to the cells, thus it may lead to cancer. When the cigarette is smoked, tar enters the oral cavity as vapor, when it is cooled, it will solidify and turn into a brown colored sediment on the surface of teeth, respiratory tract, and lungs. The sedimentation varies between 3-40mg per cigarette, while its levels in a cigarette are between 24-45mg. while cigarettes are given filters, the carcinogenic effect can still enter the lungs, when the smoker inhales deeply and continuously, with an increasing number of cigarettes (McCormack et al., 2017; Lee, 2019).
4. Lead (Pb)
   Lead (Pb) produced from a single cigarette is about 0,5 ug. One pack of cigarettes (containing 20 cigarettes) that have been smoked in a day results in 10 ug of lead. While the toxicity threshold of lead that may enter the body is 20 ug a day (United States Environmental Protection Agency, 2020).
5. Ammonia
   Ammonia is a colorless gas that is made up from nitrogen and hydrogen. This substance has a pungent smell and stimulating smell. It is so toxic that if it enters the blood stream it can cause a person to faint or go into a comatose state (Aneja, Schlesinger & Erisman, 2009).
6. Hydrogen sulfide
   Hydrogen sulfide is a toxic gas that is flammable with a strong smell. This substance prevents the oxidization of enzymes (pigmented iron) (Reiffenstein, Hulbert & Roth, 1992).

Categories of Smokers

Passive smokers are persons who inhale the smoke from an active smoker while not smoking themselves. Cigarette smoke is a pollutant towards a person and the environment. Cigarette smoke is more dangerous for a passive smoker rather than an active smoker. The smoke from an active smoker has five times more carbon monoxide and four times more nicotine (World Health Organization, 2019).

Types of Cigarettes

Cigarettes based on their raw material is divided into three

1. White cigarettes: a cigarette where its raw materials are tobacco leaves
2. *Kretek* cigarettes: a cigarette where its raw materials are tobacco leaves and cloves
3. *Klembak* cigarettes: a cigarette where its raw materials are tobacco leaves, cloves, and incense

There are other ways to divide cigarettes:

1. Cigarettes is the most commonly used tobacco product
2. Organic cigarettes are a cigarette that claims not to have addictive chemicals thus being safer to use
3. Rolled cigarettes which may be deemed as a step up to cigarettes by rolling it up yourself and is mostly caused by cultural of financial factors
4. *Bidis* originated from India and a few South East Asian countries. *Bidis* is smoked more intensely than regular cigarettes, this may cause to an increase in the amount of nicotine inhaled, which can affect the cardiovascular system.
5. Clove cigarettes contain 40% clove and 60% tobacco. The cloves produce a fragrant aroma, making clove cigarette smokers inhale deeper than regular cigarette smokers.
6. Cigars contain much more tobacco than the other types listed, most times it may contain only the tobacco. The high concentration of nicotine is very likely to cause breathing problems that cause shortness of breath and chest pains. The nicotine enters the respiratory tract and causes damage to the nerves and blood vessels of the respiratory tract leading into the heart and lungs. The Nicotine inhaled when smoking a cigar is higher compared to a cigarette. The production of a cigar and the usage of a cigar is very different compared to a cigarette, and that is the reason why the amount of nicotine that enters the respiratory system is relatively different.

7. Pipe; the smoke from a pipe is more basic compared to a cigarette, hence why it doesn't need a direct inhalation to get a large amount of nicotine into the body.
8. Water pipes have been used for centuries with the perception that this method of smoking is safer. A few names for this method of smoking are hookah, bhang, narghile, and shisha

Link between Cigarette Smoke and Acute Respiratory Infections

Generally speaking, there are 3 risk factors for ARIs which include environmental factors, individual factors, and behavioral factors. Environmental factors cover air pollution in the home (cigarette smoke and smoke caused by cooking fuel in high concentrations), ventilation in the home, and housing density. Individual factors cover the age of the child, birth weight, nutritional state, and immunization status. Behavioral factors cover preventative behaviors and prevention of ARIs in babies or the active role the parents and society play in handling ARIs (Jones et al., 2011).

Cigarette smoke from parents or inhabitants of the home are a serious pollutant and will raise the risk of disease in children. the more cigarettes that are smoked by the family raises the risks of ARIs, particularly if the mother of the child smokes. The result of a baby inhaling cigarette smoke includes vomiting, diarrhea, cholic (digestive tract disorders), raised heartbeat, respiratory problems, lung and ear infections, and developmental issues. Cigarette smoke exposure affect ARI incidences in children more than children who aren't exposed to it (Suzuki et al., 2009).

A WHO analysis states that negative effects of cigarette smoke affect passive smokers more than active smokers. When a smoker lights up a cigarette and smokes it, the smoke inhaled by said smoker is primary smoke (mainstream), and the smoke exhaled from the end of it is called side stream smoke. This side stream smoke is proven to contain more contaminants than mainstream smoke. This smoke contains five times more carbon monoxide, three times more tar and nicotine, 46 times more ammonia, three times more nickel, and 50 times more nitrosamine, a carcinogen, than what mainstream smoke contains (World Health Organization, 2018).

Link between Smoking Frequency and a Child's Nutritional Status

An individual who smokes generally as a lower body mass index (BMI) than non-smokers. Smoking increases energy expenditure because the effects of nicotine in cigarettes increases the rate of metabolism, which results in a low energy disbursement. When smoking, the nicotine will enter the blood stream in more or less 15 seconds and will enter the brain, in which the nicotine will pass the acetylcholine-nicotinic receptors which spurs the dopaminergic system in the reward pathway which will suppress appetites, leading to poor nutrition or malnutrition (Best et al., 2007).

A number of studies have shown that the more cigarettes consumed causes a decrease in a person's nutritional state, which means the incidence of poor nutrition in children/teenagers are increasing. 15 other studies show that body mass index (BMI) in a smoker is lower than someone who doesn't smoke, and it and it is certainly related to duration but not intensity when smoking with a longer duration is associated with a lower BMI. A National Health Interview and Survey in 2005-2006 confirms findings from previous studies that show that heavy smokers significantly have less weight than non-smokers.

