

**Review Article****Prevalence and impact of Gastroesophageal Reflux Disease in Infants and Children****Taral Parikh**

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**Abstract.**

The prevalence of GERD (Gastroesophageal reflux disease) is rising in the world and this review was done to analyze GER and GERD effects and their prevalence in infants and children and if left untreated, they have many consequences. Gastroesophageal reflux (GER) is a chronic GI disorder characterized by regurgitation of the gastric acidic content from the stomach into the esophagus that may result in vomiting and regurgitation. It is a consequence of insufficient lower esophageal sphincter tone and because of other anatomical factors. Gastroesophageal reflux disease (GERD) can cause many complications. History and physical examinations are sufficient to diagnose most cases. Endoscopy, barium swallow study, and pH monitoring are reserved for patients with atypical presentations, red flag signs, the possibility of another diagnosis, or not responding to conventional treatment. Most infants with regurgitation get better by 12 months and do not need any interventions. Most infants respond to body position changes while awake, frequent low-volume feeding, thickening of the formula (i.e., rice cereal), and anti-regurgitation formula. For suspected cow milk protein sensitivity, as one of the possible triggers for GERD, extensively hydrolyzed or amino acid formulas, and, in breastfed infants, elimination of cow's milk from the mother's diet could help. This article analyzes GER and GERD effects and their prevalence from a systematic literature review. This study shows that the incidence of GERD is rising and becoming more frequent in infants and in children with co-morbidities.

**Introduction**

Definition: GER is the passage of gastric content from the stomach to the esophagus, with or without regurgitation or vomiting.[1]

GER is a common chronic GI disorder. As per [2], It is normal physiologically, typically after meals, it occurs throughout the day in infants and decreases in frequency in children and adolescents. It may be asymptomatic or cause mild regurgitation or rarely vomiting. Regurgitation is caused by passive reflux from the stomach into the pharynx or oral cavity. At the same time, vomiting is the forceful expulsion of stomach contents into the mouth, which involves autonomic and voluntary muscle contractions, sometimes triggered by reflux. Regurgitation following most feed has been reported in 20% of a healthy infant

at one month of age. This can increase to 41% between 3 and 4 months of age, then decrease, becoming rare after one year [3]. The diagnosis and workup of GER and GERD depend on the clinical symptoms and signs, including physical and medical assessment. However, the symptoms and signs may be non-specific, requiring additional diagnostic investigation to qualify and quantify the condition. The typical sign and symptom of GER is heartburn, a burning feeling around the chest that radiates towards the mouth but can only be reported by an older child. The infant may present with recurrent regurgitation or Vomiting, irritability after feeding, prolonged feeding or feeding refusal, or back arching. Projectile vomiting towards the end of the first months of life, significantly worsening of the clinical course, is possible due to pyloric stenosis and requires further workup by abdominal ultrasound and surgical referral. Recurrent nonprojectile vomiting or regurgitation is uncommon beyond 18 months and suggests GERD or more concerning pathology. Poor weight gain, coughing, or choking during feeding may also indicate GERD and require further workup. Bilious vomiting is a red flag sign at any age, particularly in the first few months of life, and is an emergency as it suggests intestinal obstruction. Gastrointestinal bleeding also requires further workup.

GER is more common in infancy when it's mostly physiological and doesn't require any treatment. Diagnosis of GER and GERD primarily relies on the clinical history and physical examination; if missing, it may have long-term consequences. The primary aim of the review is to determine the prevalence of GERD in pediatric age and its common presentation in the different age groups to make primary care providers aware of possible presentation and its consequences.

**Epidemiology**

Healthy infants commonly experience gastric reflux in the esophagus daily. In infants, GERD symptoms are noted in more than a quarter of infants daily and show a steady decline in frequency with almost complete disappearance of symptoms by the of 12 months. In children older than 18 months, GERD symptoms show considerable variation in prevalence between studies (range 0%-38% of the study population) and, overall, are present in >10% and 25% on, respectively, a weekly and monthly basis [4]. Infants, especially preterm born, are vulnerable to developing gastroesophageal reflux because of, impaired peristalsis of the esophagus, lower pressure of the lower esophageal sphincter,

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slower gastric emptying, and relatively large milk intake. Some studies associate gastroesophageal reflux in infants with cow milk protein allergy [5]. On the other hand, breastfed infants are less likely to experience gastroesophageal reflux.

