Identification of Pharyngitis Bacteria in Patients with Sore Throat Features in Rizgary Teaching Hospital and Overuse of Antibiotics

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Abstract_This research is designed to study sore throat (pharyngitis) and its causes, which is considered to be one of the serious health problems that affect many individuals annually. The research included an infected study status of 81 cases suspected of pharyngitis attending Rzgary Hospital department of ENT, in Erbil city. Infection was diagnosed by culturing the throat swab and collecting data about individual gender, age, occupation and residency. Also, this study deals with acute and chronic pain of sore throat (pharyngitis) and describes their causes. As well as the diagnosis was also achieved. *Streptococcus pneumonia, Streptococcus pyogenes, Staphylococcus aureus, Staphylococcus epidermidis* and *Staphylococcus* sp., were isolated from the pharyngitis patients. The antibiotic susceptibility test was carried on the isolated bacteria using different types of antibiotics such as Ampicillin, Penicillin, Streptomycin, Ceftriaxone and Cefotaxime. The results indicated that most of the bacteria were resistant to the antibiotics. The highest sensitivity of pathogenic bacterial species was found towards streptomycin, while Ampicillin and Penicillin had the highest resistance; hence antimicrobial treatment should be recommended only after culturing and sensitivity testing. This would aid in the appropriate treatment, discourage the indiscriminate use of antibiotics, and avoid further development of drug resistance. It has been found that males are more vulnerable to getting pharyngitis than females. Age has a significant influence on increasing or decreasing the number of infected people. Also, the individuals living in Erbil city are more prone to be infected than those in the villages.

I. INTRODUCTION

A sore throat is an inflammation or infection of the pharyngeal mucus membranes [1]. This might also affect the palatine tonsils, causing scratchiness or throat irritation which often worsens during swallowing [2]. The most common cause of sore throat (pharyngitis) is a viral infection, such as a cold or the flu, which doesn't require treatment [3]. It is also caused by a bacterial infection, such as streptococcal infection, which is less common but requires antibiotic treatment to avoid side effects [4]. Other, less common causes of sore throat may require more complicated treatment [5].

Sore throat tends to affect people in many ways, and symptoms vary from person to person [6]. As a result, some people describe this disorder's unusual symptom as a burning sensation, whereas others describe it as tickling or scratching feeling in the throat. Sore throat, in general, causes a general sensation of pain that starts in the back of the mouth and progressively spreads to the area of the middle throat. These symptoms are felt with varying degrees of pain [6]. Sore throat is usually a symptom of another illness caused by inflammation of the throat's sensitive tissues [7]. As soon as the first inflammation or inflammation begins, the body responds by increasing the rate of blood flow in the throat [8]. As a result, the swelling and pain in the throat, followed by tissue redness, result from the immune system's response. As a result, the symptoms that appear, including increased circulating blood transport and an increased load of white blood cells and other substances to combat the initial infection, are simply indications that the body is fighting the infection [9]. A few of the most common causes of sore throat, or the true trigger of the condition, are major physiological reactions like allergies, but environmental factors, including dust and smoke, as well as low humidity, also play a role [1].

Furthermore, a sore throat could also arise due to viral infections and infections caused by other microorganisms, including bacteria. The body reacts to all of these factors, resulting in a sore throat [10]. Sore throat is frequently accompanied by external events such as excessive mucus drainage from the nose, sinuses in the back of the throat, and even postnatal drips. Therefore, in this case, a sore throat exists. It is typically caused by a viral infection or an allergic reaction of the body to these physical invasions [11]. Furthermore, the sensitive tissues in the throat are the primary targets of viruses that cause colds and other throat infections.

The initiation of a sore throat generated by the virus commonly takes a couple of days, at a stretch and the infection persists [12]. There are also differences in how different pathogens that cause sore throats produce symptoms in different people. E.g., viral infections can last for a long time, but the symptoms are usually mild to moderate [13]. Infections with bacteria frequently appear suddenly, causing acute symptoms and causing a

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significant amount of discomfort to the individual. Streptococcal pharyngitis is a great example of a bacterial infection that can rest in a matter of hours [14]. Bacterial infections cause severe sore throats and other unpleasant physical symptoms such as swallowing difficulty. Fever is also a common symptom of bacterial infections [6].

