

Rhinosinusitis among children and adolescents in Southwestern Nigeria

Waheed Atilade Adegbiyi,¹
Abdul Akeem Adebayo Aluko,²
Toye Gabriel Olajide³

¹ENT Department, Ekiti State University Teaching Hospital, Ado Ekiti; ²ENT Department, Bayero University/Aminu Kano Teaching hospital, Kano; ³ENT Department, Federal Teaching Hospital Ido-Ekiti, Ekiti State/Afe-Babalola University Ado-Ekiti, Nigeria

Abstract

Worldwide, rhinosinusitis is a common sinus and nasal condition. The purpose of this study was to determine the prevalence and clinical characteristics of rhinosinusitis among children and adolescents in Ekiti, in the southwest of Nigeria. This two-year retrospective hospital study included 161 children and adolescents who had rhinosinusitis at the Ekiti State University Teaching Hospital in Ado Ekiti, southwest Nigeria. SPSS version 18 was used to analyze the data. There were 161 participants, ages 2 to 17, mean \pm SD = 6.8 \pm 4.5. 101 (62.7%) of them were males, making the male to female ratio 1.5:1. 9.2% of the participants in this study had rhinosinusitis. Recurrent rhinosinusitis (41) and chronic rhinosinusitis (61) were the two most prevalent types of rhinosinusitis. According to the etiology, 81 (50.3%) cases of infective rhinosinusitis were the main clinical pattern, followed by 67 (41.6%) cases of allergic rhinosinusitis and 13 (8.1%) cases of vasomotor rhinitis. There were 127 cases of nasal stuffiness (78.9%), 108 cases of rhinorrhea (67.1%), 92 cases of snoring (57.1%), and 86 cases of coughing (53.4%). Adeno-tonsillar hypertrophy, nasal foreign body impaction, and asthma were the three main comorbid conditions with rhinosinusitis in children, with 96 (59.6%), 46 (28.6%), and 12 (7.5%) cases each. In this study, the most common complications of rhinosinusitis were tonsillitis (26.7%), otitis media (33.5%), orbital complications (36.6%), and pneumonia (8.1%). In Ado Ekiti, southwest Nigeria, rhinosinusitis was a common sino-nasal condition affecting children and adolescents. Due to the delayed presentation, chronic rhinosinusitis was the most frequent type.

Introduction

The nasal and paranasal sinus linings are symptomatically inflamed when there is rhinosinusitis.¹ Children worldwide have a 14% prevalence of this disease.² Environmental pollution, smoking, sinus infections, nasal masses, nasal foreign bodies, high-altitude climbing, swimming, diving, and diabetes mellitus are some of the risk factors for rhinosinusitis.³⁻⁶ Despite the fact that different predisposing factors exist in various regions of the world.

Ethmoid and maxillary sinuses are present at birth and fully developed by three years, whereas sphenoidal and frontal sinuses appear at three and seven years of age, respectively, and are fully developed by adolescence. As a result of the difference in sinus growth, treatment for children under the age of twelve differs from that for those aged thirteen to eighteen.⁷⁻¹⁰ The lining of the sinuses is a pseudostratified ciliated columnar epithelium with goblet cells that secrete mucus and are continuous with the nasal cavity via the ostium.⁸ The sinuses drain into the meatuses, and sinusitis results from obstruction of the osteo-meatal complex, which is the sinus drainage area in the middle meatus of the lateral wall of the nasal cavity.¹⁰

Due to allergies and adenoid hypertrophy, which contributes to a propensity for chronicity, diagnosing rhinosinusitis in children can be difficult. In contrast to adults, whose pathophysiology is caused by osteo-meatal complex obstruction, children's pathophysiology is primarily influenced by environmental and genetic factors. It degrades life quality by impairing slumber and academic performance. Children are more likely than adults to develop orbital complications from rhinosinusitis, which typically affects the ethmoid sinus.^{11,12}