### Gastroesophageal Etiology

Most GER is caused by stomach acid influx to the esophagus. Additional results have shown that many of GER episodes are non-acidic. However, refluxed gastric content is highly acidic when a patient suffers from reflux esophagitis [4]. GER is also associated with infant positioning, nonnutritive sucking, and the type of food the infants were given. Placing an infant seat inclined at 60 degrees is detrimental to GER as it is related to 28.2 % of GER cases than cases recorded in a prone position [6]. However, there is no significant difference in points in infants seated in the horizontal position, and those placed in the horizontal position in a bed or seat turned at 30 degrees. Gastroesophageal reflux is more prevalent in infants and children who are overweight and obese and those with congenital heart disease, neurological impairment, chromosomal abnormalities, gastrointestinal tract abnormalities, and congenital diaphragmatic hernia. Obesity has been identified as one of the predisposing factors as the condition is associated with higher intragastric pressure and increased transient relaxation of the lower esophageal sphincter [7]. It also frequently occurs in patients with interstitial lung disease and cystic fibrosis [8]. The condition might also be caused by a depressed diaphragm caused by abnormal pressure, hyperinflation, and chronic coughing. Esophageal mucosa is a defense against acid actions. Its protective property can be breached by prolonged exposure to acidic gastric and alkaline duodenal content leading to its damage [9]. The accumulation of acidic content from the stomach contributes to GER due to delayed gastric emptying. Esophageal squamous epithelium provides a protective defense against acidic reflux. The disruption of the muscle layer leads to GER risks. Motor abnormalities such as esophageal dysmotility have been linked to esophageal reflux as it causes impaired acid clearance, transient LES relaxation, lower pressure of the lower esophageal sphincter, and delayed gastric emptying.

### Gastroesophageal Reflux Effects

Chronic GER leads to frequent heartburn as a result to the reaction of the acid from the stomach. The burning sensation shows that the esophagus lining is getting battered with stomach acid damaging the tissues along the organ. The regular acid influx in the esophagus leads to chronic inflammation and severe complications such as chronic mucosal damage. The short-term effects of the condition among pre-term and term infants include fussiness during or following feeding, possetting, sleep interruptions, irritability and back arching, and frequent spitting up [10]. High-risk brief resolved unexplained event (HR-BRUE) episodes were reported as occurring during or after feeding (11).

### The distribution of symptoms and gastroesophageal effects in a group of infants who had HR-BRUE [8]

Adverse effects of the condition include swallowing dysfunction, re-

Symptom	Frequency	Percentage
Episode during or right after feeding	29	53.7%
Vomiting	19	35.19%
Choking	12	22.22%
Hypertonia	5	9.26%
Hypotonia	18	33.33%
Cyanosis	45	83.33%
Apnea	17	31.48%
Pallor	3	5.56%

current bronchiolitis, oxygen desaturation, choking, apnea, wheezing, adverse respiratory, neurobehavioral, and gastrointestinal effects, lower energy intake, aspiration pneumonia, and frequent vomiting [11]. The study examining the long-term effect of GER in children [12] showed that GER could result in excessive weight loss, delayed development, and dysfunctional swallowing. The evidence from the study indicates that GER is chronic and has a long-term impact on children [13]. Lack of esophageal histology improvement can lead to long-term effects such as strictures and esophageal dysplasia that can lead to adenocarcinoma. The study's finding also shows an abnormality in esophageal histology in children under one year.

GER is implicated as contributing factor to many otolaryngological and pulmonary disorders. It is associated with otalgia, laryngitis, rhinitis, chronic cough, stridor, reactive airway disease, and contact ulcerations. It is also responsible for airway diseases such as chronic sinus disease. In the study, many participants with GER showed signs and symptoms of sinusitis [14]. The most commonly reported symptoms among the GER group include cough, nasal obstruction, irritability, sore throat, and postnasal drainage. Chronic GER results in respiratory complications such as sinusitis, obstructive bronchitis, and reactive airway disease [15]. Gastroesophageal reflux can also result in recurrent otitis media.

