



## ORIGINAL ARTICLE

### Exclusive Breastfeeding from Birth to 6 Months for Reducing Community Acquired Pneumonia in Children Up to 5 Years of Age: A Systematic Review and Meta-Analysis

Vanessa Amor L. Dizon- Ditangco M.D.

Rebecca Abiog-Castro, M.D.

\* Philippine Children's Medical Center

#### Correspondence:

Dr. Vanessa Amor L. Dizon- Ditangco

Email: vanessaamordizon@gmail.com

Dr. Rebecca Abiog-Castro

Email: drbeckycastro@yahoo.com

The authors declare that the data presented are original material and has not been previously published, accepted or considered for publication elsewhere; that the manuscript has been approved by all authors, and all authors have met the requirements for authorship.

#### ABSTRACT

**Background:** Exclusive breastfeeding up to 6 months of age is the global recommendation of the World Health Organization because of its established benefits. Previous studies show that exclusive breastfeeding can protect infants during infancy but effects of breastfeeding beyond infancy are inconclusive. This study aims to identify if exclusive breastfeeding up to 6 months of age is protective for pneumonia up to 5 years of age.

**Methods:** Systematic literature search was conducted on the following electronic databases: Pubmed, MEDLINE, EMBASE, CINAHL, SciHub, Herdin, Google Scholar, the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews to identify all relevant studies assessing the effect of exclusive breastfeeding on development of pneumonia in children from birth to 5 years of age. Fixed effects meta-analysis was performed to generate pooled effect estimates (odds ratio) on the probability of developing pneumonia up to 5 years of age in exclusively breastfed compared to non-exclusively breastfed infants.

**Results:** Five studies were included in the analysis. Exclusive breastfeeding from birth to 6 months has a protective effect against pneumonia in children up to 5 years of age. The probability of developing pneumonia in children until 5 years of age was significantly lower in those who were exclusively breastfed compared to those who were not exclusively breastfed ( $OR=0.86$ ;  $95\%CI=0.77-0.95$ ,  $p-value=0.003$ ) by 23%. Systematic review showed benefit of exclusive breastfeeding and continued breastfeeding for longer protection against developing pneumonia.

**Conclusion:** Exclusive breastfeeding from birth to 6 months is associated with statistically significant reduction in the incidence of pneumonia up to 5 years of age. Results highlighted the importance of exclusive breastfeeding up to 6 months of age as an intervention in reducing pneumonia morbidity up to 5 years of age, thereby supporting the global recommendation of breastfeeding.

**KEYWORDS:** *exclusive breastfeeding, pneumonia, breastmilk*

## INTRODUCTION

Pneumonia is the leading cause of child mortality, a major cause of global morbidity, and one of the most common reasons for hospitalizations among the poorest children. It accounts for 15% of all deaths in children under 5 years old, with an estimated 808,694 children in 2017.<sup>1</sup> The disease affects children and families everywhere but is most prevalent in South Asia and sub-Saharan Africa. Worldwide, public health interventions are facilitated to prevent pneumonia that include immunization, adequate nutrition, exclusive breastfeeding and zinc supplementation.<sup>2</sup>

Exclusive breastfeeding for the first 6 months of life is key to improving children's natural defenses. Human milk contains a wealth of immunologic factors that fight against infections during infancy, and breast milk has evolved to provide the best nutrition, immune protection, regulation of growth, development and metabolism for the human infant.<sup>3</sup> The predominant antibody in breast milk-secretory IgA, confers its immune protection by inhibiting the adherence to or penetration of the gastrointestinal tract by pathogens and by phagocytosis of pathogens. Secretory IgA also provide immunological protection to the infant, whilst its own immune system matures.<sup>4</sup> Exclusive breastfeeding in early infancy significantly reduces the risk of in-patient admission for suspected pneumonia in the first 6 months of life. Breast-fed infants are better protected against infections like otitis media, diarrhea, respiratory infections, infection-induced wheezing and invasive H. influenza infections for several years after the termination of breastfeeding.<sup>5</sup> This is presumably the result of a number of potentially immune stimulatory factors in the milk like antibodies, lymphocytes, cytokines and certain hormones like leptin which may specifically stimulate TH1 lymphocytes.<sup>6</sup>