Respiratory Physiology

Respiration is the exchange or oxygen and carbon dioxide in the cells, which include ventilation (inspiration and expiration), oxygen diffusion from the alveoli to the blood and carbon dioxide from the blood to the alveoli, oxygen transport to the cells and carbon monoxide from the cells (West & Luks, 2021). The center for respiration is in the pons and medulla oblongata. There are two processes in respiration, which are

1. External respiration, which is the absorption of O2 and the release of CO2 through the alveoli's capillary membrane
2. Internal respiration, which is the usage of O2 and formation of CO2 by cells and the gas exchange between cells and the fluid around it

Based on the anatomical placements, the respiratory system is divided between

a. Upper respiratory system, comprised of
    a. Nasal cavity: to filter, deliver, and humidify the air
    b. Nasopharynx: the first portion of the pharynx, which lies the tonsils and eustachian tube
    c. Oropharynx: which lies the base of the tongue
    d. Laryngopharynx: which covers the respiratory tract and gastrointestinal tract
b. Lower respiratory system, comprised of
    a. Larynx
    b. Trachea
    c. Bronchus
    d. Bronchioles
    e. Alveolus

The physiological process of respiration, which is where O2 is taken from the air into the cells and CO2 is exits into the air via expiration, can be divided into three stadiums, which are:

1. Ventilation, which is where a mixture of gasses enters and exits the lungs
2. Transportation
    a. Diffusing gasses between alveoli and capillaries of the lung (external respiration) and systemic blood and cells
    b. Distribution of the blood in pulmonary circulation and its adjustment with air distribution in the alveoli
    c. Chemical and physical reactions between O2, CO2, and blood
3. Cell respiration, which is where matter is oxidized to obtain energy and CO2 as a form of metabolic waste and is expelled from the lungs.

Respiratory Mechanisms

Air flows into the lungs because there is a pressure gap between the atmosphere and alveoli due to the mechanics of the respiratory muscles. The diaphragm (along with the lungs that lift the ribcage and sternum) are the main muscles that play a role in the expanding volume of the lungs, the thoracic cage rising and falling because of the contractions of a few respiratory muscles (Barret et al., 2019).

During calm breathing, expiration is a passive motion because of chest wall and lung elasticity. When the external intercostal muscles relax, the ribcage falls and the curvature or the diaphragm rises into the thoracic cavity. This causes the volume of the thorax to decrease. Aside from that, abdominal muscles can contract so that the intrabdominal pressure rises and pushes the diaphragm upwards. The decrease in volume in the thorax causes an increase of intrapleural pressure as well as interpulmonary pressure. Intrapleural pressure is always under the atmospheric pressure throughout the respiratory cycle (Silverthorn, 2019).

The gas exchange depends on alveolar ventilation (the amount of air that reaches the alveolus per minute) and the blood flow in pulmonary capillaries that are closely tied to the ability of gas to diffuse (a process in which a gas fills all available space) through the alveoli and capillary surface. The speed of carbon monoxide diffusion is 20 times quicker than the diffusion of oxygen. In normal bodily conditions, the ventilation and blood flow are maintained by anatomical mechanism and local constrictions of pulmonary blood vessels that experience hypoventilation.

Acute Respiratory Infections (ARIs)

Acute respiratory infections (ARIs) are diseases that infect one or more parts of the respiratory system, from the nasal cavity to the alveoli, which can also infect adnexal tissues such as the sinus, middle ear cavity, and pleura. While the definition of acute is an infection that lasts up to 14 days (World Health Organization, 2014). The maximum of 14 days is to show the acute processes of a disease.

Non-pneumonia ARIs can be classified into:

1. Common cold

This is a primary infection of the nasopharynx which usually produces mucus and is frequently encountered in children and babies. The pathogenesis is that there is an inflammatory reaction in the mucosal lining of the respiratory tract with an incubation period of 1 to 4 days. In a wider spread infection, it also affects the paranasal sinus, the mid ear next to the nasopharynx, accompanied by a high fever.

2. Pharyngitis
   Pharyngitis the inflammation of the walls of the pharynx that may be caused by viruses (40-60%), bacteria (5-40%), allergies, trauma, toxins, and others. The virus and bacteria invade the pharynx by creating a local inflammatory reaction. This disease can infect school aged children, adults, and it doesn't usually infect children below the age od 3 years old. It infects others by nasal secretions and saliva (droplet infection).
   In the early stages of infection, might exhibit hyperemia, which causes edema and an increase of mucosal secretion. Exudates normally emerges as serous then followed by condensation which will transform into a mucous-like substance that will stick to the pharyngeal wall. The blood vessels of the pharynx will expand due to the hyperemia. The obstructions caused by the substances are are normally white, yellow, grey which is found in follicles or lymphoid tissue.
3. Tonsillitis
   Tonsillitis is the acute inflammatory reaction or swelling that occurs in the tonsil.
4. Sinusitis
   Sinusitis is the process of inflammation or infection of one or more of the mucosal membranes of the paranasal sinus and causes obstruction of normal drainage mechanisms. Traditionally sinusitis is divided into three categories, which are acute (symptoms last for less than 3 weeks), subacute (symptoms last from 3 weeks to 3 months), and chronic. Sinusitis can develop from a fever that has lasted over a week, but not all who have a fever develop sinusitis. The main principle in handling a sinus infection is to realize that the nose and paranasal sinuses are a part of the respiratory system. Diseases that infect the bronchus and lungs may also infect the nose and paranasal sinus.
5. Otitis media
   Otitis media is an inflammatory reaction that occurs in most or all of the mucosal membranes of the mid ear, eustachian tube, tympanic antrum, and mastoid cells. Based on its symptoms, otitis media can be classified into suppurative otitis media and non-suppurative otitis media, in which each type has its acute and chronic forms. Aside from that, there are also specific forms of otitis media, such as otitis media tuberculosa and otitis media sifilitika. Other forms or otitis media is otitis media adhesive.
   Acute otitis media (AOM) is the inflammatory reaction that happens in the mid ear with symptoms that swiftly progress. Symptoms and local or systemic signs that can fully or partially manifests are otalgia, fever, anxiety, nausea, vomiting, diarrhea, and otore if perforation of the tympanic membrane occurs. In otoscopic examination, there may be effusion of the mid ear. Effusion of the mid ear is marked by swelling or bulging of the tympanic membrane, mobility in the tympanic membrane, the presence of substances behind the tympanic membrane, and otore.

Etiology

ARIs may be caused by a number of organisms, most frequently by bacteria. Due to that, it is imperative that the epidemiology of the ARI-triggering bacteria to be known. As of late, there has been a shift in the pattern of ARI-causing microorganisms due to circumstances such as immune system disorders, chronic

illnesses, and the misuse of antibiotics that change characteristics of bacteria that cause ARIs, such as S. aureus, B. catarrhalis, H. influenza, and enterobacteria (Kumar, Abbas & Aster, 2020).