GER is also associated with rumination and protein-losing enteropathy. Additionally, it causes peptic esophagitis, leading to gastrointestinal bleeding [16]. The bleeding may lead to melena, hematemesis, and iron deficiency anemia. Sleeping interruption and arousal have been associated with GER due to a more significant release of nocturnal acid reflux when a child is lying down. The development of peptic esophagitis leads to complications such as Barrett's esophagus, esophageal mucosal dysplasia, esophagus shorting, and stricture formation [17]. Due to the inconsistency of heartburn as the main symptom of the disease diagnosis, there is a range of diagnostic investigations, such as 24 hours pH monitoring, to provide quantitative data on the duration and frequency of esophageal exposure to acid. The other methods for GER diagnosis are multiple intraluminal impedance and upper gastrointestinal endoscopy for detecting esophageal inflammation or erosion and histology of esophageal biopsies. Most diagnostic procedures for gastroesophageal reflux are invasive and should only be implemented for infants with recurrent pneumonia, upper airway inflammation, apnea, and non-epileptic seizure.

### Prevalence of Gastroesophageal Reflux

According to the research done by Curien-Chotard and Jantchou[18], the prevalence of gastroesophageal reflux varies depending on the population. In this study, the regurgitation incidence during the first month of life was 72.3% (95% confidence interval (CI) [64.9–79.7]). The percentage of infants regurgitating at least once a day decreased after that: 69, 56, 18, and 13% at 3, 6, 10, and 12 months, respectively. Few infants regurgitated more than six times a day (7% at one month and 6% at 3, 6% at six months of age, and none after that). The progression of physiological GER and GERD were markedly different. Whereas physiological GER peaked at three months of age (59.4%), GERD peaked at one month of age (19%) Singendonk, and al. [3] conducted a systematic review of the prevalence of GER symptoms in infants and children. The study categorizes the condition's prevalence based on risk factors such as age, sex, mode of feeding (for infants), and BMI. Results of one of the analyzed studies show that the prevalence of GERD symptoms is 3.2 % for children below ten years of age, and based on eight other studies, the prevalence was 10.1 % for children above ten years old.

According to the study of Dahlen et al., GER was highly prevalent in infants between the ages of 3 to 4 months, with higher prevalence seen in infants born preterm [19]. However, the prevalence rate of GER decreases for infants born prematurely from forty weeks onwards. The number of infants with GER remains significant in the residential units, with many GER cases remaining significantly and moderately

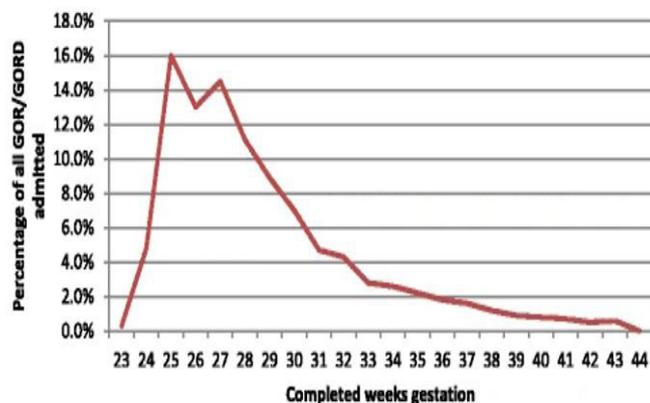


Figure 1: The proportionality of infants diagnosed with GER weeks after birth [19]

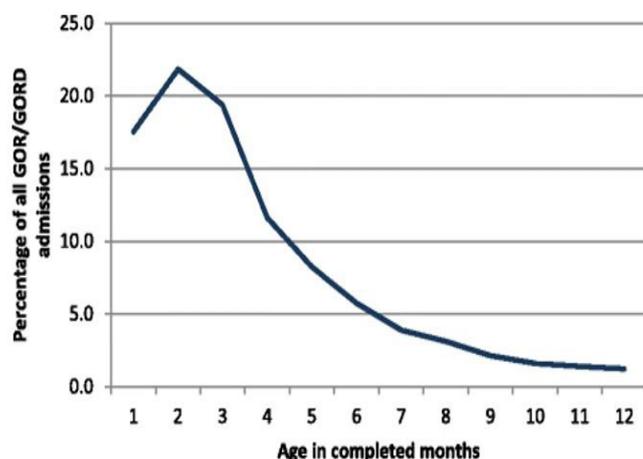


Figure 2: Percentage of cased relative to infant ages according to admitted cases [19].