Protective effects of breastfeeding on infectious diseases are well known, but whether or not such effects last after infancy are rarely investigated. Studies done in United Kingdom reported that protective associations of breastfeeding with respiratory tract infection wore off soon after cessation of breastfeeding.<sup>7</sup> Moreover, protective effect of breastfeeding lasted up to the age of 2 years only.<sup>8</sup> The mechanisms by which human milk confers protective effects that last beyond infancy and after breastfeeding ends are unclear. Few studies have begun to investigate on the protective effect up to 5

years of age of exclusive breastfeeding and have shown promising outcomes. It has been speculated that immunologic factors in breast milk influence the development of the infant's immune system such that they influence the pathogenesis of illness later in life.<sup>9</sup>

To date, there is scarcity of Philippine studies on the effect of breastfeeding beyond the breastfeeding years on childhood pneumonia. However due to the theoretical possibilities and the presence of conflicting studies, this study was performed to systematically review and analyze available studies and evaluate if exclusive breastfeeding is protective against pneumonia up to the age of 5 years. This study aims to contribute more evidence in upholding exclusive breastfeeding as a measure of preventive health care. It also aims to generate robust data to support policy making measures on breastfeeding that will aid in achieving the Millennium Development Goals and therefore mitigate inequities in the access to health services. Breastfeeding is natural, safe and sustainable source of nutrition and protection for children. It is recognized by the International Convention on the Rights of the Child as a key component of every child's human right. It is therefore important that every Filipino child, benefit from the results of this study and therefore impact the society as well. Information to be gathered in this study can empower mothers, health workers and administrators in reinforcing the advantages of breastfeeding to achieve best health outcomes.

### Operational Definition of Terms and Variables

**Exclusive Breastfeeding** – practice of giving infants breast milk from mother or wet nurse or expressed breast milk with no other liquids or solids except vitamin drops or syrups, mineral supplements, prescribed medicines or oral rehydration solution from birth to 6 months of age.

**Non-exclusive Breastfeeding** – practice of giving infants milk other than breast milk or those who did not fit the definition of exclusively breastfed that include those who never breastfed, partially breastfed or are formula-fed. In this study, infants who were exclusively breastfed for less than 6 months were included in this group.

**Community Acquired Pneumonia** – an acute disease that is marked by inflammation of lung tissue accompanied by infiltration of alveoli and often bronchioles with white blood and fibrinous exudate, is

characterized by fever, chills, cough, difficulty in breathing, fatigue, chest pain, and reduced lung expansion and is typically caused by an infectious agent.

## **METHODOLOGY**

### **Search Strategy and Study Identification**

Literature search was conducted on the following electronic databases: Pubmed, MEDLINE, EMBASE, CINAHL, SciHub, Herdin, Google Scholar, the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews to identify all relevant trials (randomized controlled trials, cohort, cross-sectional, or case-control studies) between 1980 and December 2017. The literature search used the following terms or combination of keywords: exclusive breastfeeding, breast milk, human milk, pneumonia, community acquired pneumonia. No language and publication restrictions were applied. Excluded were trials wherein respiratory infections were not fully defined as pneumonia such as bronchiolitis, bronchitis, tuberculosis, asthma or included only upper respiratory tract infection such as colds or otitis media. If respiratory infections were not defined or upper respiratory tract infections and lower respiratory tract infections were combined, the researcher included studies where such cases were hospitalized, assuming illness is due to acute LRTI. Studies including infants born to HIV positive mothers were excluded because of the possibility of altered immune status of infants.

