

Review Article

Overview of Respiratory tract infections among children under five years in Ghana: A **systematics study**

Comment [R-1]: systematic study?

Abstract

It is well-documented that respiratory tract infections, especially in children, have the highest incidence and mortality rates in developing countries. Infections of the sinuses, throat, airways, and lungs are collectively referred to as Respiratory Tract Infections by the National Health Services (NHS). According to the statistics, in Ghana, the seasonal patterns of reported paediatric cases were different in the Northern sector than in the Central and Southern sectors. Hospitalization rates for children in the Volta Region showed clear seasonal trends, with most ailments being more common during the dry seasons than the wet ones. The purpose of this study is to examine respiratory tract infections among children under five years in Ghana. This will give readers and policy makers the nature and the condition of RTIs among children in Ghana. The study used the systematic review method to achieve this objective. The type of systematic review method used was the rapid review, which uses existing research documents and data to draw new findings.

The study found that, there is high rate of respiratory tract infections among children in Ghana. This is attributed to many factors. Poor breastfeeding and supplemented eating in early life may lead to childhood wasting, the leading cause of mortality in under-5s with poorer RTI worldwide. Severe acute malnutrition is one of numerous socioeconomic variables that have increased pneumonia, diarrheal illness, and malaria prevalence and severity. Other variables that have contributed to this rise including low birth weight, under-vaccination, parental smoking, early childhood respiratory impairment owing to indoor air pollution, other diseases, and overcrowding.

This study recommends that, much attentions should be given to children in Ghana. Prevention strategies for RTIs include frequent nutritional programs, campaigns, and education in the district to address stunting and underweight in children younger than five, as well as correct complementary feeding. Further population-based study in different parts of Ghana might strengthen these results.

Keywords: Respiratory tract infection, children, Ghana

INTRODUCTION

In underdeveloped nations, particularly among children, respiratory tract infections are known to have the greatest incidence rates as well as the highest death rates. According to the National Health Services (NHS) in United Kingdom, infections involving regions of the body that are involved in breathing, such as the sinuses, throat, airways, or lungs, are referred to together as Respiratory Tract Infections (RTIs) (National Health Services, 2021). A respiratory tract infection (RTI) is any infectious condition affecting the upper or lower

Comment [R-2]: Too lengthy. Only important and relevant background for the study is to be mentioned here.

respiratory tract. Upper respiratory tract infections (URTIs) include the common cold as well as laryngitis, pharyngitis/tonsillitis, rhinitis, rhinosinusitis/sinusitis, and otitis media. Otitis media is an inflammation of the middle ear. Infections of the lower respiratory tract (LRTIs) include conditions such as bronchitis, bronchiolitis, pneumonia, and tracheitis. The common cold, pharyngitis and tonsillitis, rhinosinusitis and sinusitis, acute otitis media, and acute cough and acute bronchitis are the five common respiratory tract illnesses that are addressed by this guideline (The National Center for Biotechnology Information, 2023).

A wide variety of viruses can cause illness in the respiratory system. Common viruses that cause respiratory illness in children include rhinoviruses, influenza viruses (during seasonal outbreaks), parainfluenza viruses, respiratory syncytial virus (RSV), enteroviruses, coronaviruses, and even some strains of adenovirus. Most cases of viral respiratory tract infections are passed from one person to another when children's hands come into touch with nasal secretions. There are viruses in these discharges (Tesini, 2022). The children spread the virus to themselves when they touch their eyes or nose. In rare cases, children might catch an illness through breathing in droplets that an infected person coughed or sneezed into the air. Children with viral respiratory tract infections typically have higher viral loads in their nasal or respiratory secretions than adults with the same illness do. Children are more prone to infect others due to their greater viral production and their generally worse hygiene practices. The likelihood of transmission increases when a large number of youngsters are in close proximity to one another, as occurs in classrooms and day cares. Some parents worry that their child's susceptibility to colds and other infections may grow if they let their children play outside in the rain or cold (Tesini, 2022).

Among the projected 5.4 million children under the age of five who passed away in 2017, over half of those deaths took place in sub-Saharan Africa, and acute respiratory infections were responsible for the biggest number of deaths (Accinelli, Leon-Abarca, & Gozal, 2017). In children younger than five years old all throughout the world, acute respiratory infections (ARIs) are among the main causes of morbidity and death. There is a large geographical disparity in the mortality rate owing to ARI (Collaborators GCM, 2016). More than 12 million children with severe ARI were hospitalised to hospitals throughout the world every year, according to a report that was published by global burden disease in 2010 (Nair H, Azziz-Baumgartner, Zhang, & al., 2013). Around the world, ARI is responsible for up to half of all emergency room visits involving children (Accinelli, Leon-Abarca, & Gozal, 2017).