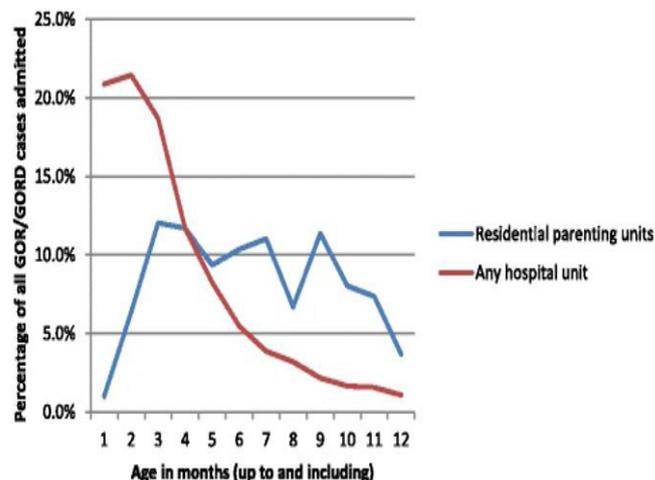


Figure 3: The difference between residential and in-hospital cases [19].

maintained within twelve months after birth [20]. The figures below show the visual representation of the results of the study.

Another study indicates that almost 50 % of healthy infants, using the PubMed database, regurgitate at least once a day, and the observation is at its peak at four months of age. Still, it doesn't require any intervention or treatment most of the time [21].

### Evaluation

#### The evaluation depends on age and symptoms [22]

Infants and young children: No single test is enough to make a reliable diagnosis of GERD. Clinicians must rely on clinical assessment and diagnostic tests. It's very difficult to differentiate between physiologic and pathological GER, especially in infants. So, the evaluation of GERD in young children, especially infants, should be based on if some associated co-morbidities or red flags are present. Some co-morbid conditions frequently associated with GERD are Neurologic impairment and obesity. Hiatal hernia, chronic respiratory disorders, prematurity, etc. At the same time, red flags which may require further evaluations include but are not limited to bilious vomiting, GI bleeding, forceful vomiting, failure to thrive, persistent GI symptoms like constipation or diarrhea, neurological conditions (Seizure, micro/macrocephaly), suspected metabolic problems.

Older children and adolescents: They may report classic symptoms like the adult of heartburn and regurgitation, and diagnosis may not be difficult in this age group.

- 1) Proton pump inhibitor (PPI) test: It is generally represented first-line diagnostic and therapeutic modality in adults and can be used in older children and adolescence. PPI is given for 2-4 weeks which can be extended up to 12 weeks if the symptomatic improvement is noted. If there is a 50% reduction in symptoms, its highly suggestive of GERD, and this approach can be used in older children and adolescents who present with typical GERD symptoms with no red flags signs.
- 2) Endoscopy and esophageal biopsy: The use of upper GI endoscopy should be reserved in patients with red flags or refractory symptoms. But it may not always be helpful as the macroscopic appearance of

mucosa in children may not correlate with histological findings. At the same time, histology findings in children are insufficient to support GERD as inflammatory infiltrate can be patchy. Often, esophageal eosinophilia can be found with cow milk protein allergy or even in asymptomatic infants, so difficult to differentiate from Eosinophilic esophagitis.

3) Upper GI contrast series: It's not recommended in the pediatric age group to diagnose GERD because of a lack of standardized values and technique.

4) Reflux monitoring: PH metry and multiple intraluminal impedance (MII) Ph- impedance monitoring can be done to evaluate the presence of reflux. MII pH-impedance monitoring helps to discriminate between acidic (pH 4), weakly acidic (4 pH 7), and alkaline (pH 7) GER episodes. Almost 45% of infants diagnosed with GERD by MII pH-impedance would have had normal pH-metry.