### **Study Selection**

Observational studies comparing exclusive breastfeeding and non-exclusive breastfeeding and incidence of pneumonia from birth to 5 years of age were included. Studies that did not define infection as pneumonia were excluded. Systematic reviews and previous meta-analyses were excluded but were reviewed to identify potential studies. The author used titles and abstracts to exclude studies which clearly did not meet the set inclusion criteria. The common reasons for exclusion of articles from the electronic search were age group more than 5 years and missing data on non-exclusive breastfeeding. Full articles were retrieved for further assessment if the abstracts indicated that there was a possibility that the study fulfilled the inclusion criteria. Two authors independently screened the studies for study eligibility. For this meta-analysis, those studies

that compared exclusive breastfeeding from non-exclusive breastfeeding and pneumonia incidence from birth to 5 years were considered. The investigator and another peer independently reviewed and assessed inclusion criteria. Five potentially eligible papers were identified and reviewed. The primary outcome measure was the prevention of community acquired pneumonia up to 5 years of age.

### **Data Collection and Processing**

The journals were screened and peer reviewed by another reviewer to assess study eligibility. The investigator and another peer independently reviewed and assessed inclusion criteria, extracted the data, assessed risk of bias and resolved disagreements. Data concerning details of the study population, intervention and outcomes were extracted independently using the data extraction form from the Cochrane Library. From each paper, the researcher extracted information related to general information (title, authors, year of publication and number of patients from the study), study characteristics (method of randomization and blinding), intervention (duration of exclusive breastfeeding), participant characteristics (inclusion and exclusion criteria, age group, number of patients in each intervention), outcomes (incidence of developing pneumonia after exclusive breastfeeding compared to non-exclusive breastfeeding) and results (data were expressed as weighted mean differences, odds ratio).

Each included study was assessed based on the following indicators of risk of bias namely random sequence generation, allocation concealment, blinding of participants and outcome assessment, incomplete outcome data and selective outcome reporting. A verdict of Low Risk meant low risk of bias, High Risk meant high risk of bias and Unclear Risk for unknown risk of bias were used criteria for judging. See Appendix.

### **Data Analysis**

Meta-analysis using fixed effects was conducted using Review Manager 5.3. Generic Inverse Variance method was used to include studies with only Odds Ratio as given data. In studies where the researcher was unable to extract all the information needed from the study, the plan was to contact the authors. Fortunately, all numerical data needed were adequate for analysis. Both positive and negative results were reported among

the studies. Subgroup analysis at 6-12 months of age was done because previous studies showed that the benefit of exclusive breastfeeding only lasted during time of breastfeeding. Publication bias was assessed by a funnel plot using occurrence of pneumonia at 5 years as endpoint.

### Ethical Considerations

The study protocol was reviewed and approved by the hospital's ethics review committee. Personal information from any of the study will not be released without the consent of the stakeholders. The investigator and all key personnel have completed the Good Clinical Practice (GCP) training on the responsible conduct of research with human data. All gathered information was reviewed and kept transparent throughout the study.

### RESULTS

The search retrieved a total of 233 references. After screening the studies against the inclusion criteria five studies were included in the meta-analysis. A flowchart diagram for the studies evaluated and the reasons for exclusion are shown in **Figure 1**.