There are different types of rhinosinusitis depending on how long it lasts. When symptoms last less than four weeks, it is called acute rhinosinusitis; when they last between four and twelve weeks, it is called sub-acute rhinosinusitis; and when they last for more than twelve weeks, it is called chronic rhinosinusitis. When there are four or more episodes of acute rhinosinusitis in a year, each lasting about a week, this condition is known as recurrent rhinosinusitis.^{13,14} Additionally, rhinosinusitis can have a variety of etiologies, including parasitic rhinosinusitis, bacterial rhinosinusitis, fungal rhinosinusitis, viral rhinosinusitis, and mixed rhinosinusitis.^{15,16} Whether acute rhinosinusitis was untreated, improperly treated, or refractory, will determine how long it lasts and how severe it is.¹⁵

In acute rhinosinusitis, typical symp-

Correspondence: Abdul Akeem Adebayo Aluko, Department of Otorhinolaryngology, Aminu Kano Teaching Hospital/Bayero University Kano-Nigeria.
Tel.: +234.803.357.1040
E-mail: aaluko.oto@buk.edu.ng

Key words: Rhinosinusitis; children; Nigeria; Lund-Mackay CT scoring.

Acknowledgments: The authors are most grateful to Ekiti state university teaching hospital, the staff, and all the subjects who participated in this study.

Contributions: The authors contributed equally.

Conflict of interest: The authors declare no potential conflict of interest.

Funding: None

Availability of data and materials: All data generated or analyzed during this study are included in this published article.

Ethics approval and consent to participate: The Ethics Committee of Ekiti State University Teaching Hospital, Ado Ekiti, Nigeria approved this study (EKSUTH/A67/2018/02/016A). The study is conformed with the Helsinki Declaration of 1964, as revised in 2013, concerning human and animal rights. All patients participating in this study signed a written informed consent form for participating in this study.

Informed consent: Written informed consent was obtained from a legally authorized representative for anonymized patient information to be published in this article.

Received for publication: 12 April 2022.

Revision received: 26 July 2022.

Accepted for publication: 26 July 2022.

This work is licensed under a Creative Commons Attribution NonCommercial 4.0 License (CC BY-NC 4.0).

©Copyright: the Author(s), 2022

Licensee PAGEPress, Italy

Pyramid Journal of Medicine 2022; 5:203

doi:10.4081/pjm.2022.203

Publisher's note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.

toms include fever, malaise, irritability, headache, facial pain, coughing, rhinorrhea, stuffy nose, and a loss or diminution of

olfactory sensations. Purulent nasal secretions, a high fever, and periorbital oedema are the results of the severe bacterial infection. Postnasal drip, halitosis, and medial otitis can all be symptoms of chronic rhinosinusitis. A nasal examination might reveal a nasal polyp, an enlarging and inflamed inferior turbinate, pus or crust at the middle meatus, or even foreign objects.¹⁷

When a common cold does not get better after 10 days or when nasal stuffiness is present along with mucopurulent nasal discharge, facial pain, headaches, and fever, rhinosinusitis must be suspected. The proper evaluation of the nasal cavity may benefit from anterior rhinoscopy and fiber-optic nasal endoscopy. It's important to rule out alternative diagnoses for these symptoms, including allergies, environmental toxins, dental, and ocular conditions.¹⁸⁻²⁰

In Nigeria, there is a dearth of research on rhinosinusitis in children and adolescents. The otorhinolaryngologist should be aware that more severe cases of rhinosinusitis are likely to present to the primary care doctor before being referred to the specialist. In Ado-Ekiti, southwest Nigeria, this study sought to determine the prevalence, socio-demographic characteristics, and clinical patterns of rhinosinusitis among children and adolescents.

Materials and Methods

This study looked back at children and teenagers who had been treated at our facility for rhinosinusitis after receiving a clinical diagnosis. The research was done from March 2018 to February 2020. The study included every patient who visited the department of Ear, Nose and Throat.

Ethical clearance was sought for and obtained from the ethical committee of Ekiti State University Teaching Hospital, Ado Ekiti, southwestern Nigeria. Informed consent was obtained from subjects/guardians/parents enrolled in the study.