In developing countries, acute respiratory infections (ARIs) are a leading cause of death in children younger than 5 years old. Sub-Saharan African children have a mortality risk before the age of 5 that is more than 15 times that of children in high-income countries (WHO, 2019). The third goal of the Sustainable Development Goals intends to decrease under-5 mortality to as low as 25 per 1000 live births by 2030, in part because of the threat presented by these health events to survival (United Nations, 2020). As part of efforts to decrease child mortality and illness before the age of five, the World Health Organization (WHO) has suggested that governments ensure all children have access to basic medical care regardless of their families' ability to pay (WHO, 2019). Diseases including RTIs are major contributors to the high under-5 death rate in Ghana (UNICEF, 2020). Childhood RTIs are a leading cause of hospitalisation and death in Ghanaian children under the age of 5 (Ghana Health Service, 2020). The under-5 mortality rate in Ghana has dropped from 82 in 2011 to 56 in 2018 (Ghana Statistical Service, 2011). While under-5 death rates appear to be falling, Kipp et al. found that Ghana is one of eight African nations that has made little improvement in this area

(Kipp, et al., 2016). Slow progress in reducing infant mortality is primarily attributable to the high rates of RTI morbidities in children younger than 5 years old.

Poor nursing practises and poor supplemental feeding in early life may contribute to childhood wasting, the biggest risk factor for death among under-fives with lower RTI over the world. Among the many unfavourable socioeconomic factors that have contributed to the increased prevalence and severity of pneumonia, diarrheal disease, and malaria is severe acute malnutrition (Tazinya, et al., 2020). Other factors that have contributed to this increase include a younger age at disease onset, a low birth weight, under-vaccination, parental smoking, early childhood respiratory damage due to indoor air pollution, other diseases, and overcrowding (World Health Organisation, 2020).

The high under-5 morbidity and mortality in Ghana has prompted the implementation of a number of policies and interventions, such as the Free maternal health policy, the Child health policy 2007-2015, the Newborn care strategy 2014-2018, and the Community-based health planning and services (CHPS) policy. Given the correlation between RTIs and infant mortality in Ghana, studying the risk factors for these conditions is important (Ghana Health Service, 2020). Considering the significance of ARI on morbidity and mortality in children under 5 in SSA countries, notably Ghana, there is a shortage of information regarding ARI among children under 5. However, research on the reasons for the discrepancy in ARI episode recurrence between SSA countries is lacking. In order to achieve the Sustainable Development Goal (SDG) of reducing child mortality to at least 125 per 1000 live birth worldwide, information on the incidence and risk factors of ARI must be easily accessible. SSA has the highest mortality rate (55%) of under-five fatalities (United Nations Children's Fund, 2023). In order to reduce the incidence of ARI in SSA countries and in Ghana, it is crucial to analyse the prevalence and deciding factors of ARI at the regional and national levels. The purpose of this study is to use a systematic study to examine respiratory tract infections among children under five years in Ghana. This will give readers and policy makers the nature and the condition of RTIs among children in Ghana.

METHODS

Research methods may be thought of as the strategies, procedures, or techniques that are utilised in the process of collecting data or evidence for the purpose of analysis in order to either discover new knowledge or generate a better understanding of a subject. This study made use of existing data on respiratory tract infections in children under five years. This includes already published articles, thesis and online publish resources like books and websites. This method is known as the systematic method. A "systematic review" is a specific kind of review in which a predetermined and methodical strategy is employed to gather and evaluate data in order to arrive at findings on research concerns. The phrase "systematic review" refers to a certain kind of review. A systematic review is an in-depth investigation and synthesis of the pertinent published literature on a particular subject or clinical problem. It is also known as a meta-analysis. In order to improve scientific writing, a step-by-step guide to completing a systematic review has been systematically shown. Not only can systematic reviews provide the evidence foundation for knowledge translation products such as patient decision aids, clinical practise guidelines, and policy briefs, but they also assist decision-makers in better comprehending the conclusions of individual research within the context of the overall data. In this study, a procedure known as rapid review, which is a subcategory of systematic review, was utilised. In order to give information in a timely manner, rapid reviews can be thought of as a type of knowledge synthesis. In rapid

reviews, certain aspects of the process of conducting systematic reviews are either streamlined or left out entirely. Key words like Respiratory tract infection, children, Ghana were used during the search for information.