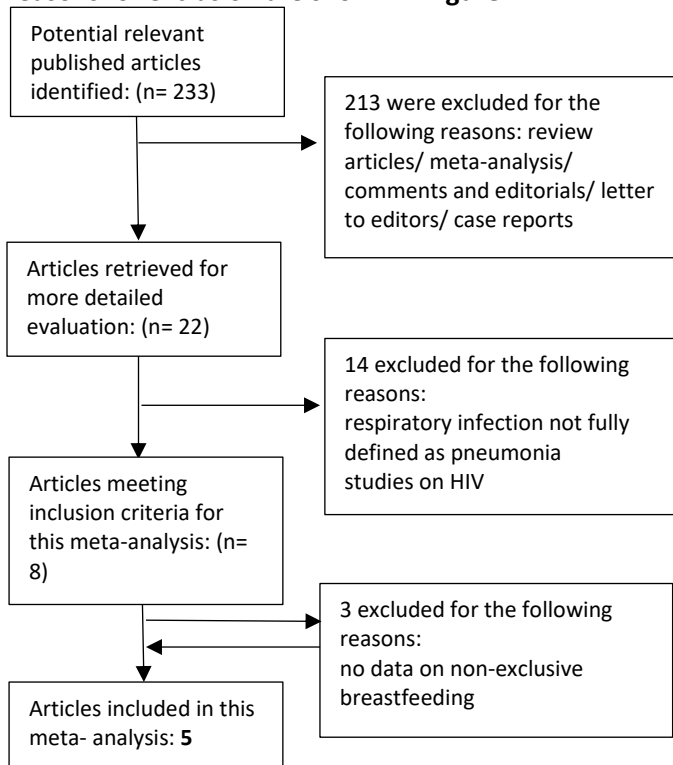


Figure 1. Flow Chart of Study Selection.

### Study Characteristics

The study characteristics are summarized in **Table 1**. A total of 45,776 patients with pneumonia were included. The total sample population for each study were 39531 (Yamanaka et al), 5322 (Tromp et al.), 1281 (Li et al), 120 (Svivastava et al) and 512 (Tazinya et al). All studies were published from 2014 to 2018 and were conducted in different countries. They were composed of three cohort studies, one case-control and one cross-sectional study. By WHO region, the included studies were conducted in America (n=1), European (n=1), Western Pacific (n=1), South East Asia (n=1) and Africa (n=1). All the cohort studies and the case control study included recruited subjects since birth and followed up until 5 years of age, while the cross-sectional study recruited subjects from 2 months of age to 5 years of age. In all studies, data were collected from interviews, survey questionnaire and hospital records. The included studies showed high risk for selection bias, performance bias and detection bias. The quality assessment of these studies is summarized in the appendix section. The results of the meta-analyses that investigated the effect of exclusive breastfeeding on pneumonia are shown in **Table 2**.

**Table 1. Characteristics of study population**

<b>Study, Year</b>	<b>Study Design</b>	<b>Population</b>	<b>Intervention</b>	<b>Control</b>	<b>Outcome</b>
<b>Yamakawa et al., 2015</b>	Cohort (Nationwide Longitudinal Study)	All singleton children who were born after 37 gestational week, born between 10th and 17th January or 10th and 17th July 2001	Exclusive breastfeeding for 6 months from birth	Formula milk, Partial breastfeeding and exclusive breastfeeding of less than 4 months	Hospitalization for Pneumonia until 5 years of age
<b>Tromp et al., 2017</b>	Cohort (Population Based Prospective Study)	Mothers delivered from April 2002 through January 2006	Exclusive breastfeeding 6 months and 6 months and beyond	Never breastfed and breastfeeding for less than 3 months	Pneumonia incidence until 5 years of age
<b>Li et al., 2014</b>	Cohort (Prospective Longitudinal Study)	Mothers on late pregnancy until 1 year after birth from 2005-2012	Exclusive breastfeeding until 6 months and 6 months and beyond	Formula feeding	Pneumonia incidence until 5 years of age
<b>Srivastava et al., 2015</b>	Prospective Case- Control Study	Children aged 1 month to 5 years	Exclusive breastfeeding up to 6 months	Non- exclusive breastfeeding	Pneumonia incidence up to 5 years of age
<b>Tazinya et al., 2018</b>	Cross-Sectional Study	Children under 5 years of age	Exclusive Breastfeeding up to 6 months	Non-exclusive breastfeeding	Pneumonia up to 5 years of age

Table 2. Outcome data of all trials included in the meta-analysis

Study	Incidence of Pneumonia (n/N)	
	Exclusive Breastfeeding	Non-exclusive Breastfeeding
Yamakawa et al., 2015	8862/39531	30651/39531
Tromp et al., 2017	2827/5322	2495/5322
Li et al., 2014	1106/1281	175/1281
Svivistava et al., 2015	81/120	39/120
Tazinya et al., 2018	438/512	74/512