Questionnaires given out by the interviewer received responses from each subject and their parents. Utilizing a Thudicum nasal speculum, a battery-operated headlight (Model: VersaBrite 2250 by Pelican), and a disposable wooden tongue depressor (Model: Narrow 10cm X 2cm X 2mm) for anterior rhinoscopy and throat examination, rhinological and oropharyngeal examinations were carried out.

The Symptom Score For Allergic Rhinitis was used to identify allergic rhinosinusitis (SFAR).²¹ Aseptically collected Sino-nasal discharge was sent for microscopy, culture, and sensitivity testing.

Vasomotor rhinitis was ruled out as a diagnosis of exclusion.^{12,14} It was requested to conduct additional tests like X-rays and Computerized Tomographic (CT) scans of the paranasal sinuses. The Lund-Mackay CT scoring²² was used to categorize the severity of the disease. The maxillary sinus, anterior ethmoid sinuses, posterior ethmoid sinuses, sphenoid sinus, frontal sinus, and osteo-meatal complex were the six sections of the right or left sinuses, respectively. For the aforementioned six portions, the degree of sinus mucosal inflammation or fluid buildup was unilaterally and bilaterally summed, yielding respective values for the unilateral and bilateral total Lund-Mackay CT scores. The results guided the treatments for all subjects, and they received instruction on how to manage rhinosinusitis. They were monitored for potential results and complications in our ear, nose, and throat clinic.

The presence of either 2 major symptoms or 1 major and 2 minor symptoms was required to make a clinical diagnosis of rhinosinusitis, according to the case definition of rhinosinusitis. The nasal obstruction/blockage/congestion, nasal discharge (anterior/posterior or postnasal drip), facial pain/pressure (forehead/nasal/eye), and reduction or loss of smell were the four major rhinosinusitis symptoms. Along with positive results on a CT scan or nasal examination, minor rhinosinusitis symptoms included headaches, fever (other than acute rhinosinusitis), halitosis, fatigue, dental

pain, coughing, and ear pain/pressure/fullness.

Data obtained were analyzed using SPSS version 18 and presented in simple charts and tables.

Results

From a total of 1752 children and adolescents seen at the ENT clinic during the study period, 161 children and adolescents with a diagnosis of rhinosinusitis were recruited into the study. Age was between 2 and 17, with a mean \pm SD of 6.8 ± 4.5 . The male to female ratio was 1.5:1, with 101 (62.7%) males and 60 (37.3%) females present. Christians made up the majority of the subjects, while 24 (14.9%) were Muslims. Ninety-nine (61.5%) of the participants lived in cities, while 62 (38.5%) lived in rural areas. Table 1 lists the socio-demographic characteristics.

In this study, rhinosinusitis was present 9.2% of the time. According to duration, chronic rhinosinusitis accounted for 61 (37.8%) of all cases, followed by acute rhinosinusitis (73, 45.4%) and sub-acute rhinosinusitis (27, 16.8%). According to aetiology, 13 (8.1%) cases of vasomotor rhinitis and 67 (41.6%) cases of allergic rhinosinusitis, with 81 (50.3%) cases of infective rhinosinusitis. In 80 (49.7%) of the collected specimens, the nasal discharge was microscopic, culture- and sensitivity-negative. *Streptococcus sp.* (21.1%),

Table 1. Socio-demographic features of subjects.

Socio-demographic features	Number	Percentage (%)
Age		
1 – 5	83	51.6
6 – 10	47	29.1
11 – 15	18	11.2
16 – 18	13	8.1
mean \pm SD = 6.8 ± 4.5 .		
Gender		
Male	101	62.7
Female	60	37.3
Religion		
Christian	137	85.1
Muslim	24	14.9
Residential		
Urban	99	61.5
Rural	62	38.5
Parental education level		
Illiterate	43	26.7
Primary	39	24.2
Secondary	42	26.1
Tertiary	37	23.0
Parental occupation		
Unemployed	22	13.7
Business	17	10.6
Driver	25	15.5
Civil servant	78	48.4

Staphylococcus aureus (17.4%), and *Hemophilus influenzae* (11.8%) growths were noted.

In this study, environmental pollution was the most frequent predisposing factor in 84 (52.2%) cases, followed by parental smoking in 27 (16.8%) cases and peers/nursing homes in 23 (14.3%). The rhinosinusitis pattern was shown in Table 2.