The aim of the study

Our research aim to study the incidence of pharyngitis in Erbil city, also studying the factors that affect the incidence of pharyngitis such as gender, history, resident area, age, socioeconomic status. More over determine the most pathogenic bacteria that cause pharyngitis in the patients. Finally studying the antimicrobial sensitivity of isolated pathogenic bacteria and determine the most effective antibiotics.

II. MATERIALS AND METHODS

This study targeted 81 cases suspected of having Throat infection (pharyngitis) attending Rzgary hospital in Erbil city. All throat specimens were processed in the laboratory using standard laboratory protocols. The infection was diagnosed by biochemical, mechanical tests and throat sample culture. Data for the patients, such as (gender, residence area, age, and carrier), were also collected using a specially designed questionnaire.

Table 1: *The antibiotics used in this research.*

Antibiotic	Abbreviations	Mode of action	Bactericidal or Bacteriostatic
Ceftriaxone	CRO (10)	Cell wall	Bactericidal
Cefotaxime	CTX (30)	Cell wall	Bactericidal
Ampicillin	AM (25)	Cell wall	Bactericidal
Penicillin	P (10)	Cell wall	Bactericidal
Streptomycin	S (25)	Inhibit protein synthesize	Bactericidal

A. Microscopic examination (Gram staining film)

Smears were prepared on a glass slide by mixing a colony of the tested bacterium with a drop of distilled water, stained with Gram stain, and examined with an oil immersion objective lens at 100X power. The gram stain is used to distinguish between gram-positive (purple/blue colour) and gram-negative (pink/red colour) bacteria [15].

B. Diagnostic emphatic tests

The diagnostic emphatic tests for bacteria were performed in a private facility by using a manual biochemical test, in accordance with the regulatory diagnostic system, which is based on [15].

C. Antimicrobial sensitivity test

The Kirby Bauer standardized single disk method was carried out [16] as the following:

Mueller-Hinton Agar was prepared and cooled to 45-50 ℃, then poured in Petri dishes on a level surface to a depth of 4 ml. After the medium had hardened, the Petri dish was placed in an incubator set to 35-37 ° C for 15-30 minutes to evaporate extra water. A sterile cotton swab was dipped in a bacterial suspension. Excess liquid was removed by firmly rotating a cotton swab against the inside of the tube above the liquid level. The swab was then stroked in three different planes on the dry surface of the Mueller-Hinton agar medium to achieve a uniform distribution of inoculum. The plate lid was replaced, and the inoculated plate was left to absorb excess water for 3-5 minutes. The selected disc is placed on the inoculation plate with sterile forceps and gently pushed into the agar. The inoculated plate was inverted after 15 minutes and incubated at 37 ° C for 24 hours. The diameter of the suppression zone was measured with a ruler.

III. RESULT AND DISCUSSION

A. The effect of gender

During the collection of throat sample results showed that the males were more vulnerable to have the disease with a high percentage compared to females.

Table 2: *Percentage of pharyngitis in patients according to the gender.*

Pharyngitis patients	Number	Percentage
Male	45	55.55%
Female	36	44.44%
Total	81	100 %

(Table 2) and (Figure 1) show that the transmission of pharyngitis was more in males patients (45) with 55.55% compared to female patients (36) 44.44%. This might be because the numbers of patients reported were more than female patients, and this result corresponds to what [17] and [18] have found in Iraq.

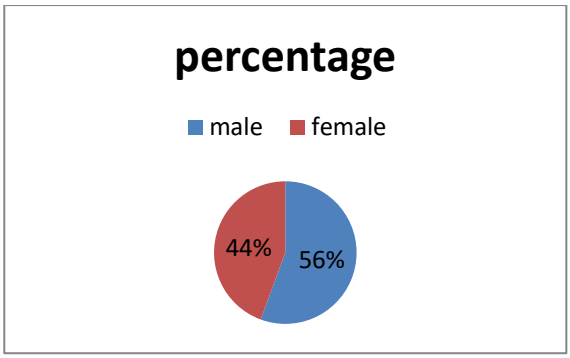

Figure 1*: The percentage of pharyngitis in patients according to the gender.*

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B. The effect of location

Regarding the effect of residence location on the possibility of becoming affected by the disease, we found that Erbil's affected cases were significantly higher than the rural areas as shown in (Table 3) and (Figure 2).