### Exclusive Breastfeeding and Pneumonia up to 5 years

Pooled estimate of Odds Ratio showed that exclusive breastfeeding was significantly associated with lower odds of pneumonia at age 5 years old ( $OR=0.86$ ;  $95\%CI=0.77-0.95$ ,  $p-value=0.003$ ). Only the studies of Tromp et al (2017) and Yamakawa et al (2015) showed significantly lower odds for pneumonia among children who were exclusively breastfed. The rest of the studies did not show significant differences between exclusively and non-exclusively breastfed children. See figure 2. Studies are homogenous ( $I^2=0\%$ ,  $p-value=0.41$ ).

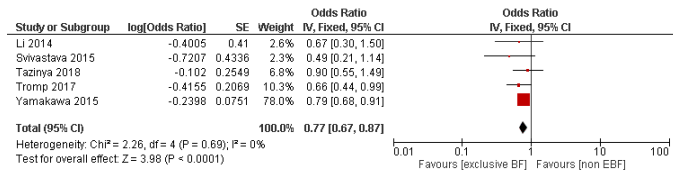


Figure 2. Forest plot comparing the odds of pneumonia up to 5 years between exclusively breastfed compared to non-exclusively breastfed.

### Exclusive Breastfeeding compared to Non-Exclusive Breastfeeding from 6 to 12 months

Results from the analyses were available to examine the effect of exclusive breastfeeding compared to non-exclusive breastfeeding in the incidence of pneumonia from 6 to 12 months. The studies are homogenous. ( $I^2=30\%$ ,  $p-value=0.22$ ). Pooled estimate of Odds Ratio showed no significant differences in odds for pneumonia between the two groups ( $OR=0.95$ ;  $95\%CI=0.84-1.01$ ,  $p-value=0.07$ ). Only the study of Tromp et al (2017) showed significantly lower odds for pneumonia among children who were exclusively breastfed. The rest of the studies did not show significant differences between exclusively and non-exclusively breastfed children. See Figure 3.

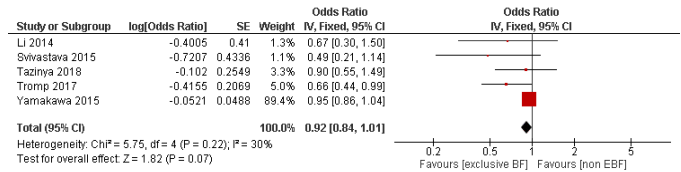


Figure 3. Forest plot showing the odds of pneumonia at 6-12 months old between exclusively breastfed compared to non-exclusively breastfed.

### DISCUSSION

The study highlighted the protective effect of exclusive breastfeeding against pneumonia up to five years of age. Findings of the study showed that exclusive breastfeeding from birth to 6 months reduced the probability of pneumonia up to 5 years old by 23%. These results are congruent to the findings of a cohort study done in 1998 by Wilson et. al which concluded that exclusive breastfeeding was associated with reduced risk of respiratory illness even after cessation of breastfeeding.<sup>10</sup> The results were also consistent with the systematic review done by Horta et al.<sup>11</sup> wherein findings showed that breastfeeding reduces the risk for respiratory infection and this protective effect did not change with age. The protective effects as shown by the results were observed on ages 36 to 48 months and not 6-12 months. These findings may be explained by the fact that breastfeeding may truly have long-term protective effects on respiratory infections and such protective effects may become apparent as the children becomes older. Breastmilk contains immune and non-immune compounds which are likely to contribute to long term benefits to infants by facilitating immune development and maturation.<sup>12</sup> Similar to the findings of the study, a prospective longitudinal study found that breastfeeding duration, including breastfeeding longer than 6 months, was not associated with pneumonia or lung infection in 6-year-old children.<sup>13</sup> The results are in contrast to another study wherein findings showed protective effect

of breastfeeding was said to be strongest in the first 6 months of life.<sup>14</sup>