Nasal stuffiness 127 (78.9%), rhinorrhea 108 (67.1%), snoring 92 (57.1%), and coughs 86 (53.4%) were common clinical features. Other symptoms included mouth breathing, middle meatus with pus or crust, malaise, and halitosis, which were observed in 84 (52.2%), 76 (47.2%), 54 (32.3%), and 49 (30.4%) of subjects, respectively (Table 3). Adenotonsillar hypertrophy was observed in 96 (59.6%) subjects with rhinosinusitis, nasal foreign body impaction in 46 (28.6%), asthma in 12 (7.5%) subjects, and nasal mass in 7 (4.3%) subjects (Figure 1).

Otitis media 54 (33.5%) and orbital complications 59 (36.6%) were frequent effects of rhinosinusitis. In addition, 43 (26.7%) had tonsillitis, 13 (8.1%) had pneumonia, and 12 (7.5%) had pharyngitis. Sleep disturbance 53 (32.9%) and school absence 49 (30.4%) were two factors that frequently impacted quality of life. The following were also present in 41 (25.5%), 32 (19.9%) and 23 (14.3%): body ache, general health, and social functioning (Table 4).

Paranasal sinuses CT scan findings graded using the Lund-Mackay scoring method as shown in Table 5.

Discussions

The nasal and paranasal sinuses' mucosa are both inflamed at the same time in rhinosinusitis. All pediatric age groups were impacted by rhinosinusitis, but the preschool age group was the hardest hit. At the nursing homes, this coincides with being active and interacting with people of similar ages. This study's male preponderance is comparable to other studies,^{20,23} but distinct from other studies,²⁴ or equal sex distribution.²⁵ The majority of the subjects were city dwellers, which may be a result of obstacles like the study center's location in the capital city, transportation costs that were too expensive, hospital fees, sociocultural beliefs about how easily children could get rhinosinusitis, and the availability of alternative treatments.^{26,27} In this study, the prevalence of rhinosinusitis was 9.2%, which was lower than what was discovered among Caucasians.²²

Due to associated complications like adenotonsillar hypertrophy, mouth breath-

Table 2. Pattern of rhinosinusitis.

Characteristics	Number	Percentage (%)
Type		
Acute	73	45.4
Sub-acute	27	16.8
Chronic	61	37.8
Aetiology		
Infective	81	50.3
Allergic rhinosinusitis	67	41.6
Vasomotor rhinitis	13	8.1
Bacteriology		
No growth	80	49.7
Streptococcus sp	34	21.1
Staphylococcus aureus	28	17.4
Hemophilus influenzae	19	11.8
Predisposing factors		
Group childcare /creche	23	14.3
Parental tobacco smoking	27	16.8
Environmental pollution	84	52.2
Gastroesophageal reflux disorders	16	9.9
Immunodeficiency	11	6.8

Table 3. Rhinosinusitis clinical features at presentation among the subjects.

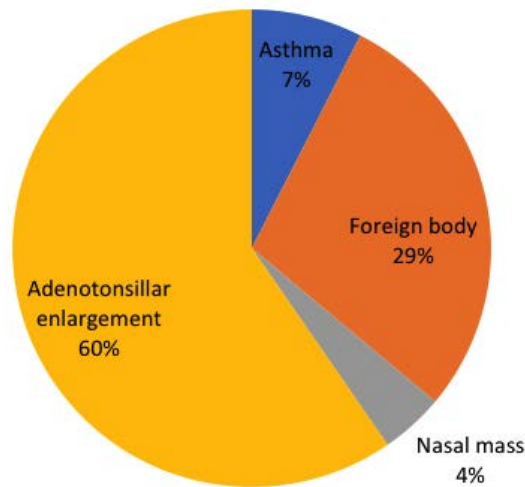
Clinical features	Number	Percentage (%)
Fever	47	29.2
Malaise	52	32.3
Irritability	48	29.8
Facial pain/headache	34	21.1
Cough	86	53.4
Rhinorrhoea	108	67.1
Nasal stuffiness	127	78.9
Diminution/loss of olfaction	16	9.9
Periorbital edema	41	25.5
Postnasal drip	29	18.0
Halitosis	49	30.4
Hypertrophied inferior turbinate	18	11.2
Snoring	92	57.1
Pus/crust middle meatus	76	47.2
Foreign bodies	47	29.2
Mouth breathing	84	52.2

Table 4. Complications and quality of life of subjects with rhinosinusitis.