Risk factors

Toddlers run the highest risk of being infected by ARIs. Toddlers are children with the age range from 0 to 59 months. Babies are the starting point of the human life cycle. If we know how a baby develop, then we know what to do and what to avoid so that the baby can develop optimally so that they fully develop into adulthood (Kliegmanet al., 2020).

Babies under 3 months have a low infection rate, because their antibodies come from their mothers. Infections start to increase when they reach the age of 3 to 6 months, because this time period the antibodies fade, and the babies start to develop their own antibodies. The amount of lymphoid tissues increases in a developing child thus strengthening their immune system. The stronger the immune system is, the less risk a child has of being infected.

Breastmilk

Breastmilk is detrimental to a baby's development and health. Breastmilk contains a high percentage of protein, so that the effects can be immediately felt till adulthood in maintaining their health. Breastmilk may improve and maintain the immune system. This is caused by the colostrum that increase the production of antibodies, resulting in antioxidants and free antiradicals (Victora et al., 2016).

Immunization

Immunization is the effort to protect someone from certain contagious diseases so that they are impervious to the infections. The influenza immunization significantly decreases the prevalence, occurrence, and duration of an influenza infection and alleviates its symptoms. The DPT, pneumococcus, and measles immunizations also play a role in preventing ARIs (Plotkin et al., 2018).

Immunization given to children doesn't directly immunize them to ARIs, rather they prevent factors that may cause ARIs. The high number of ARIs in toddlers who have received complete immunizations are due to the fact that there isn't an immunization to prevent ARIs directly. A low immune system also affects the occurrence of ARIs in toddlers who have received complete immunizations.

Low Birth Weight

Acute respiratory infections (ARIs) more frequently occur in toddlers who have a lower birth weight than toddlers who don't. this is due to the fact that toddlers with low birth weight don't have a fully developed immune system, the pulmonary surfactants are still lacking, the respiratory muscles as well as the thoracic bones are weak, and hyaline membrane diseases may also be factored in. aside from that, babies with low birth weight can easily experience lung infections and the inability to breathe (World Health Organization, 2014).

Administration of Vitamin A and Zinc

The amount of vitamin A in serum doesn't only correlate to a rich intake of vitamin A, but it also correlates to other micronutrients that play a role in metabolism and vitamin A transport. In oxidative processes, vitamin A in periphery tissues need zinc-dependent retinol dehydrogenase enzyme activation. Vitamin A functions to differentiate T lymphocyte cells and B lymphocyte cells in the immune system, inhibit apoptosis, and maintain the integrity and function of the mucosal surface. Zinc is needed to activate biological thymulin that functions to produce interleukin-2 and mature T lymphocyte cells. A zinc deficiency will disrupt the production of PMN, natural killer cells, and complementary activation, so that it makes it easier for a child to get an ARIs. A deficiency in zinc also causes a decrease in vitamin a (World Health Organization, 2011).

Environmental factors

Air Pollution

Air pollution is the presence of one or more physical substances, chemical or biological, that endangers human, animal, and plants health. Air pollution can be divided into two types, primary air pollution and

secondary air pollution. Primary air pollution are pollutants generated directly from the source air pollution, while secondary air pollution is pollutants formed from the reaction primary pollution with air. Smoke in the household is an example of primary pollution (World Health Organization, 2021).

Ventilation

Air quality is also determined by ventilation. Ventilation is the exchange of indoor air with outdoor air and the place where sunlight may enter a room and can kill pathogenic microorganisms. Qualified ventilation (that has a minimum 10% floor area room) can avoid risk factors that may be detrimental human health in a closed space (ASHRAE, 2019).

Occupancy density

The daily lifestyle of families that often gather together in a home environment will have risks the of upper and lower respiratory tract infections occurring. Exposure to infectious agents in the family the most intensely occurs when family members share a bedroom. Occupancy density requirements for the entire house usually expressed in m2/person. The minimum area per person is very relative depending on the quality of the building and facilities available. A House ideally has a minimum of 10 m2/person, and a bedroom a floor area of 3m2 / person is needed and to prevent transmission respiratory disease the distance between the edges of the bed one with that another 90cm. Bedrooms should not be used by more than 2 people in adults (Baker et al., 2000).

Clinical signs and symptoms

ARIs are infectious diseases that attacks one and/or more section of the airway, starting from the nose (upper channel) to the alveoli (lower channel) including adnexal tissue, such as sinuses, middle ear cavities, and the pleura. In general, symptoms and signs of ARIs may manifest as fevers, coughs, a runny nose, and are often accompanied by rapid breathing or a pulling sensation chest wall to the bottom inside. Pulmonary diseases with general symptoms and respiratory symptoms including coughing, sputum excessive, dyspnea and chest pain (Jameson et al., 2022).

Coughing is the most common symptom of breathing disorders. Stimulation that usually causes coughing are mechanical and chemical stimuli. Inhalation of dust, smoke and foreign objects small size is the most frequent cause of cough. This may lead to dyspnea or shortness of breath, which is a feeling of difficulty breathing and pain chest.

RESEARCH METHODS

This type of research is observational analytic research with cross sectional study approach (Creswell & Creswell, 2018). This research observed the relationship between parental knowledge about the dangers of smoke exposure cigarettes against the incidence of upper respiratory infections (ARI). The study was conducted in January 2017, in the Duren Sawit District, East Jakarta. The population of this study consisted of reachable and target population. The reachable population in this study is all parents at the area of Duren Sawit District, East Jakarta. The target population or this research are parents who have toddlers in the (38) Duren Sawit District. The inclussive criteria in this study were

1. 1. Parents who have children aged 0-5 years.
2. Willing to sign an informed consent

Exclusion criteria in this study are

1. Parents who are traveling while filling out the questionnaire
2. Parents who are not willing to fill out the questionnaire
3. Toddlers have real congenital abnormalities
4. Toddlers have metabolic disorders
5. Toddlers have chronic diseases
6. 6. Toddlers have immune deficiency or are on long-term immunosuppressants

Sampling is done by cluster random method of sampling, which is a random sampling method with a population size that is not known with certainty and the existence of the sample is spread geographically. This study uses a cluster random method sampling because it takes samples in the form of parents and toddlers throughout the Duren Sawit District which is spread in several villages. Number of samples minimum is calculated using the following formula:

Information: n = number of samples, P = prevalence of ARI in infants (25%), d = limit error (0.1), Z = normal distribution value at significance level of 0.05 = 1.96 so that the total number of samples is obtained as many as 72 parents who have toddlers in Duren Sawit District.