In this study, exclusive breastfeeding showed no significant difference in the odds of pneumonia for the immediate period of 6-12 months. This result is consistent with a study by Quigley et al, which suggests that the protective effect of breastfeeding might wear off after breastfeeding cessation after introduction of solid food that may prevent children from maintaining their immune properties within a sufficient level.<sup>7</sup> It may also be affected by the differences in the population for infectious diseases during the first year of life are strongly related to the gestational age and birth weight, and the present study did not exclude them as subjects.

These results, altogether, support the WHO recommendation for exclusive breastfeeding during the first six months of life at least and beyond. Breastfeeding mothers should be encouraged and supported in making decisions to initiate breastfeeding and maintain exclusive breastfeeding for the first 6 months. Although there is a lack of literature assessing the effect of exclusive breastfeeding and beyond, the studies in this review consistently showed positive effect of breastfeeding even after 6 months. A study in Japan by Yamakawa et al.,<sup>9</sup> observed that the protective effect on the risk of hospitalization for respiratory infections was evident between 18 to 30 months and 30 to 42 months. It suggests that longer duration of breastfeeding was associated with reduced risk of hospitalization for respiratory tract infections and that the protective effect was stronger if breastfeeding was done beyond 6 months. The study of Tromp et al.<sup>15</sup> found breastfeeding for 6 months or longer to be associated with a reduced risk for lower respiratory tract infections after infancy till the age of 4 years. These are consistent with a cross-sectional study done by Chantry<sup>16</sup> in 2006, that showed exclusive breastfeeding for more than 6 months provides more protection against respiratory diseases than does exclusive breastfeeding in less than 4 or 6 months. Protection was also found in the age group of 6 to 72 months in whom the odds of pneumonia were more than fourfold lower if full breastfeeding was continued through 6 months. The results therefore can be beneficial in improving breastfeeding practices given the potentially harmful cost of infection. These findings are compatible with the hypothesis that the protective effect

of the duration of breastfeeding for respiratory tract infections persist after infancy.

Similar to these findings, a prospective longitudinal study by Li et al.<sup>13</sup> found that exclusive breastfeeding longer than 6 months was not associated with pneumonia or lung infection in 6 years old children. However, the odds of 6 years old children having greater than 2 sick visits in a year for ear, throat and sinus infection were found to be associated with duration and exclusivity of breastfeeding, the timing of supplementing breastfeeding with formula and breast milk intensity. Previous studies also stated that lack of exclusive breastfeeding wasn't significantly associated with pneumonia. The study of Srivastava<sup>14</sup> concluded the lack of exclusive breastfeeding was not significantly associated with pneumonia when all the children between 1 month to 5 years were considered. Nevertheless, considering only children less than 1 year old among subjects, it was observed that lack of exclusive breastfeeding was significantly associated with pneumonia. In contrast, the study by Tazinya<sup>17</sup> established that children who were inadequately breastfed and did not have significant different proportion of respiratory infections when compared those who were exclusively breastfed.

This review confirms and expands the evidence of the recommendation of the Department of Health on exclusive breastfeeding campaign dubbed "Breastfeeding TSEK: Tama, Sapat at Exclusibo" targeting the new and expectant mothers in urban areas, which aims to reduce child mortality and improve child survival. These data should help convince more mothers to exclusively breastfeed their infants up to 6 months of age.

All of the studies included in this review did not utilize methods to reduce reverse causality bias. Since all studies included were observational, the possibility of confounding is high. However, the effect sizes of the studies involved were large and consistent among age groups and outcomes. The analyses were limited by inclusion of measures calculated with raw data for potential confounders such as age of mothers, socio-economic status, educational background, vaccination status and other acute illnesses.