Complications	Number	Percentage (%)
Orbital complication	59	36.6
Otitis media	54	33.5
Pharyngitis	12	7.5
Tonsillitis	43	26.7
Pneumonia	13	8.1
Quality of life		
Sleep disturbances	53	32.9
Body ache	41	25.5
General health	32	19.9
Social functioning	23	14.3
School absenteeism	49	30.4

Table 5. Lund-Mackay scores distributions of the right and left paranasal sinuses.

Paranasal sinuses	Right 0 (%)	Right1 (%)	Right2 (%)	Left 0 (%)	Left1 (%)	Left2 (%)
Maxillary sinus	57.1	14.3	28.6	54.8	16.7	28.6
Anterior ethmoid sinus	67.6	24.3	8.1	64.9	21.6	13.5
Posterior ethmoid sinus	59.5	29.7	10.8	51.4	35.1	13.5
Frontal sinus	73.9	17.4	8.7	73.9	17.4	8.7
Sphenoid sinus	63.2	21.1	15.8	52.6	21.1	26.3
Osteo-meatal complex	87.2		12.8	83.0		17.2

**Figure 1. Rhinosinusitis comorbid illnesses.**

ing, snoring, and obstructive sleep apnea, chronic rhinosinusitis and recurrent rhinosinusitis were the most prevalent among subjects in this study. This was in contrast to findings from a different study.²⁸ It might also be a result of acute rhinosinusitis that has gone untreated, been treated incorrectly, or is not responding. Less frequently observed were acute and sub-acute rhinosinusitis. Similar results were obtained by DeConde and Soler.²⁹ Due to the associated symptoms of fever, headache, and malaise, they were primarily misdiagnosed as malaria cases. Additionally, in our study, infective rhinosinusitis was more prevalent than allergic rhinosinusitis and vasomotor rhinitis. Our center's inadequate and nonexistent viral study facilities prevented further accurate classification of infectious rhinosinusitis into viral and bacterial forms. Environmental pollution was the most frequent predisposing factor in this study, accounting for 84 (52.2%) cases. Similar to the findings of other studies,^{30,31} this study also implicated other risk factors, such as smoke from exhaust, cooking, burning of garbage or tobacco, and cross-infection from group childcare/crèche.

In this study, adenotonsillar hypertro-

phy, nasal foreign body impaction, asthma, and nasal mass were the most prevalent associated co-morbid illnesses. Similar immunoglobulin E (IgE) hypersensitivity reactions to allergic rhinosinusitis may cause asthma. Adenotonsillar hypertrophy may be brought on by allergies or infections that cause mucous stasis and, when combined, cause or aggravate rhinosinusitis. Picking at the nose and insertion of foreign objects with subsequent impaction may be caused by mucous stasis and sinonasal irritation.

The majority of 61 (37.8%) of the subjects had chronic rhinosinusitis at the time of presentation, according to their clinical histories. These results were consistent with what other studies^{24,28,29} had reported. Nasal congestion, chronic rhinorrhea, snoring, and coughing were frequent clinical symptoms. These were all brought on by upper respiratory tract inflammatory oedema. Other less common symptoms like halitosis and pus/crust in the middle meatus were caused by a superimposed sino-nasal infection, in line with other reports.^{29,32}

In this study, otitis media, tonsillitis, pneumonia, and pharyngitis were among the complications of rhinosinusitis.

Contrary to reports from other studies, which indicated that rhinosinusitis spread to nearby organs, causing adenoiditis, otitis media, laryngitis, and dacryocystitis as well as osteomyelitis and mucocele,^{33,34} Intra-orbital, extracranial, and intracranial complications were separated from these issues. The cause may be because complications are influenced by the organism's virulence, anatomical flaws, and therapeutic interventions. In this study, symptoms and complications such as sleep disturbance, school absenteeism, body ache, general health, and social functioning have an impact on quality of life.