Comment [R-3]: too lengthy. Repitition of the same information

The table below summarises the research papers, books, online information and data used by the study to achieve its results.

Table 1. Summarization of research papers, books, online information and data used by the study

UNDER PEER REVIEW

No	Topic	Author(s)	Year	Country	Method	Results
1	<i>“Pathogens associated with hospitalization due to acute lower respiratory tract infections in children in rural Ghana: a case-control study”</i>	Ralf Krumkamp et al.	2023	Ghana	A sample size of 233 cases and 350 controls was	Children under the age of five years old have a higher risk of passing away due to respiratory illnesses than any other cause of mortality. There is currently a dearth of data on the frequency of certain organisms in African youngsters as well as their importance.
2	<i>“Acute Lower Respiratory Infections among Children Under Five in Sub-Saharan Africa: A Scoping Review of Prevalence and Risk Factors”</i>	Jacob Owusu Sarfo et al.	2023	Sub-Saharan Africa	Four major databases were searched in depth. (PubMed, JSTOR, Web of Science and Central). After rigorous screening and the removal of duplicates, a total of 3,329 records were discovered, and 107 full-text studies were examined for assessment, of which 43 were included in this scoping review.	ALRTIs are common in SSA children under five (1.9–60.2%). inadequate education, poverty, hunger, exposure to second-hand smoke, inadequate ventilation, HIV, traditional cooking stoves, filthy fuel, poor sanitation, and unclean drinking water make SSA children under five more susceptible to ALRTIs. Health promotion interventions including health education have increased the health-seeking behaviours of mothers of under-5-year-olds against ALRTIs.
3	<i>Acute respiratory infection and its associated factors among children under five years attending</i>	Henok Dagne, Zewudu Andualem, Baye Dagne and Asefa Adimasu Taddese	2020	Ethiopia	Cross-sectional study	Children less than five years old disproportionately suffered from acute respiratory infections. Significant characteristics reported as being related with an acute respiratory infection in

	<i>pediatrics ward at University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: institution-based cross-sectional study</i>					children were maternal age, maternal residency, and maternal hand hygiene information.
4	“Factors associated with diarrhoea and acute respiratory infection in children under-5 years old in Ghana: an analysis of a national cross-sectional survey”	Paschal Awingura Apanga and Maxwell Tii Kumbeni	2021	Ghana	cross-sectional survey	Children between the ages of 6 and 11 months, as well as those between the ages of 12 and 23 months, were shown to have a greater frequency of diarrhoea and ARI than infants and toddlers. The frequency of diarrhoea in children under the age of five was lower among those whose moms had completed some college education compared to those whose mothers had not.
5	“Patterns of respiratory tract infections in children under 5 years of age in a low–middle-income country”	Nehal M. El- Koofy , Mortada H. El- Shabrawi , Basant A. Abd El- alim , Marwa M. Zein and Nora E.	2022	Egypt	Patients with upper and lower RTIs identified clinically and/or radiologically at the outpatient clinics at Cairo University Children's Hospital in Egypt were the subjects of a cross-sectional,	Roughly one-third of infections in under-fives were lower RTI. Malnutrition was one of the significant risk variables for decreased RTI in children below 2 years.