The variables used in this study are Independent variable: Parents' knowledge of the dangers of exposure to cigarette smoke. Dependent variable: Behavior and incidence of upper acute respiratory infections (ARI) The operational definition of the research is presented in Table 3.1.

Table 3.1 Operational Definitions of Research

No.	Variable	Operational Definition	Measurement Method	Scale
1	Incidence of Upper Respiratory Tract Infection (URTI)	The occurrence of the entry of germs or microorganisms into the upper respiratory tract causing infection within 14 days in toddlers. (Habeahan, 2009)	Questionnaire	Ordinal 1. No 2. Yes
2	Parents' knowledge regarding cigarette smoke exposure and URTI in children	Everything known by fathers and mothers about the dangers of cigarette smoke for toddlers, such as understanding the terms active smoker, passive smoker, and the effects of cigarette smoke on toddlers.	Questionnaire	Ordinal 1. Poor, if score ≤ 50% 2. Good, if score > 50% (Budiman & Riyanto, 2013)
3	Parents' smoking behavior toward children's health	Parents' habits in responding to the dangers of smoking near children.	Questionnaire	Ordinal 1. Poor, if score ≤ 50% 2. Good, if score > 50% (Budiman & Riyanto, 2013)

Research Instrument

Data collection is done by interviewing and using instruments in the form of a parent knowledge questionnaire on the dangers of exposure cigarette smoke and upper ARI occurrence questionnaire in infants. Data collected in the form of personal data from respondents in the form of age, education level, the amount of health education obtained, the presence or absence of family members smoking, data on the level of knowledge about the dangers of exposure to cigarette smoke and upper ARI incidence data in infants

This research was conducted using primary data, namely data obtained from distributing questionnaires to respondents who is a resident of Duren Sawit sub-district. After being chosen randomly and through inclusion and exclusion criteria 72 parents were obtained as a respondent.

Analysis of this study includes descriptive analysis and analysis statistics. Descriptive analysis includes the characteristics of data from all over respondents and statistical analysis included bivariate analysis. Analysis this research was carried out using the SPSS program (Statistical Package for Social Sciences)

Descriptive analysis was conducted on all respondents who used as a research sample. The first step is calculated frequency of the number of respondents based on the ISPA incident, knowledge parents to the dangers of cigarette smoke exposure and smoking behavior for children's health. The second stage makes a comparison knowledge of parents about the dangers of exposure to cigarette smoke with impact parents 'smoking behavior on toddlers' health and doing comparison of the incidence of ARI in children to people's knowledge old is the danger of exposure to cigarette smoke. experiencing upper respiratory infection. And in the past 6 months 45 toddlers (62.5%) had more than 2x upper ISPA, 12 toddlers (16.7%) experienced upper respiratory infection only 2 times, and 15 toddlers (20.8%) or not experiencing upper respiratory infection. 35 parents (48.6%) chose to go to treatment doctors, 22 parents (30.6) are happier when buying over-the-counter medicines at pharmacies, and 15 others choose to use alternative medicine. Of all 72 respondents had attended health education, as many as 11 parents (15.3%) following more than 5 counseling sessions, 23 parents (31.9%) participated more than 3 times 46 counseling, and 38 parents (52.8%) only ever participated in one extension health.

proportion of respondents who have a level good knowledge about the dangers of exposure to cigarette smoke 45 people (62.5%) and less knowledge level as many as 27 people (37.5%).

Table 3.2 Respondents' Knowledge Distribution about the level of knowledge danger of exposure to cigarette smoke

No.	Parents' Knowledge	n	%
1	URTI stands for		
	c. Acute Respiratory Tract Infection	48	66.7
	d. Upper Digestive Tract Infection	10	13.9
	e. Do not know	14	19.4
	Total	72	100.0

Based on table 3.3 below, it is known that 31 parents (43.1%) know that bacteria and viruses are the cause of ARI, 28 parents (38.9%) only know if bacteria are the cause of ARI and 13 parents (18.1%) say dirty environment is the cause of ARI. 26 parents (36.1%) knowing that coughs, colds and sore throats are symptoms of ARI. 48 parents (66.7%) know that ARI is a disease that attacks the channel breathing. 39 parents (54,%) knew that toddlers were malnourished and often breathe dirty air more easily infected with upper ARI, 22 parents (30.6%) know that by breathing dust smoke or cigarettes can contracted upper ISPA, and 11 parents (15.3%) knew that toddlers living in a dirty environment can contract upper ARI. 33 parents

(45.8%) realize that ARI can spread through the air and splashes of cough containing germs. 44 parents know that with provide nutritious food, maintain environmental comfort and avoiding precipitating factors can prevent upper ARI in infants. 34 parents (47.2%) chose to bring a toddler to the doctor and give medication and 38 parents (52.8%) prefer toddlers to rest and eat nutritious food.

Table 3.3 The frequency of parents' smoking behavior on toddler health

Smoking Behavior	n	%
Good	18	25.0
Poor	54	75.0
Total	72	100.0

Based on table 3.3 above, 37 families (51.4%) has more than 1 person who smoke in their homes and 30 families (41.7%) only 1-person smokes inside the house. 28 families (38.9%) were family members smoking in the house consumes more than 1 pack of cigarettes, 24 families (33.3%) spent less than 1 pack and 20 families (27.8%) were smoking less 5 cigarettes. 2 families (2.8%) use the type of cigar for smoking, 38 families (52.8%) used clove cigarettes and 32 families (44.4%) use filter cigarettes. 44 parents (61.1%) still smoke near toddlers, 16 parents (22.2%) sometimes still smoke near toddlers, and 12 parents (16.7%) never smoked if they were near a toddler. 21 people (29.2%) immediately play and approach the child if they have just finished smoking, 41 people (56.9%) sometimes directly play or approach children and 10 people (13.9%) did not play and approached the child after finishing smoke. 31 people (43.1%) did not immediately dispose of cigarette ash, 23 people (31.9%) sometimes throw cigarette ash from ashtrays and 18 people (25.0%) immediately dispose of cigarette ash from ashtrays. 58 people (80.6%) 53 know that cigarette smoke is dangerous for toddlers and 14 (19.4%) others said it could be dangerous cigarette smoke for toddlers.