Table 3: *The percentage of pharyngitis patients according to the resident area.*

Location	Number	Percentage
Erbil	71	87.65%
Villages	10	12.34%
Total	81	100%

Regarding the effect of the area of residency (Table 3) on the chance of being affected by the disease, we found that the affected cases in the Erbil city were higher than the surrounding villages. These results agree with what [19] has found. This is because the city is very crowded therefore it's very easy to the disease to transmit between the individuals.

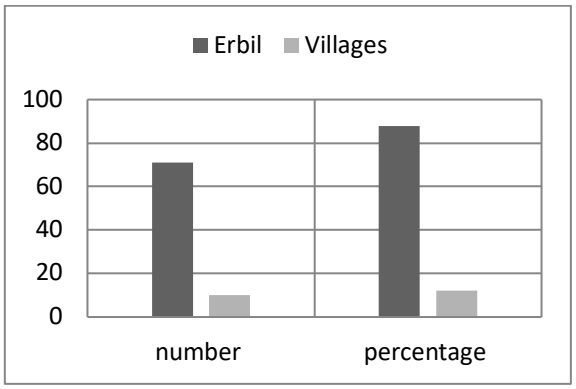

Figure 2: *The percentage of pharyngitis patients according to the residential area.*

C. Isolated pathogenic bacteria

Table (4) shows the percentage of the pathogenic bacterial species that cause pharyngitis in patients. Prevalence of *Streptococcus pneumoniae* was 34 cases which is equal to **41.97%**, *Staphylococcus aureus* 18 with **22.22%,** *Streptococcus pyogenes* 13 cases **16.04%,** *Staphylococcus epidermidis* 4 cases **4.93%** and *Staphylococcus* sp. 3 cases **3.703%** respectively **a**s shown in (Table 4) and (Figure 3).

Table 4: *The percentage of pathogenic bacteria species that cause pharyngitis in infected person.*

Bacterial Species	Number	Percentage
Streptococcus pyogenes	13	16.04%
Streptococcus pneumonia	34	41.97%
Staphylococcus aureus	18	22.22%
Staphylococcus epidermidis	4	4.93%
Staphylococcus sp.	3	3.70%
Total	81	100%

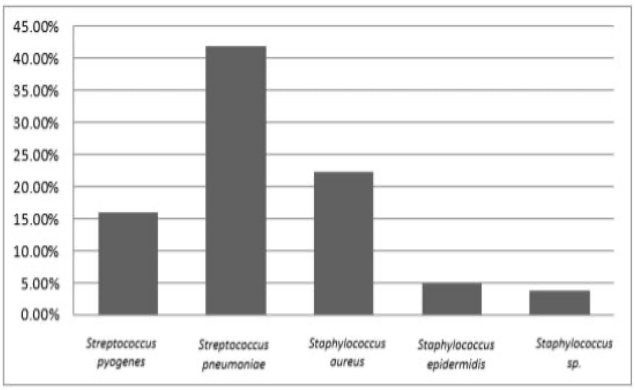

Figure 3: *The percentage of pathogenic bacteria species that cause pharyngitis in infected person.*

The results show the percentage of the pathogenic bacterial species that causes pharyngitis in patients. Prevalence of *Streptococcus pneumoniae* was 34 cases which equal to 41.97%, *Staphylococcus aureus* 18 with 22.22%, *Streptococcus pyogenes* 13 cases 16.04%, *Staphylococcus epidermidis* 4 cases 4.93% and *staphylococcus* sp. 3 cases 3.703% respectively. Our work agrees with many researches which refer to that the patients have a higher tendency of *Streptococcus pneumoniae, where* this is also stated by [20] and other researchers as they found that *Streptococcus pneumoniae* most dominance among the pathogenic bacteria in the pharyngitis patients [21].

D. Carrier of patients

The incidence of the disease with regard to different occupations, it was noted that **40.740%** of the patients, maximum cases belonged to preschool children, **32.098%** for students, **16.04%** for officers, and **11.11%** for housewife, **3.70%** for businessman, and **1.23%** for retired as shown in (Table 5) and (Figure 4). The reasons for such high incidence in preschool children may be due to low immunity in the children, cross infection because of overcrowded rooms in home and poor ventilation of the rooms, and this is in agreement with other published results [21].