		Badawi			observational, epidemiological study.	
6	<i>“Prevalence and factors associated with acute respiratory infection among under-five children in selected tertiary hospitals of Kathmandu Valley”</i>	Pratima GhimireI, Rashmi Gachhadar, Nebina Piyal , Kunja ShresthaI, Kalpana Shrestha	2022	Nepal	A cross-sectional research was done at Nepal Medical College and Teaching Hospital and International Friendship Children’s Hospital (IFCH) in athmandu among children of age 2–59 months attending Pediatric OPD.	Acute Respiratory Infection affected 60.8% of 286 children. (ARI). Nearly 20% of youngsters had serious pneumonia. Religion, family, presence of the child in the kitchen while cooking, and family respiratory tract infection were significantly associated with acute respiratory infection (p = 0.009, OR = 4.59 CI = 1.47–14.36).
7	<i>“Analysis of risk factors associated with acute respiratory infections among under-five children in Uganda”</i>	Yassin Nshimiyimana and Yingchun Zhou	2022	Uganda	Data on 13,493 Ugandan children less than 5 years old from the 2016 UDHS (Ugandan Demographic and Health Survey) were analysed using a cross-sectional approach.	40.3% of Ugandan children had ARI symptoms two weeks before the study. ARI illness signs were common in infants and toddlers. By evaluating 75% of the sample, the random forest outperformed logistic regression (accuracy=62.0%; AUC=0.638) and other approaches in predicting childhood ARI symptoms (accuracy=88.7%; AUC=0.951).
8	<i>“Risk factors of acute respiratory infections among under five children attending public hospitals in</i>	Sielu Alemayehu , Kalayou Kidanu, Tensay Kahsay and Mekuria Kassa	2019	Ethiopia	Institution-based case control research ran from November 2016 to June 2017. 288 children under 5 (96 cases and 192 controls) were interviewed using a	This study found that mother literacy, smoking, cow dung consumption, and diet were highly linked with kid acute respiratory illness. Healthcare providers and the public should

	<i>southern Tigray, Ethiopia, 2016/2017”</i>				standardised questionnaire. SPSS version 20 was used to analyse data from systematic random sampling.	share scientific information and acute respiratory infection prevention recommendations.
9	<i>“Differentials in the Prevalence of Acute Respiratory Infections Among Under-Five Children: An Analysis of 37 Sub-Saharan Countries”</i>	Michael Ekholuenetale et al	2023	Sub-Saharan Country	This study analysed data from the Demographic and Health Survey (DHS) in 37 African nations. Information gathered from kids less than five years old was analysed. Differences in the prevalence of ARIs amongst SSA nations were uncovered using a forest plot.	Children under the age of five were more likely to have ARI in the following countries: Uganda (9%), Kenya (9%), Sao Tome and Principe (9%), Gabon (8%), Chad (8%), Eswatini (8%), Burundi (7%), Ethiopia (7%), and the Congo Democratic Republic (7%).
10	<i>“Exposure to pesticides and symptoms of acute respiratory tract Infection in children under five in the Offinso-North District”</i>	Enoch Akyeamong	2017	Ghana	The Offinso North Farm Health Study is a population-based cross-sectional design from which the study population was drawn. (ONFAHS). A questionnaire provided during interviews obtained data on self-reported markers of exposure to pesticides.	Children younger than five years old are more likely to exhibit signs of acute lower respiratory infections if they have been exposed to pesticides.
11	<i>“Ecological zone and symptoms of acute respiratory infection among children under</i>	Abdul-Aziz Seidua, Edward Kwabena Ameyawb, Bright Opoku	2019	Ghana	Data from the Ghana Demographic and Health Surveys were utilised for the study. (1993–2014). Women of reproductive age who had	The findings of the study have indicated the necessity for public health education and sensitization on ARI to be more specific and target women who reside in the

	<i>five in Ghana: 1993–2014”</i>	Ahinkorahb, Linus Baatiemaa, Francis Appiah			children under the age of five and who had had a cough that was accompanied by short, quick breaths in the two weeks before to each of the surveys were included in the research sample.	Middle zone who have children under the age of five. This is in comparison to those who live in other ecological zones.
12	<i>“Patterns of Frequently Diagnosed Pediatric Morbidities in Hospitalized Children in the Volta Region of Ghana”</i>	Samuel Mawuli Adadey, Richmond Ayee, Sylvester Languon, Darius Quansah, and Osbourne Quaye		Ghana	Among the most often diagnosed paediatric morbidities were those with more than a thousand documented hospitalisations.	According to the statistics, the seasonal patterns of reported paediatric cases were different in the Northern sector than in the Central and Southern sectors. Hospitalization rates for children in the Volta Region showed clear seasonal trends, with most ailments being more common during the dry seasons than the wet ones.

Source: Author’s compiled data

RESULTS AND DISCUSSION

Respiratory Tract Infections in Children under five years Ghana

Comment [R-4]: results to be presented separately from discussion and not combined

In Ghana, RTI is the second common outpatient diagnosis after malaria. More than half of patients who sought medical attention for respiratory infections were prescribed antibiotics, despite the fact that the vast majority of these infections were caused by viruses. (Accra Metropolitan Assembly, 2015). For antibiotics to be used responsibly, they must be given to patients when they need them, at the right dosages, for the right amounts of time, and at the lowest possible cost to the community. Antibiotics are widely used, but the fast rise of antibiotic resistance has prompted a fresh look at how often they are really administered (Accra Metropolitan Assembly, 2015).