A CT scan of the sinuses was another radiological investigation, and it improves visualization during preoperative planning. This accurately depicts osteo-meatal complex anomalies and also notes mucosal changes, intra-sinus collections/growths, and adjacent bone diseases. Findings from other studies agreed with those in this report.^{35,36}

Common bacteriology recorded in this study were *Streptococcus* species, *Staphylococcus aureus* and *Hemophilus influenza* which were at variance from growth recorded in other studies.³⁷⁻³⁸

Conclusions

In southwestern Nigeria, rhinosinusitis is a common sino-nasal condition affecting children and adolescents, with a prevalence of 9.2%. Due to delayed presentation, chronic rhinosinusitis was the most prevalent. It affects life quality and may lead to complications. For a better outcome, early presentation, prompt diagnosis, and management are strongly advised.

References

1. Report of the Rhinosinusitis Task Force Committee Meeting. Alexandria, Virginia, August 17, 1996. *Otolaryngology* 1997;117:S1-S68.
2. Masood A, Moumoulidis I, Panesar J. Acute rhinosinusitis in adults: an update on current management. *Postgraduate*

- Med J 2007;83:402–8.
3. Ng YT, Butler IJ. Sphenoid sinusitis masquerading as migraine headaches in children. *J Child Neurol* 2001;16:882–4.
 4. Ah-See KW, Evans AS. Sinusitis and its management. *Br Med J* 2007;334:358–61.
 5. Gilger MA. Pediatric otolaryngologic manifestations of gastroesophageal reflux disease. *Current Gastroenterol Rep* 2003;5:247–52.
 6. Kretzschmar DP, Kretzschmar CJL. Rhinosinusitis: a review from a dental perspective. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:128–35.
 7. Baroody FM. Nasal and paranasal sinus anatomy and physiology. *Clin Allergy Immunol* 2007;19:1–21.
 8. Lee JT, Jansen M, Yilma AN, et al. Antimicrobial lipids: novel innate defense molecules are elevated in sinus secretions of patients with chronic rhinosinusitis. *Am J Rhinol Allergy* 2010;24:99–104.
 9. Gotwald TF, Zinreich SJ, Corl F, Fishman EK. Three-dimensional volumetric display of the nasal osteo-meatal channels and paranasal sinuses. *Am J Roentgenol* 2001;176:241–5.
 10. Momeni AK, Roberts CC, Chew FS. Imaging of chronic and exotic sino-nasal disease: review. *Am J Roentgenol* 2007;189:S35–45.
 11. Snidvongs K, Sangubol M, Poachanukoon O. Pediatric versus adult chronic rhinosinusitis. *Curr Allergy Asthma Rep* 2020;20:29.
 12. McDermott SM, Onwuka A, Elmaraghy C, Walz PC. Management patterns in pediatric complicated sinusitis. *Otolaryngol Head Neck Surg* 2020;163:814–21.
 13. Fokkens W, Lund V, Bachert C, et al. EAACI position paper on rhinosinusitis and nasal polypsexecutive summary. *Allergy* 2005;60:583–601.
 14. Benninger MS, Ferguson BJ, Hadley JA, et al. Adult chronic rhinosinusitis: definitions, diagnosis, epidemiology, and pathophysiology. *Otolaryngolog* 2003;129:S1–S32.
 15. Brook I. Microbiology and antimicrobial management of sinusitis. *Otolaryngologic Clin North Am* 2004;37:253–66.
 16. Wald ER, Bordley WC, Darrow DH, et al. Clinical practice guideline: management of sinusitis. *Pediatrics* 2001;108:798–808.
 17. Lee JT, Kennedy DW, Palmer JN, et al. The incidence of concurrent osteitis in patients with chronic rhinosinusitis: a clinicopathological study. *Am J Rhinol* 2006;20:278–82.