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Table 5: *The percentage of pharyngitis in patients according to the occupation.*

patients	Number	Percentage
Student	26	32.09%
Retired	1	1.23%
Officer	13	16.04%
House wife	9	11.11%
Preschool children	33	40.74%
Businessman	3	3.70%
Total	81	100%

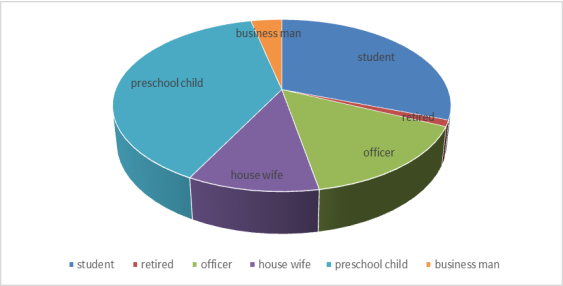

Figure 4: *The percentage of pharyngitis in patients according to the occupation.*

The disease's onset in relation to various occupations was found to be **40.740 %** of patients, with preschool children accounting for the majority of cases, and students accounting for **32.098 %, 16.04%** for officers, and **11.11%** for housewife, **3.70%** for businessman, and **1.23%** for retired (Table 5). The main reason for such high incidence in preschool children may be due to 1ow immunity in the children, cross infection because of overcrowded rooms in home and poor ventilation, and this is in agreement with other published results [21].

E. Age of patients

During our study, we found that the children ages 1 to 10 years were most vulnerable to have pharyngitis compared to elder ages which were 45 cases (55.55%) and ages of 10 to 30 years were 25 cases (30.86%), age between 31 to 50 years were 9 cases (11.11%), and 51 to 70 years were only 3 cases (3.70%). This result visualizes that there should be a relation between the incidence of pharyngitis and age, in which the incidence of pharyngitis decreases by increasing the age (Table 6) and (Figure 5). Our results **is** similar observations were reported by [22].

Table 6: *Prevalence of pharyngitis in patients according to their age.*

Age of patients	Number	Percentage
1 to 10 years	45	55.55%
10 to 30 years	25	30.86%
31 to 50 years	9	11.11%
51 to 70 years	3	3.70%
Total	81	100%

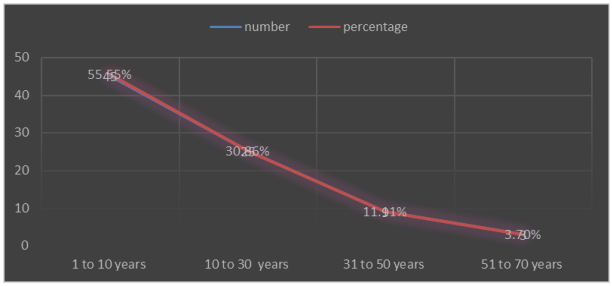

Figure 5: *The prevalence of pharyngitis in patients according to their age.*

F. Symptoms of pharyngitis

During our study, we have noticed the symptoms of pharyngitis, pharyngitis have poly-symptoms, but some of them are common and some are less common according to the age, gender and pathogen. According to our study we found that the incidence of symptoms stated that sore throat and exudates were shown in all the patients, fever in **74.07%,** odynophagia in **12.34%,** constitutional symptoms were in **28.39**% and difficult swallowing in **80.24%** observed in patients according to (Table 7) and (Figure 6).

Table 7: *The symptoms of pharyngitis among the patients of pharyngitis.*

Symptoms	Number	Percentage
Sore throat	81	100%
Fever	60	74.07%
Odynophagia	10	12.34%
Constitutional symptoms	23	28.39%
Difficult swallowing	65	80.24%
Exudates	81	100%
Total	81	100%

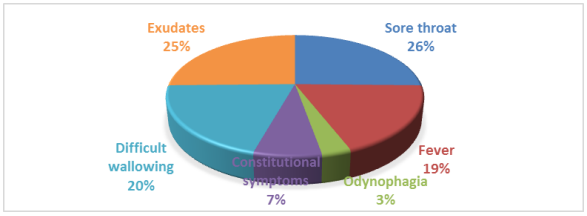

Figure 6: *The prevalence of some common symptoms among the patients of pharyngitis.*

The occurrence of symptoms indicated that sore throat and exudates were observed in all the patients, fever in 74.07%, odynophagia in 12.34%, constitutional symptoms were in 28.39% and difficult swallowing in 80.24% observed in patients according to (table 7). This result agrees with other researchers [23] who obtained results comparable to our study. Also these observations are in line with the earlier reported works of [24].