Finally, although the study yielded the benefit of exclusive breastfeeding on childhood pneumonia up to 5 years of age, the results did not aim to estimate the risk

of breastfeeding children born with congenital infections, malformations or preterm. In addition, there is also a dearth of local data for analysis and data on breastfeeding beyond 6 months of age. In 2004, infant and young child feeding practices were assessed using the WHO assessment protocol and the Philippines rated poor to fair. Findings showed four out of ten newborns were initiated to breastfeeding within an hour after birth, three out of ten infants less than six months were exclusively breastfed and the median duration of breastfeeding was only thirteen months.<sup>18</sup> These are the areas that are yet to be ventured into when it comes to producing cohort studies on breastfeeding and pneumonia. A review on the impact of breastfeeding promotion is also suggested given the low coverage of exclusive and continued breastfeeding in the Philippines.

#### **CONCLUSIONS AND RECOMMENDATIONS**

Exclusive breastfeeding from birth to 6 months is associated with statistically significant reduction in the incidence of pneumonia up to 5 years of age. These findings are compatible with the protective effect of breastfeeding for respiratory tract infection that persists after infancy and supports the WHO recommendation for exclusive breastfeeding up to 6 months of age. More observational studies on exclusive breastfeeding and pneumonia with local data, diverse population of children and on continued breastfeeding are needed.



## REFERENCES

1. World Health Organization. (2019, August 2). *Pneumonia*. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/pneumonia>.
2. World Health Organization. (2014, February 16). EWARN Post Typhoon Yolanda Week 15. *Early Warning and Response Network Weekly Summary Report*. <https://reliefweb.int/sites/reliefweb.int/files/resources/EWARN%2016Feb-22Feb.pdf>.
3. Liu, K. (2003) 'Cost analysis of pneumonia treatment in the Philippines', *The International Journal of Health Planning and Management*, 18(3), pp. .
4. Dieterich, C. (2013) 'Breastfeeding and Health Outcomes for the Mother-Infant Dyad', *Pediatr Clin North Am*, 60(1), pp. 31-48.
5. Brandtzaeg P. Mucosal immunity: integration between mother and the breast-fed infant. *Vaccine*. 2003; 21(24):3382–8.
6. Hanson LA, Korotkova M. The role of breastfeeding in prevention of neonatal infection. *Semin Neonatol* 2002;7(4):275–81.
7. Quigley, M. A., Kelly, Y. J., & Sacker, A. (2007). Breastfeeding and Hospitalization for Diarrheal and Respiratory Infection in the United Kingdom Millennium Cohort Study. *PEDIATRICS*, 119(4), e837–e842. doi:10.1542/peds.2006-2256
8. Duijts, L., Jaddoe, V. W. V., Hofman, A., & Moll, H. A. (2010). Prolonged and Exclusive Breastfeeding Reduces the Risk of Infectious Diseases in Infancy. *PEDIATRICS*, 126(1), e18–e25. doi:10.1542/peds.2008-3256
9. Yamakawa, M., Yorifuji, T., Kato, T., Inoue, S., Tokinobu, A., Tsuda, T., & Doi, H. (2015). Long-Term Effects of Breastfeeding on Children's Hospitalization for Respiratory Tract Infections and Diarrhea in Early Childhood in Japan. *Maternal and Child Health Journal*, 19(9), 1956–1965. doi:10.1007/s10995-015-1703-4
10. Wilson, A.C., Forsyth, J. S., Green, S, A. Irvine, L., Hau, C., (1998) Relation of infant diet to childhood health: seven year follow up of cohort of children in Dundee infants study., *BMJ*, 316 (7124), 21-25
11. Horta, B.L., Victora C.G., (2013) Short-term effect of breastfeeding: a systematic review on the benefits on diarrhea and pneumonia mortality., WHO publication
12. Field, C. J. (2005). The immunological components of human milk and their effect on immune development in infants. *The Journal of Nutrition*, 135(1), 1–4.
13. Li R, Dee D, Li CM, Hoffman HJ, Grummer-Strawn LM. Breastfeeding and risk of infections at 6 years. *Pediatrics*. 2014; 134 Suppl 1: S13–20.
14. Srivastava P, Mishra AK, Roy AK (2015) Predisposing Factors of Community Acquired Pneumonia in Under-Five Children. *Lung Dis Treat* 1: 101. doi:10.4172/2472-1018.1000101
15. Tromp I, Kieft-de Jong J, Raat H, Jaddoe V, Franco O, Hofman A, et al. (2017) Breastfeeding and the risk of respiratory tract infections after infancy: The Generation R Study. *PLoS ONE* 12(2): e0172763. doi:10.1371/journal.pone.0172763
16. Chantry, C. J. (2006). Full Breastfeeding Duration and Associated Decrease in Respiratory Tract Infection in US Children. *PEDIATRICS*, 117(2), 425–432. doi:10.1542/peds.2004-2283
17. Tazinya, Alexis A et al. "Risk factors for acute respiratory infections in children under five years attending the Bamenda Regional Hospital in Cameroon." *BMC pulmonary medicine* vol. 18,1 7. 16 Jan. 2018, doi:10.1186/s12890-018-0579-7
18. Borja, V. E. (2005). Infant and Young Child Feeding (IYCF): Department of Health website. Retrieved October 09, 2020, from <https://www.doh.gov.ph/infant-and-young-child-feeding>