Respiratory infections in children follow a seasonal distribution pattern, according to studies. The virus is most active throughout the winter and spring in temperate regions, where it frequently causes epidemics. RSV infection rates are higher in the winter in both tropical and subtropical nations, however there is a wide range in seasonality from place to region (Annan, et al., 2016). Infection rates for RTIs are highest between July and October in Ghana, according to previous research. Ghana has a tropical climate, with a dry winter and a wet summer due to the African monsoon. The wettest months are April through October in the central region, May through September in the north, and April through November in the south. However, the rainy season is shorter in the east coast, lasting just from April to June before taking a break in July and August and then slowly picking back up again in September and October (Adiku, et al., 2015). The southern hemisphere is the wettest. The north, with its single rainy season, and the eastern coast (including Accra), with its two rainy seasons, are the driest regions (Adiku, et al., 2015).

Children's demographics, parents' socioeconomic status, housing, and upbringing all have a role in the likelihood that they may contract an acute respiratory illness. Age, (Seidu, Dickson, Amu, Darteh, & Kumi-Kyereme, 2019), sex, (Akinyemi & Morakinyo, 2018), immunisation status, (Barrow, Ayobami, Chidozie Azubuike, & Cham, 2022), HIV infection, diarrheal comorbidity, malnutrition, and poor weaning timing have all been linked to RTIs in studies conducted in the SSA area and other emerging countries. Several studies have found a correlation between a variety of parent variables and ARIs. These include age, employment position, and education level (Lutpiatina, et al., 2020). Increased risk of ARIs has also been associated to factors including lower socioeconomic status, smaller family size, and less access to basic amenities like clean water and proper sanitation. Risk factors for ARIs include household smoking, the quality of cooking fuel, the cleanliness of drinking water, and the availability of restrooms (Andualem, Nigussie Azene, Dessie, Dagne, & Dagne, 2020).

There was a study conducted by Denno et al. on Maternal knowledge, attitude and practices regarding childhood acute respiratory infections in Kumasi, Ghana. The study's findings suggested that, at "Kumasi's two major open-air marketplaces, 143 mothers with at least one kid under five were interviewed. Acute respiratory infection (ARI) in children was the focus of the study. Married, Christian, Ashanti, 20-29 years old, and with 2-3 live children, the ladies were typical. 73.4 percent had a youngster with cough and fever in the past six months. Coughing was directly caused by cold exposure for 73.4%. Many women wrongly attributed worm infestation for cough and fever (21%), and constipation for cough (25.9%). None attributed cough and fever to infections. No one stated proper ventilation and avoiding overcrowding prevent cough and fever. The more severe the symptoms, the more likely the mothers were to seek medical treatment (e.g., cough only, 0.7%; cough and fever, 6.3%;

cough, fever, and anorexia, 30%; and cough, fever, and lethargy, 57.3%). Ephedrine or other nasal drops, herbal remedies, antipyretics, and antibiotics were used to cure runny noses at home. Coughs are treated with antibiotics by 39.9%. Cough and fever treatments included honey and cough syrup. Some herbal and home care remedies were hazardous. Castor oil and enemas were used by 25.9% to avoid ARI. Symptom severity knowledge was adequate for the women (mean = 15/20; range = 11-18)".

The study's findings suggested that, a health education programme for mothers of children under five is needed based on these findings.

4.0 CONCLUSION

Comment [R-5]: Too lengthy.

Acute respiratory infections (ARIs) affect the respiratory tract from the nasal cavities to the lungs. There are two types of ARIs: those that affect the upper respiratory system (URIs) and those that affect the lower respiratory system (LRIs). Children less than five years old get acute respiratory infections more frequently than any other age group, making them a significant burden on the health care system. The World Health Organization (WHO) estimates that respiratory infections are responsible for 6% of the world's disease burden. Nearly all of the 6.6 million children under the age of five who die every year do so in low-income countries, with a third of those fatalities attributable to acute respiratory infections (ARI). Most studies have found that between 10% and 60% of children under five in SSA have ALRTIs. Most studies employ demographic health surveys and hospitalised samples, which would explain why the rate of ALRTIs in children is so high, although the results from these surveys and samples show more complete evidence. No matter how the study was done, children under five in SSA had a high rate of pneumonia. Also, compared to other ALRTIs like Bronchiolitis, pneumonia has always been more common in children under five years old in SSA. It is possible that more children die from pneumonia in SSA because it is so common among children. Self-reported symptoms may not be a viable way to diagnose ALRTIs in children, therefore studies that rely on self-reported symptoms may reflect an incorrect number of cases.