Bivariate Analysis

Bivariate analysis aims to determine the relationship between independent variables with dependent variables using the Chi square (x2) test. Existence relationship between parents' knowledge of the dangers of cigarette smoke exposure to occurrences of ARIs, relation to the incidence of ARI in children to smoking behavior of parents, and the relationship between the level of knowledge of parents about the dangers of exposure to cigarette smoke with parents' smoking behavior.

Table 3.4 Relationship between the level of knowledge of parents of the dangers of exposure cigarette smoke with ARI events

Smoking Behavior	n	%
Good	18	25.0
Poor	54	75.0

Total	72	100.0

Table 3.5 Relationship between the incidence of ARI in children and parental smoking behavior

No.	Smoking Behavior	n	%
1	Number of family members smoking inside the house		
	a. More than one person	37	51.4
	b. One person	30	41.7
	c. None	5	6.9
	Total	72	100.0

Based on the table 3.5, respondents with a good level of knowledge also can occur a high incidence of ARI as many as 30 events (66.7%), likewise with respondents who have a level of knowledge less ARI incidence was also high at 22 events (81.5%) The Chi-Square test results were obtained 0.174 ($p < 0.05$) which means there is no meaningful relationship between the level of knowledge about hazards exposure to cigarette smoke with ARI events.

Table 3.6 Relationship between the incidence of ARI in children and parental smoking behavior

Behavior	URTI Incidence (No) n (%)	URTI Incidence (Yes) n (%)	Total	P-Value
Good	9 (50.0%)	9 (50.0%)	18 (100.0%)	**0.015**
Poor	11 (20.4%)	43 (79.6%)	54 (100.0%)	
Total	20 (27.8%)	52 (72.2%)	72 (100.0%)	

The Chi-Square test results obtained p 0.015 ($p < 0.05$) which means there are significant relationship between parents' smoking behavior with ARI events.

Table 3.7 Relationship between parents' level of knowledge of the dangers of exposure to cigarette smoke and parents' smoking behavior

Knowledge Level	Good Behavior n (%)	Poor Behavior n (%)	Total	P-Value
Good	15 (33.3%)	30 (66.7%)	45 (100.0%)	0.035
Poor	3 (11.1%)	24 (88.9%)	27 (100.0%)	
Total	20 (27.8%)	52 (72.2%)	72 (100.0%)	

Based on the table 3.7 and 3.8, respondents with a good level of knowledge most also have poor smoking behavior 30 people (66.7%), likewise with respondents who have a level of knowledge also lacks bad behavior 24 people (88.9%). The Chi-Square test results were obtained 0.035 ($p < 0.05$) which means there are meaningful relationship between the level of knowledge about hazards exposure to cigarette smoke with the behavior of parents smoking near children.

Table 3.8 Relationship between parents' level of knowledge of the dangers of exposure to cigarette smoke and the incidence of ARI

Knowledge Level	URTI Incidence (No) n (%)	URTI Incidence (Yes) n (%)	Total	P-Value
Good	15 (33.3%)	30 (66.7%)	45 (100.0%)	0.174
Poor	5 (18.5%)	22 (81.5%)	27 (100.0%)	
Total	20 (27.8%)	52 (72.2%)	72 (100.0%)	

DISCUSSION

From the total number of 102 respondents, there were 57 toddlers who had been exposed to ARI the upper part and 45 respondents been exposed twice to upper ARI. 37 respondents prefer to directly give the medicine (buy it freely to take medicine or use alternative treatments rather than bringing them to a doctor). It is a point of concern because if the medicine is purchased freely and they don't use it as intended, it may cause the illness not to be dealt with quickly and precisely in accordance with the type of ARI suffered. 62.5% of parents of children under five have good knowledge of ARI as well the effect of exposure to cigarette smoke starts from the cause of ARI due to bacteria and also viruses, factors of ARI due to lack of nutritious food and dirty environment, then ways of transmission and prevention methods treatment. But there are still parents whose knowledge still lacking ARI disease from the causes, factors, modes of transmission and prevention methods themselves so they do not know that exposure cigarette smoke

against toddlers is dangerous. Thanks to the increasing number of parents who smoke near children the risk of the child breathing in cigarette smoke itself and even though the parents do not smoke near children but if after smoking they immediately approach and playing with children, children can breathe in the remnants of cigarette smoke that stick in people who have just smoked. Although many parents know that cigarette smoke is harmful to children, they still do the habit can endanger the child's breathing such as smoking near children, directly play or approach or hug a child, and do not immediately throw ash cigarette marks in an ashtray.

Relationship between parents' knowledge of the dangers of exposure to cigarette smoke with ARI events

Based on the results of the study, it was found that there was no significant relationship between the incidence of ARI in children against knowledge of parents about the dangers of exposure to cigarette smoke because of the p-value obtained is > 0.05 (Jones et al., 2011). Because, even though the level of knowledge of parents is good regarding the dangers of exposure to cigarette smoke, the incidence of upper ARI in children remain in large numbers. Just like the study by Marhamah et al (2012) there is no relationship between knowledge of mothers and the incidence of ARI in infants with the results of the chi-square test p = 0.790. Seen that level knowledge of parents does not necessarily affect the incidence of ARI in toddlers.

Relation of ARI incidence in infants to the parents smoking behaviours

From the results of the study it was found that there was a correlation between ARI events in toddlers to parents smoking behavior with Chi test results Square the value of p = 0.015. In the working area of the Rembang District Health Center Purbalingga also found a relationship between smoking behavior poor age with ARI incidence with a value of p = 0,000, likewise with the results of the study of Marhamah et al (2012) with results chi-square test p = 0.026, where the behavior of family members who smoke especially in the home associated with the incidence of ARI in infants. This shows a tendency with increasingly the poor smoking behavior of parents, the greater the potential of children the child is affected by ARI (Trisnawati & Juwarni, 2012: Marhamah et al, 2012).