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G. Antibiotic sensitivity test

Our studies found that, the highest sensitivity of the pathogenic bacteria were toward *Streptomycin* with 72 (88.88%) isolates. The highest resistance was to *Ampicillin* and *penicillin* 80 (98.76%). As shown in (Table 8) and (Figure 7). These findings suggested that antibiotic therapy should be recommended only after culturing the sample and performing the sensitivity test. This will help in the proper treatment and discourage the overuse of antibiotics from avoiding further development of antibiotic resistance [25]. The current results agrees with the result of [26].

Table 8: *Antibiotic sensitivity test of pathogenic bacteria species that cause pharyngitis***.**

Antibiotic	Sensitivity		Resistance		Total
	Number	%	Number	%	
Ceftriaxone	3	3.70%	78	96.29%	81
Cefotaxime	2	2.46%	79	97.53%	81
Ampicillin	1	1.23%	80	98.76%	81
Penicillin	1	1.23%	80	98.76%	81
Streptomycin	72	88.88%	9	11.11%	81

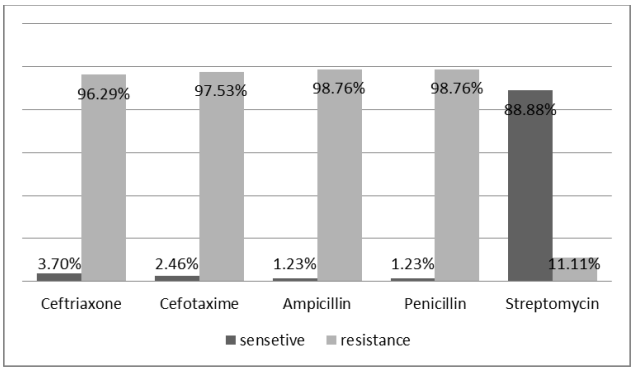

Figure 7: *Antibiotic sensitivity patterns of Gram positive bacteria isolated from sore throat patients.*

CONCLUSION

The current study was performed to identify the prevalent bacterial infections and their antibiotic sensitivity on patients of pharyngitis demonstrated the bacterial infection is much more prevalent in the age group of (1 to 10) years with 55% and followed by age group (1 to 30) years 30%, (31 to 50) 11%, (51 to 70) years with 3.70%. Again, it was observed that *Streptococcus pneumoniae* with 41.9% species to be the most predominant bacteria followed by *Staphylococcus aureus* with 22.22%*, Streptococcus pyogenes* with 16.04%, *staphylococcus epidermidis* with 4.9% and last one which is *staphylococcus* sp. with only 3.7%.

The *streptomycin* antibiotic was found to be the effective drug to cure pharyngitis besides other antibiotics. Moreover, it was observed that males are more vulnerable to pharyngitis compared to females. In addition, the individuals who are living in Erbil city are more prone to be infected than the ones in the villages. Furthermore, the result indicates that *streptococcus pneumonia,* is the main cause of pharyngitis, which is isolated from approximately two third of pharyngitis patients. As a result, preschool students are more vulnerable to pharyngitis. Finally, the symptoms of (fever and Exudates) were common among the patients.

REFERENCES

[1] B. Renner, C. A. Mueller, and A. Shephard, "Environmental and non-infectious factors in the aetiology of pharyngitis (sore throat)," *Inflammation Research,* vol. 61, pp. 1041-1052, 2012.

[2] G. Albert, S. Arnocky, D. A. Puts, and C. R. Hodges-Simeon, "Can listeners assess men's self-reported health from their voice?," *Evolution and Human Behavior,* vol. 42, pp. 91-103, 2021.

[3] S. Bathala and R. Eccles, "A review on the mechanism of sore throat in tonsillitis," *The Journal of Laryngology & Otology,* vol. 127, pp. 227-232, 2013.

[4] J. M. Cots, J.-I. Alós, M. Bárcena, X. Boleda, J. L. Cañada, N. Gomez*, et al.*, "Recommendations for management of acute pharyngitis in adults," *Acta Otorrinolaringologica (English Edition),* vol. 66, pp. 159-170, 2015.

[5] M. Wilson and P. Wilson, *Close Encounters of the Microbial Kind*: Springer, 2021.

[6] A. Somro, M. Akram, M. I. Khan, H. Asif, A. Sami, S. Shah*, et al.*, "Pharyngitis and sore throat: A review," *African Journal of Biotechnology,* vol. 10, pp. 6190-6197, 2011.

[7] K. Stelter, "Tonsillitis and sore throat in children," *GMS current topics in otorhinolaryngology, head and neck surgery,* vol. 13, 2014.