The study found that, there is high rate of respiratory tract infections among children in Ghana. This is attributed to many factors. Poor breastfeeding and supplemented eating in early life may lead to childhood wasting, the leading cause of mortality in under- five years children with poorer RTI worldwide. Severe acute malnutrition is one of numerous socioeconomic variables that have increased pneumonia, diarrheal illness, and malaria prevalence and severity. Other variables that have contributed to this rise including low birth weight, under-vaccination, parental smoking, early childhood respiratory impairment owing to indoor air pollution, other diseases, and overcrowding.

This study recommends that, much attentions should be given to children in Ghana. Prevention strategies for RTIs include frequent nutritional programs, campaigns, and education in the district to address stunting and underweight in children younger than five, as well as correct complementary feeding. Further population-based study in different parts of Ghana might strengthen these results.

References

Comment [R-6]: Recent references are missing

- Accinelli, R., Leon-Abarca, J., & Gozal, D. (2017). Ecological study on solid fuel use and pneumonia in young children: a worldwide association. *Respirology*.
- Accra Metropolitan Assembly, A. (2015). *Respiratory tract infections: a major child killer*. Retrieved from <http://www.ghanadistricts.com/Home/District/104>
- Adiku, T., Asmah, R., Rodrigues, O., Goka, B., Obodai, E., & Adjei, A. e. (2015). Aetiology of acute lower respiratory infections among children under five years in Accra, Ghana. *Pathogens*, 22–33.
- Akinyemi, J., & Morakinyo, O. (2018). Household environment and symptoms of childhood acute respiratory tract infections in Nigeria, 2003-2013: a decade of progress and stagnation. *BMC Infect Dis*.
- Andualem, Z., Nigussie Azene, Z., Dessie, A., Dagne, H., & Dagne, B. (2020). Acute respiratory infections among under-five children from households using biomass fuel in Ethiopia: systematic review and meta-analysis. *Multidiscip Respir Med*.
- Annan, A., Ebach, F., Corman, V., Krumkamp, R., Adu-Sarkodie, Y., & Eis-Hubinger, A. e. (2016). Similar virus spectra and seasonality in paediatric patients with acute respiratory disease, Ghana and Germany. *Clin Microbiol Infect*.
- Barrow, A., Ayobami, A., Chidozie Azubuikwe, P., & Cham, D. (2022). Prevalence and determinants of acute respiratory infections among children under five years in rural settings of the Gambia: evidence from a national survey. . *Glob J Epidemiol Infect Dis*.
- Collaborators GCM. (2016). Erratum: Global, regional, national, and selected subnational levels of stillbirths, neonatal, infant, and under-5 mortality, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet*.
- Ghana Health Service, G. (2020, December 27). *The Health Sector in Ghana: Facts and Figures 2018*. Retrieved from https://ghanahealthservice.org/downloads/Facts+Figures_2018.pdf
- Ghana Statistical Service, G. (2011). *Ghana Multiple Indicator Cluster Survey with an Enhanced Malaria Module and Biomarker, 2011, Final Report*. Accra: Ghana Statistical Service.
- Kipp, A., Blevins, M., Haley, C., Mwinga, K., Habimana, P., Shepherd, B., & al, e. (2016). Factors associated with declining under-five mortality rates from 2000 to 2013: an ecological analysis of 46 African countries. . *BMJ Open*.
- Lutpiatina, L., Sulistyorini, L., Notobroto, H., Raya, R., Utama, R., & Thuraidah, A. (2020). Multilevel analysis of lifestyle and household environment for toddlers with symptoms of acute respiratory infection (ARI) in Indonesia in 2007, 2012, and 2017. . *Glob Pediatr Health*.
- Nair H, S. E., Azziz-Baumgartner, E., Zhang, J., & al., e. (2013). Global and regional burden of hospital admissions for severe acute lower respiratory infections in young children in 2010: a systematic analysis. *Lacent*.
- National Health Services, N. (2021, April 28). *Respiratory Tract Infections (RTIs)*. Retrieved from National Health Services: <https://www.nhs.uk/conditions/respiratory-tract->