 18. Chiu AG. Osteitis in chronic rhinosinusitis. *Otolaryngol Clin North Am* 2005;38:1237–42.
 19. van Crombruggen K, Zhang N, Gevaert P, et al. Pathogenesis of chronic rhinosinusitis: inflammation. *J Allergy Clin Immunol* 2011;128:728–32.
 20. Nakaseko H, Uemura O, Nagai T, et al. High prevalence of sinusitis in children with Henoch-Schonlein purpura. *Int J Pediatr* 2011;2011:562638.
 21. Ologe FE, Adebola SO, Dunmade AD, et al. Symptom score for allergic rhinitis. *Otolaryngol Head Neck Surg* 2013;148:557–63.
 22. Fokkens WJ, Lund VJ, Mullol J. European Position Paper on rhinosinusitis and nasal polyps 2012. *Rhinol Suppl* 2012;23:1–298.
 23. Alsowaidi S, Abdulle A, Bernsen R, Zuberbier T. Allergic rhinitis and asthma: a large cross-sectional study in the United Arab Emirates. *Int Arch Allergy Immunol* 2011;153:274–9.
 24. Marom T, Alvarez-Fernandez PE, Jennings K, et al. Acute bacterial sinusitis complicating viral upper respiratory tract infection in young children. *Pediatr Infect Dis J* 2014;33:803–8.
 25. Gathiru C, Macharia I. The prevalence of allergic rhinitis in college students at Kenya Medical Training College-Nairobi, Kenya. *World Allergy Organ J* 2007;S84-S85.
 26. Adegbiyi WA, Aremu SK, Lasisi AO. Patients barrier to ear, nose and throat surgical care in Nigeria. *Am Sci Res J Engin Technol Sci (ASRJETS)* 2017;32:96-104.
 27. Adegbiyi WA, Olajide GT, Aremu SK, Alabi SB. Barriers to adenoid and tonsil surgeries in Ekiti, Nigeria. *Am J Med Med Sci* 2017;7:385-92.
 28. Brook I. The role of antibiotics in pediatric chronic rhinosinusitis. *Allergy Rhinol Immunol* 2017;2:104–8.
 29. DeConde AS, Soler ZM. Chronic rhinosinusitis: epidemiology and burden of disease. *Am J Rhinol Allergy* 2016;30:134-9.
 30. Reh DD, Higgins TS, Smith TL. Impact of tobacco smoke on chronic rhinosinusitis: a review of the literature. *Int Forum Allergy Rhinol* 2012;2:362–9.
 31. Uhliarova B, Adamkov M, Svec M, Calkovska A. The effect of smoking on CT score, bacterial colonization and distribution of inflammatory cells in the upper airways of patients with chronic rhinosinusitis. *Inhal Toxicol* 2014;26:419–25.
 32. Wald ER, Applegate KE, Bordley C, et al. Clinical practice guideline for the diagnosis and management of acute bacterial sinusitis in children aged 1 to 18 years. *Pediatrics* 2013;132:e262-80.
 33. Soon VT. Pediatric subperiosteal orbital abscess secondary to acute sinusitis: a 5-year review. *Am J Otolaryngol* 2011;32:62-8.
 34. Hakim HE, Malik AC, Aronyk K, et al. The prevalence of intracranial complications in pediatric frontal sinusitis. *Int J Pediatric Otorhinolaryngol* 2006;70:1383–7.
 35. Lund VJ, Mackay IS. Staging in rhinosinusitis. *Rhinology* 1993;31:183-4.
 36. Oyinloye OI, Akande JH, Alabi BS, Afolabi OA. Incidental paranasal sinus abnormality on cranial computed tomography in a Nigerian population. *Ann Afr Med* 2013;12:62-4.
 37. Eziyi JAE, Amusa YB, Nwawolo CC. The prevalence of nasal diseases in Nigerian school children. *J Med Med Sci April* 2014;5:71-7.
 38. Ogah SA, Ogah JI, Enesi IE, Oseji DI. Aerobic bacteriology of throat swabs in adult patients with chronic rhinosinusitis in Lokoja, Kogi State, Nigeria. *Nig J Pure Appl Sci* 2017;30:2965-70.