[8] S. M. Kuhn, J. Preiksaitis, G. J. Tyrrell, T. Jadavji, D. Church, and H. Davies, "Evaluation of potential factors contributing to microbiological treatment failure in Streptococcus pyogenes pharyngitis," *Canadian Journal of Infectious Diseases,* vol. 12, pp. 33-39, 2001.

[9] P. Little, B. Stuart, F. R. Hobbs, C. C. Butler, A. D. Hay, B. Delaney*, et al.*, "Antibiotic prescription strategies for acute sore throat: a prospective observational cohort study," *The Lancet Infectious Diseases,* vol. 14, pp. 213-219, 2014.

[10] H. Bandara and L. P. Samaranayake, "Viral, bacterial, and fungal infections of the oral mucosa: Types, incidence, predisposing factors, diagnostic algorithms, and management," *Periodontology 2000,* vol. 80, pp. 148-176, 2019.

[11] A. Z. Maxfield and B. S. Bleier, "Sinonasal disease and allergy as an etiology of chronic cough," *Chronic cough. San Diego: Plural Publishing,* pp. 39-64, 2019.

[12] G. M. Allan and B. Arroll, "Prevention and treatment of the common cold: making sense of the evidence," *Cmaj,* vol. 186, pp. 190-199, 2014.

[13] C. J. Burrell, C. R. Howard, and F. A. Murphy, "Antiviral Chemotherapy," *Fenner and White's Medical Virology,* p. 169, 2017.

[14] A. Henningham, T. C. Barnett, P. G. Maamary, and M. J. Walker, "Pathogenesis of group A streptococcal infections," *Discovery medicine,* vol. 13, pp. 329-342, 2012.

[15] J. Vandepitte, J. Verhaegen, K. Engbaek, P. Piot, C. C. Heuck, P. Rohner*, et al.*, *Basic laboratory procedures in clinical bacteriology*: World Health Organization, 2003.

[16] J. Hudzicki, "Kirby-Bauer disk diffusion susceptibility test protocol," *American society for microbiology,* vol. 15, pp. 55-63, 2009.

[17] N. Al-Jassar, "Clinico-epidemiological study of acute respiratory infections (ARI) in children under 5 years of age," *Iraqi Journal of Medical Science,* vol. 10, pp. 200-207, 1994.

[18] T. Al-Karaguily, "Risk factors of pneumonia in children under 6 years of age," *Journal of Saddam University,* vol. 2, pp. 103-111, 1998.

DOI: http://doi.org/10.24086/biohs2022/paper.745

[19] L. Hai-Feng, Z. Yan, J. Pei-Gang, and J. Hong-Xing, "Risk factors for recurrent respiratory infections in preschool children in china," *Iranian Journal of Pediatrics,* vol. 24, p. 14, 2014.

[20] L. Harsha and L. Thangavelu, "Screening of ethanolic extracts of medicinal herbal drugs against oral microbes," *Pharmacognosy Journal,* vol. 9, 2017.

[21] M. H. Ebell, M. A. Smith, H. C. Barry, K. Ives, and M. Carey, "Does this patient have strep throat?," *Jama,* vol. 284, pp. 2912-2918, 2000.

[22] M. P. Eccles, J. M. Grimshaw, M. Johnston, N. Steen, N. B. Pitts, R. Thomas*, et al.*, "Applying psychological theories to evidence-based clinical practice: Identifying factors predictive of managing upper respiratory tract infections without antibiotics," *Implementation Science,* vol. 2, pp. 1-14, 2007.

[23] M. R. Wessels, "Pharyngitis and scarlet fever," *Streptococcus pyogenes: Basic Biology to Clinical Manifestations [Internet],* 2016.

[24] M. R. Wessels, "Streptococcal pharyngitis," *New England Journal of Medicine,* vol. 364, pp. 648-655, 2011.

[25] R. J. Rubin, C. A. Harrington, A. Poon, K. Dietrich, J. A. Greene, and A. Moiduddin, "The economic impact of Staphylococcus aureus infection in New York City hospitals," *Emerging infectious diseases,* vol. 5, p. 9, 1999.

[26] D. H. Howard and R. D. Scott, "The economic burden of drug resistance," *Clinical Infectious Diseases,* vol. 41, pp. S283-S286, 2005.

DOI: http://doi.org/10.24086/biohs2022/paper.745