Relationship The level of knowledge of parents about the dangers of exposure to smoke smoking with parents' smoking behavior

From the results of the study, there was a relationship between the lack of knowledge parents of the dangers of exposure to cigarette smoke make parents' smoking near children still exists and may cause harm to children. On Chi-Square test results obtained p value = 0.035. Because there is a relationship Parents' lack of knowledge causes smoking behavior near children too bad. According to the results of the research in Medan Martubung Health Center show that parents have an important role in the prevention of ARI cases that should be at the level of knowledge good parents, the smoking behavior of parents can be good as one prevention of reduced rates of ARI. On results Chi-square test found a significant relationship with the results of the chi test square p = 0.003. 35 (Habeahan, 2009).

LIMITATION

The limitation in this study is the time of data retrieval very short because you have to adjust to the author's class schedule, and short questionnaire distribution schedule so that the results aren't optimal.

CONCLUSION

As many as 62.5% of children are infected with upper ARI due to either insufficient knowledge of the causes of upper ISPA or because of poor environment (residential density, pollution). As many as 93.1% of parents still smoke inside the house even though they are parents know that exposure to cigarette smoke in the house if inhaled by toddlers is at risk to endanger greater health. There is no relationship between ARI incidence in infants and knowledge parents will be at risk of exposure to cigarette smoke, but there is a connection between events ARI in toddlers with smoking behavior parents who are bad because they are still many parents often smoke near children so children become passive smokers who breathe exposure to cigarette smoke from nearby smokers. Due to the lack of knowledge so that it can cause parents' smoking behavior is bad which results in numbers the incidence of ARI in infants is large. Still lack of knowledge of

parents causes old smoking behavior become bad so there are still many parents who smoke inside the house or near children.

RECOMMENDATION

Parents are expected to not smoke inside the house, if they wish playing with children after smoking can clean up first. And it is expected to always throw cigarette ash in an ashtray after you finish smoking. It is recommended that further research can produce research better, with more scheduled research times with good so that researchers can examine the data in detail, and with a larger number of samples so that it can represent the proportion in East Jakarta area.

REFERENCES

Altheide, D. L., & Schneider, C. J. (2013). *Qualitative media analysis* (2nd ed.). Sage. https://doi.org/10.4135/9781452270043

Aneja, V. P., Schlesinger, W. H., & Erisman, J. W. (2009). Effects of agriculture upon the air quality and climate: Research, policy, and regulations. *Environmental Science & Technology, 43*(12), 4234–4240. https://doi.org/10.1021/es8024403

ASHRAE. (2019). *ANSI/ASHRAE Standard 62.1-2019: Ventilation for acceptable indoor air quality*. American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Baker, M., McNicholas, A., Garrett, N., Jones, N., Stewart, J., Koberstein, V., & Lennon, D. (2000). Household crowding a major risk factor for epidemic meningococcal disease in Auckland children. *The Pediatric Infectious Disease Journal, 19*(10), 983–990. https://doi.org/10.1097/00006454-200010000-00009

Barr, R. B., & Tagg, J. (1995). From teaching to learning—A new paradigm for undergraduate education. *Change*, *27*, 18–25. https://doi.org/10.1080/00091383.1995.10544672

Barrett, K. E., Barman, S. M., Brooks, H. L., & Yuan, J. X.-J. (2019). *Ganong's review of medical physiology* (26th ed.). McGraw-Hill Education.

Barrows, H. (1989). *The Tutorial Process*. Southern Illinois University School of Medicine.

Barrows, H. S. (2000). *Problem-based learning applied to medical education*. Southern Illinois University School of Medicine.

Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-based learning: An approach to medical education*. Springer Publishing Company.

Barry, J. (2007). *Using writing in the science classroom to develop critical thinking skills*. University of Pennsylvania.

Berman, S., & McIntosh, K. (2005). Acute respiratory infections in children. In D. T. Jamison, J. G. Breman, A. R. Measham, et al. (Eds.), *Disease control priorities in developing countries* (2nd ed., pp. 483–497). World Bank. https://www.ncbi.nlm.nih.gov/books/NBK11786/

Best, C. M., Sun, K., de Pee, S., Bloem, M. W., Stallkamp, G., Semba, R. D. (2007). Parental tobacco use is associated with increased risk of child malnutrition in Bangladesh. *Nutrition, 23*(10), 731–738. https://doi.org/10.1016/j.nut.2007.06.014

Bjork, C. (2004). Decentralisation in education, institutional culture and teacher autonomy in Indonesia. *International Review of Education*, *50*, 245–262. https://link.springer.com/content/pdf/10.1007%2Fs11159-004-2622-6.pdf.

Blaško, M. (2025). What are students expected to know? Comparing integrated and non-integrated science curricula. *Cogent Education*. https://doi.org/10.1080/2331186X.2025.2592393

Champagne, A. B., & Kouba, V. L. (2005). Chapter 10 - Writing to Inquire: Written Products as Performance Measures. In J. J. Mintzes, J. H. Wandersee, & J. D. B. T.-A. S. U. Novak (Eds.), *Educational Psychology* (pp. 223–247). Academic Press. https://doi.org/https://doi.org/10.1016/B978-012498365-6/50012-3

Çolak, E., Yılmaz, H., & Demir, E. (2025). Assessing parental awareness and concerns about children's exposure to tobacco smoke. *BMC Pediatrics, 25*, 42.

https://pmc.ncbi.nlm.nih.gov/articles/PMC11827174//

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, *107*(2), 261–288. https://doi.org/10.1037/0033-295X.107.2.261

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Department of Health and Aged Care. (2023, December 19). *Passive smoking*. Australian Government, Department of Health, Disability and Aged Care. https://www.health.gov.au/topics/smoking-vaping-and-tobacco/about-smoking/passive-smoking

Dewi, L., Susilana, R., Setiawan, B., Alias, N., & Zulnaidi, H. (2023). A Proposed Problem-Centered Thinking Skill (PCTS) Model at Secondary Schools in Indonesia and Malaysia. *International Journal of Instruction*, *16*(3), 615–638. https://doi.org/10.29333/iji.2023.16333a

Emilia, E. (2010). *Teaching writing: developing critical learners*. Rizqi Press.

Faisal, & Martin, N. S. (2019). Science education in Indonesia: past, present, and future. *Asia-Pacific Science Education*, *5*(4). https://doi.org/10.1186/s41029-019-0032-0

Gee, J. P. (2005). *An Introduction to Discourse Analysis: Theory and Method*. Routledge.