5) Manometry: It's not used to diagnose GERD but can be used to diagnose esophageal motility disorders.

### Treatment

Lifestyle changes remain the fundamental treatment for maintaining GER and GERD. For infants, treatment involves proper positioning, modifying feeding, rarely acid-suppressive therapy, and surgery for chronic conditions. Modified feeding is implemented by giving infants dense food, providing infants with smaller, more frequent feedings, changing the mother's diet for lactating mothers, and using hypoallergenic formula. Thickening of the formula is more effective, particularly when infants are upright for close to 30 minutes after feeding [23]. Providing small and more frequent meals to infants keeps the stomach pressure down and thus reduces the frequency of reflux [2]. Medication can be helpful if the infant's health does not improve after the lifestyle and dietary treatment trial. The GERD patient should be treated with acid-suppressing medicine such as omeprazole and lansoprazole as a second-line treatment. Other drugs recommended to be used rarely in infants with GERD include promotility drugs and histamine-2 (H2) blockers [24]. Promotility drugs promote gastric emptying and thus reduce gastric content volume. Examples of promotility drugs are bethanechol, baclofen, erythromycin, cisapride, and metoclopramide. Promotility drugs are prohibited from being used as first-line treatment for gastroesophageal reflux. Infants with life-threatening complications of GERD that are unresponsive to other therapy can be referred to surgical treatment such as ant-reflux surgery.

### Conclusion

In conclusion, GER is more prevalent in children aged less than one year, but most cases resolve spontaneously with time as infants get older. GERD incidence was age-dependent and highest among very young children and older female adolescents. Children with neurological impairments, obesity, and other comorbidities have an increased risk for GERD. Unless there are red flags like failure to thrive, hematemesis, or forceful or bilious vomiting, most infants with GER need no treatment, and just lifestyle modifications are recommended. Thickening of feeds, posture modification, and lifestyle changes, including weight loss in obese children, should be considered as the first-line treatment if reflux is frequent and causing symptoms. Pharmacotherapy should

be considered in treating more severe gastroesophageal reflux disease for patients who do not respond to conservative measures. Proton pump inhibitors are preferred over H2-receptor antagonists because of their superior efficacy. Anti-reflux surgery is indicated for patients with significant gastroesophageal reflux disease with severe complications and not responding to medical therapy. The prevalence of GERD is rising worldwide, which may be related to increasing diagnosis, obesity, or some other factor that needs to be investigated.