**APPENDIX**  
**Yamanaka, 2015**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	All babies born between 10th and 17th January or 10th and 17th July 2001 all over Japan were targeted
Allocation concealment (selection bias)	High risk	None
Blinding of participants and personnel (performance bias)	High risk	Longitudinal Survey was used
Blinding of outcome assessment (detection bias)	High risk	None
Incomplete outcome data (attrition bias)	Low risk	88% response rate from participants
Selective reporting (reporting bias)	High risk	Longitudinal Survey was used
Other bias	Unclear risk	

**Tromp, 2017**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	None
Allocation concealment (selection bias)	High risk	None
Blinding of participants and personnel (performance bias)	High risk	No
Blinding of outcome assessment (detection bias)	High risk	Postal parent-reported questionnaires were used
Incomplete outcome data (attrition bias)	Low risk	Consent for postnatal follow-up was provided by 7893 participants from 9778 mothers
Selective reporting (reporting bias)	High risk	Questionnaire form
Other bias	Unclear risk	

**Li et al., 2014**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	None
Allocation concealment (selection bias)	High risk	None
Blinding of participants and personnel (performance bias)	Unclear risk	None
Blinding of outcome assessment (detection bias)	High risk	None
Incomplete outcome data (attrition bias)	Low risk	1542 mother-child pairs
Selective reporting (reporting bias)	Unclear risk	Survey Form for 6 years follow up study
Other bias	Unclear risk	

**Srivastava et al., 2015**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	All cases and controls were selected from the age group of 1 month to 5 years if they fulfilled the inclusion criteria
Allocation concealment (selection bias)	Unclear risk	None
Blinding of participants and personnel (performance bias)	High risk	Questionnaire forms were utilized
Blinding of outcome assessment (detection bias)	High risk	None
Incomplete outcome data (attrition bias)	Low risk	120 participants with 60 control subjects and 60 cases subjects
Selective reporting (reporting bias)	High risk	Questionnaire and Interviews
Other bias	Unclear risk	

**Tazinya et al., 2018**

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Participants were enrolled by a consecutive convenient sampling method
Allocation concealment (selection bias)	High risk	Participants were enrolled by a consecutive convenient sampling method
Blinding of participants and personnel (performance bias)	High risk	None
Blinding of outcome assessment (detection bias)	High risk	Structured Questionnaire
Incomplete outcome data (attrition bias)	High risk	Out of 620 children screened, 512 completed the study
Selective reporting (reporting bias)	High risk	Structured Questionnaire
Other bias	Unclear risk	