Gijselaers, W. H., & Schmidt, H. G. (1990). *Development and evaluation of a causal model of problem-based learning*. Springer. http://hdl.handle.net/1765/2776

Goniewicz, M. L., & Gawron, M. (2016). Ingredients and additives in tobacco products. *Tobacco Prevention & Cessation, 2*, 6. https://doi.org/10.18332/tpc/62445

Greeno, J. G. (1992). Mathematical and scientific thinking in classrooms and other situations. In *Enhancing thinking skills in the sciences and mathematics* (pp. 39–61). Lawrence Erlbaum.

Gustine, G. G. (2018). A survey on critical literacy as a pedagogical approach to teaching English in Indonesia. *Indonesian Journal of Applied Linguistics*, *7*(3), 531. https://doi.org/10.17509/ijal.v7i3.9798

Habeahan, E. M. (2009). *Hubungan peran orang tua dalam pencegahan infeksi saluran pernafasan akut (ISPA) dengan kekambuhan infeksi saluran pernafasan akut (ISPA) pada balita di wilayah kerja Puskesmas Martubung Medan* (Undergraduate thesis, Universitas Sumatera Utara). Universitas Sumatera Utara.

Heong, Y. M., Othman, W. B., Yunos, J. B. M., Kiong, T. T., Hassan, R. B., & Mohamad, M. M. B. (2011). The level of marzano higher order thinking skills among technical education students. *International Journal of Social Science*, *1*(2), 121–125.

Heyward, M. O., Cannon, R. A., & Sarjono. (2011). Implementing school-based management in Indonesia: impact and lessons learned. *Journal of Development Effectiveness*, *3*(3), 371–388. https://doi.org/10.1080/19439342.2011.568122

Hoyle, P., & Stone, C. (2000). *Developing the literate scientist*. Routledge.

Indah, R. N. (2017). Critical thinking, writing performance and topic familiarity of Indonesian EFL learners. *Journal of Language Teaching and Research*, *8*(2), 229–236. https://doi.org/10.17507/jltr.0802.04

Jameson, J. L., Fauci, A. S., Kasper, D. L., Hauser, S. L., Longo, D. L., & Loscalzo, J. (2022). *Harrison's principles of internal medicine* (21st ed.). McGraw-Hill Education.

Jones, L. L., Hashim, A., McKeever, T., Cook, D. G., Britton, J., & Leonardi-Bee, J. (2011). Parental and household smoking and the increased risk of bronchitis, bronchiolitis and other lower respiratory infections in infancy: Systematic review and meta-analysis. *Respiratory Research, 12*(1), 5. https://doi.org/10.1186/1465-9921-12-5

Jones, L. L., Hashim, A., McKeever, T., Cook, D. G., Britton, J., & Leonardi-Bee, J. (2011). Parental and household smoking and the increased risk of bronchitis, bronchiolitis and other lower respiratory infections in infancy: Systematic review and meta-analysis. *Respiratory Research, 12*(1), 5. https://doi.org/10.1186/1465-9921-12-5

Karpov, Y. V, & Haywood, H. C. (1998). Two ways to elaborate Vygotsky's concept. *American Psychologist*, *53*(1), 27–36. https://doi.org/10.1037/0003-066X.53.1.27

Kliegman, R. M., St. Geme, J. W., Blum, N. J., Shah, S. S., Tasker, R. C., & Wilson, K. M. (2020). *Nelson textbook*

of pediatrics (21st ed.). Elsevier.

Knowledge and Human Development Authority. (2006). *Law No. (30) of 2006 establishing the Knowledge and Human Development Authority.* Government of Dubai.

Kumar, V., Abbas, A. K., & Aster, J. C. (2020). *Robbins and Cotran pathologic basis of disease* (10th ed.). Elsevier.

Lee, P. N. (2019). Tar level of cigarettes smoked and risk of smoking-related diseases. *Inhalation Toxicology, 31*(2), 47–62. https://www.tandfonline.com/doi/full/10.1080/08958378.2018.1443174

Lloyd-Jones, G., Margetson, D., & Bligh, J. G. (1998). Problem-based learning: a coat of many colours. *MEDICAL EDUCATION-OXFORD*, *32*, 492–494. https://doi.org/10.1046/j.1365-2923.1998.00248.x

Margetson, D. (1991). *Why is problem-based learning a challenge? In Boud D., Feletti G. (Eds.), The challenge of problem-based learning.* St. Martin's.

Marhamah, A., & Arsin, A. W. (2012). *Faktor yang berhubungan dengan kejadian ISPA pada anak balita di Desa Bontongan Kabupaten Enrekang* [Undergraduate thesis, Universitas Hasanuddin]. Repository Universitas Hasanuddin.

Maricopa Community Colleges. (2017). *Centre for Learning and Instruction*. http://www.mcli.dist.maricopa.edu/pbl/info/

Mauffette, Y., Kandlbinder, P., & Soucisse, A. (2004). *The problem in problem-based learning is the problems: But do they motivate students? In: Savin-Baden M, Wilkie K, Editors, Challenging Research into Problem-based Learning*. SRHE/Open University Press.

McCormack, V. A., Agudo, A., & others. (2017). Case–control study of cumulative cigarette tar exposure and lung and upper aerodigestive tract cancers. *International Journal of Cancer, 141*(7), 1317–1330. https://pmc.ncbi.nlm.nih.gov/articles/PMC5552057/

Merrill, D. M., Li, Z., & Jones, M. K. (1991). Instructional transaction theory: An introduction. *Educational Technology*, *31*(6), 7–12.

Merrill, M. D. (2002). First Principles of Instruction. *Educational Technology Research and Development*, *50*, 43–59. https://doi.org/10.1007/BF02505024

Merrill, M. D. (2007). *First principles of instruction synthesis* (pp. 62–71). Merrill/Prentice Hall.

Ningsih, H. K. (2016). *Multilingual re-instantiation: genre pedagogy in Indonesian classrooms*. University of Sydney.

Parker, L. (2017). Religious environmental education? The new school curriculum in Indonesia. *Environmental Education Research*, *23*(9), 1249–1272. https://doi.org/10.1080/13504622.2016.1150425

Pertiwi, E. R. (2020). Critical thinking among Indonesian students studying public health in Australia: Autoethnography of Challenges and Strategies to Adapt. *The 2nd International Scientific Meeting on Public Health and Sports (ISMoPHS)*.

Plotkin, S. A., Orenstein, W. A., Offit, P. A., & Edwards, K. M. (2018). *Plotkin's vaccines* (7th ed.). Elsevier.