### References

1. Antunes, C., Aleem, A., & Curtis, S. A. (2017). Gastroesophageal reflux disease.
2. Baird DC, Harker DJ, Karmes AS. Diagnosis and Treatment of Gastroesophageal Reflux in Infants and Children. *Am Fam Physician*. 2015 Oct 15;92(8):705-14. PMID: 26554410.
3. <https://cps.ca/en/documents/position/gastro-esophageal-reflux-in-healthy-infants>
4. Singendonk, Maartje\*; Goudswaard, Eline\*; Langendam, Miranda†; van Wijk, Michiel\*,‡; van Etten-Jamaludin, Faridi\*; Beninga, Marc\*; Tabbers, Merit\*. Prevalence of Gastroesophageal Reflux Disease Symptoms in Infants and Children: A Systematic Review. *Journal of Pediatric Gastroenterology and Nutrition* 68(6):p 811-817, June 2019. | DOI: 10.1097/MPG.0000000000002280
5. Hojsak, I., Ivković, L., Trbojević, T., Pavić, I., Jadrešin, O., Mišak, Z., & Kolaček, S. (2016). The role of combined 24-h multichannel intraluminal impedance-pH monitoring in the evaluation of children with gastrointestinal symptoms suggesting gastro-esophageal reflux disease. *Neurogastroenterology & Motility*, 28(10), 1488-1493.
6. Carroll, A. E., Garrison, M. M., & Christakis, D. A. (2002). A systematic review of nonpharmacological and nonsurgical therapies for gastroesophageal reflux in infants. *Archives of pediatrics & adolescent medicine*, 156(2), 109-113.
7. Clarrett, D. M., & Hachem, C. (2018). Gastroesophageal reflux disease (GERD). *Missouri medicine*, 115(3), 214.
8. Leung, A. K., & Hon, K. L. (2019). Gastroesophageal reflux in children: an updated review. *Drugs in context*, 8.
9. Antunes, C., Aleem, A., & Curtis, S. A. (2017). Gastroesophageal reflux disease.
10. Bellomo-Brandão, M. A., Stranguetti, F. M., Lopes, I. F., Peixoto, A. O., Marson, F. A. L., & Lomazi, E. A. (2021). Gastroesophageal reflux disease in infants who presented Brief Resolved Unexplained Event (BRUE). *Arquivos de Gastroenterologia*, 58, 424-428.
11. Baird, D. C., Harker, D. J., & Karmes, A. S. (2015). Diagnosis and treatment of gastroesophageal reflux in infants and children. *American family physician*, 92(8), 705-714.
12. Gold, B. D. (2006). Is gastroesophageal reflux disease really a life-long disease: do babies who regurgitate grow up to be adults with GERD complications?. *Official journal of the American College of Gastroenterology* | *ACG*, 101(3), 641-644.
13. GI Alliance. (2020). The short- & long-term effects of GERD - GI alliance. Retrieved July 11, 2022, from <https://gialliance.com/gastroenterology-blog/the-short-long-term-effects-of-gerd>
14. Phipps, C. D., Wood, W. E., Gibson, W. S., & Cochran, W. J.

- (2000). Gastroesophageal reflux contributing to chronic sinus disease in children: a prospective analysis. *Archives of otolaryngology-head & neck surgery*, 126(7), 831-836.
15. Jung, A. (2001). Gastroesophageal reflux in infants and children. *American family physician*, 64(11), 1853.
  16. Helin, N. (2021). Outcomes of early childhood non-specific gastrointestinal symptoms: from diagnosis to long-term follow-up.
  17. Leung, A. K., & Hon, K. L. (2019). Gastroesophageal reflux in children: an updated review. *Drugs in context*, 8.
  18. Curien-Chotard, M., & Jantchou, P. (2020). Natural history of gastroesophageal reflux in infancy: new data from a prospective cohort. *BMC Pediatrics*, 20(1), 1-8.
  19. Dahlen, H. G., Foster, J. P., Psaila, K., Spence, K., Badawi, N., Fowler, C., ... & Thornton, C. (2018). Gastroesophageal reflux: a mixed-methods study of infants admitted to hospital in the first 12 months following birth in NSW (2000–2011). *BMC Pediatrics*, 18(1), 1-15.
  20. Poddar, U. (2019). Gastroesophageal reflux disease (GERD) in children. *Pediatrics and international child health*, 39(1), 7-12.
  21. Muhardi, L., Aw, M., Hasosah, M., Ng, R. T., Yee, C. S., Syarif, B. H., ... & Vandenplas, Y. (2021). A narrative review on the update in the prevalence of infantile colic, regurgitation, and constipation in young children: Implications of the ROME IV criteria. *Frontiers in Pediatrics*, 1493.
  22. Rybak A, Pesce M, Thapar N, Borrelli O. Gastro-Esophageal Reflux in Children. *International Journal of Molecular Sciences*. 2017; 18(8):1671. <https://doi.org/10.3390/ijms18081671>
  23. Rosen R, Vandenplas Y, Singendonk M, Cabana M, DiLorenzo C, Gottrand F, Gupta S, Langendam M, Staiano A, Thapar N, Tipnis N, Tabbers M. Pediatric Gastroesophageal Reflux Clinical Practice Guidelines: Joint Recommendations of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition. *J Pediatr Gastroenterol Nutr*. 2018 Mar;66(3):516-554. DOI: 10.1097/MPG.0000000000001889. PMID: 29470322; PMCID: PMC5958910
  24. Hibbs, A. M., & Lorch, S. A. (2006). Metoclopramide for the treatment of gastroesophageal reflux disease in infants: a systematic review. *Pediatrics*, 118(2), 746-752.