Quitadamo, I. J., & Kurtz, M. J. (2007). Using writing to increase critical thinking performance in general education biology. *CBE Life Sciences Education*, *6*(1), 140–154. https://doi.org/10.1187/cbe.06-11-0203

Rahman, A., Singh, P., & Khatun, S. (2025). Indoor air pollution exposure and acute respiratory infection in under-five children: A systematic review and meta-analysis. *Journal of Global Health, 15*(4), 04012. https://pmc.ncbi.nlm.nih.gov/articles/PMC12751865

Raine, D. J., & Symons, S. (2005). *Possibilities: A Practice Guide to Problem-based Learning In Physics and Astronomy*. The Higher Education Academy Physical Sciences Centre.

Reiffenstein, R. J., Hulbert, W. C., & Roth, S. H. (1992). Toxicology of hydrogen sulfide. *Annual Review of Pharmacology and Toxicology, 32*, 109–134. https://doi.org/10.1146/annurev.pa.32.040192.000545

RIS Dubai. (2025). *What is KHDA and why KHDA attestation matters for students in Dubai.* https://www.risdubai.com

Saini, N. K., & Saini, V. (2015). Harmful effects of nicotine. *Indian Journal of Medical and Paediatric Oncology, 36*(1), 24–31. https://pmc.ncbi.nlm.nih.gov/articles/PMC4363846/

Savin-Baden, M., & Major, C. H. (2004). *Foundations of Problem-Based Learning*. Society for Research into Higher Education & Open University Press.

Schmidt, H. G. (2000). Assumptions underlying self-directed learning may be false. *Medical Education*, *34*, 243–245. https://doi.org/10.1046/j.1365-2923.2000.0656a.x

Setiawan, B. (2022). The development of Indonesia national curriculum and its implications for science education. *Journal of Innovation in Educational and Cultural Research*. https://www.jiecr.org

Silva, R., Alvarez, M., & Nguyen, T. (2025). Acute respiratory infections (ARIs): Current etiological perspectives and emerging viral threats. *Journal of Clinical Virology, 170*, 105567. https://pmc.ncbi.nlm.nih.gov/articles/PMC12737513/

Silverthorn, D. U. (2019). *Human physiology: An integrated approach* (8th ed.). Pearson.

Suzuki, M., Thiem, V. D., Yanai, H., Matsubayashi, T., Yoshida, L. M., Tho, L. H., Minh, D. P., Anh, D. D., Ariyoshi, K., & Morimoto, K. (2009). Association of environmental tobacco smoking exposure with an increased risk of hospital admissions for pneumonia in children under 5 years of age in Vietnam. *Thorax, 64*(6), 484–489. https://doi.org/10.1136/thx.2008.106385

Talhout, R., Schulz, T., Florek, E., van Benthem, J., Wester, P., & Opperhuizen, A. (2011). Hazardous compounds in tobacco smoke. *International Journal of Environmental Research and Public Health, 8*(2), 613–628. https://pmc.ncbi.nlm.nih.gov/articles/PMC3084482/

Toohey, S. (1999). *Designing Courses for Higher Education*. The Society for Research into Higher Education & Open University Press.

Trisnawati, Y., & Juwarni. (2013). Hubungan perilaku merokok orang tua dengan kejadian ISPA pada balita di wilayah kerja Puskesmas Rembang Kabupaten Purbalingga 2012. *Kesmas Indonesia: Jurnal Ilmiah Kesehatan Masyarakat, 6*(1), 35–42.

U.S. Department of Health and Human Services. (2006). Respiratory effects in children from exposure to secondhand smoke. In *The health consequences of involuntary exposure to tobacco smoke: A report of the Surgeon General* (pp. 257–336). U.S. Centers for Disease Control and Prevention. https://www.ncbi.nlm.nih.gov/books/NBK44318/

UCLA Health. (2024, September 29). *Carbon monoxide in cigarette smoke harms health*. UCLA Health. https://www.uclahealth.org/news/article/carbon-monoxide-cigarette-smoke-harms-health

United States Environmental Protection Agency. (2014, August 27). *The inside story: A guide to indoor air quality*. https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality

United States Environmental Protection Agency. (2020, January 29). *What are some of the health effects of lead?* https://www.epa.gov/lead/what-are-some-health-effects-lead

Victora, C. G., Bahl, R., Barros, A. J. D., França, G. V. A., Horton, S., Krasevec, J., Murch, S., Sankar, M. J., Walker, N., & Rollins, N. C. (2016). Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. *The Lancet, 387*(10017), 475–490. https://doi.org/10.1016/S0140-6736(15)01024-7

West, J. B., & Luks, A. M. (2021). *West's respiratory physiology: The essentials* (11th ed.). Wolters Kluwer. West, J. B., & Luks, A. M. (2021). *West's respiratory physiology: The essentials* (11th ed.). Wolters Kluwer.

Widana, I. W. (2020). The effect of HOTS-based assessment on students' higher-order thinking skills in mathematics. *Journal of Physics Conference Series*, *1503*(1). https://doi.org/10.1088/1742-6596/1503/1/012051

Wilkerson, L., & Gijselaers, W. H. (1996). Concluding comments. *New Directions for Teaching and Learning*, *68*(1), 101–104. https://doi.org/10.1002/tl.37219966814

Winarno, N., Rusdiana, D., Riandi, R., Susilowati, E., & Afifah, R. M. A. (2020). Implementation of integrated science curriculum: A critical review of the literature. *Journal for the Education of Gifted Young Scientists*, *8*(2), 795–817. https://doi.org/10.17478/jegys.675722

Wolfinger, D. M. (2000). *Science in the elementary and middle school*. Addison Wesley Longman.

World Health Organization. (2011). *Guideline: Vitamin A supplementation in infants and children 6–59 months of age*. World Health Organization.

World Health Organization. (2014). *Global nutrition targets 2025: Low birth weight policy brief*. World Health Organization.

World Health Organization. (2014). *Revised WHO classification and treatment of childhood pneumonia at health facilities: Evidence summaries*. World Health Organization.

World Health Organization. (2014). *Revised WHO classification and treatment of childhood pneumonia at health facilities: Evidence summaries*. World Health Organization.

World Health Organization. (2018). *Tobacco and its environmental impact: An overview*. World Health Organization.

World Health Organization. (2019). *WHO report on the global tobacco epidemic 2019: Offer help to quit tobacco use*. World Health Organization.

World Health Organization. (2021). *WHO global air quality guidelines: Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*. World Health Organization.