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Assessment of Antibiotic Prescribing for Influenza in the US Outpatient Care Setting

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ABSTRACT

This retrospective research was aimed to study the prescribing trends of antibiotics for influenza and adherence to the guidelines issued by the Infectious Diseases Society of America (IDSA) by utilizing the National Ambulatory Medical Survey (NAMCS) 2016 database. This was based on a sample of visits to non-federally employed office-based physicians who are engaged in direct patient care at community health centers. Patient sex, race, as well as the source of payment, and the provider type were among the demographic variables studied for adherence to the guidelines. The total number of ambulatory care visits were 1,753. Of those, 63.6% of patients were prescribed, inappropriate agents. General and Family Practice physicians were the most frequented providers (32.9%), followed by Nurse Practitioners (21.9%), and Pediatricians (17.1%). Family practice physicians and nurse practitioners appeared to prescribe more inappropriately as compared to the other specialties (X2=0.001). White and black patients were prescribed more inappropriately as compared to other races (X2=0.032). Antibiotic resistance is a public health problem of increasing magnitude, and finding effective solutions to address this problem is critical. Antibiotic resistance is also an economic healthcare burden. Adherence to guidelines minimizes antibiotic resistance and promotes patients and public health.

Keywords:

National Ambulatory Medical Care Survey, Prescribing patterns, Antibiotic resistance; Adherence, Healthcare disparity

Introduction

Influenza, commonly known as “the flu”, is an infectious disease caused by an influenza virus. Symptoms range from mild to severe, and the most common symptoms include high fever, runny nose, sore throat, muscle and joint pain, headache, cough, and fatigue. Symptoms typically begin two days after exposure to the virus and most last less than a week. The Center for Disease Control and Prevention (CDC) estimates that there have been about 39,000,00-56,000,000 flu illnesses, 18,000,000-26,000,000 flu medical visits, 410,000-740,000 flu hospitalizations, and 24,000-62,000 flu deaths from October 1, 2019 through April 4, 2020 [1]. Potential complications from influenza include bacterial pneumonia, ear infections, sinus infections, and worsening of chronic medical conditions, such as diabetes [2].

COVID-19 shares similarities with seasonal influenza, but it “appears to be more transmissible and more virulent than any influenza since the 1918 influenza pandemic” [3]. There have been approximately 807,617 deaths reported worldwide, and 180,130 people in the U.S. have died of COVID-19 as of August 19, 2020 [4]. According to the CDC, a new surge in coronavirus cases could coincide with the next flu season, causing an even more difficult crisis than the one the nation is facing now” [5]. There is a possibility that we will be dealing with two respiratory viruses , influenza and COVID-19, at the same time, which could be a double challenge for our health care systems [6]. Influenza can be treated with antiviral agents, such as Oseltamivir, and a are generally the main medications prescribed for influenza. However, providers may inappropriately prescribe antibiotics for influenza regardless of influenza being a viral infection rather than a bacterial infection.

Some antibiotic prescriptions might be appropriate for concurrent or secondary infections due to influenza, but most prescriptions are likely unnecessary and inappropriate as they can lead to antibiotic resistance [6]. Furthermore, inappropriately prescribing antibiotics to patients with influenza can potentially hinder the supply of antibiotics available for patients who have a bacterial infection. There is an associated cost with the use of unnecessary antibiotics, and patients with influenza will most likely not benefit from taking antibiotics and their symptoms may worsen if not treated with an antiviral agent. The 2018 Infectious Diseases of America (IDSA) influenza treatment guidelines recommend against the use of antibiotics for influenza treatment in the absence of concomitant bacterial infections [7].

Influenza and pneumonia were the 9th leading causes of death for men, the 8th leading causes of death for women in 2017, and accounted for 55,672 deaths with a 5.9% increase in deaths compared to 2016. The male to female ratio of age-adjusted death rates from influenza and pneumonia in 2017 was 1.3, the non-Hispanic black to non-Hispanic white ratio was 1.1, and the non-Hispanic white to Hispanic ratio was 1:3 [8]. According to the CDC Morbidity and Mortality Weekly Reports (MMWR) of 2019 from September through February, adults aged ≥ 65 years

had the highest hospitalization rates (53%), followed by children aged <5 years (33.5%) [9].

Influenza severity varies with age, geographical location, and seasons. School-aged children are more likely to experience flu morbidity in an initial pandemic wave because they have limited prior exposure to influenza and have a greater chance of coming into contact with influenza. Adults have greater prior exposure to influenza compared to children and fewer chances of coming into contact with influenza; therefore, high flu activity in adults occurs only when the flu season is severe [10,11]. Influenza-associated outpatient visit rates are greater among children and young persons during pre-pandemic and pandemic influenza seasons. Specifically, during a pandemic, children aged 2-17 years usually have the largest increase in rates of outpatient rates with pneumonia visits [12].

Another study by Havers et. al. found that over 30% were prescribed antibiotics, and only 16% were prescribed antiviral medications. Although some antibiotic prescriptions may have been appropriate for concurrent or secondary infections due to influenza, it is likely that most of the prescriptions were unnecessary [6].

Low-income and minority workers may have difficulty in adhering to directives to stay home from work. Significant race/ethnicity-related disparities in potential risk from influenza. Disparities in the risks of exposure, susceptibility (particularly to severe disease), lack of health coverage, and access to health care may exacerbate existing health inequalities and contribute to increased morbidity and mortality in low-income populations. According to the 2006 National Healthcare Disparities Report, among people younger than 65 years of age living in the United States, 81.9% of African Americans had insurance compared with 83.3% of Whites, whereas only 65% of Hispanics had health insurance compared with 87.5% of non-Hispanic Whites [13].

This research aimed to assess influenza rates across various demographics, and identify potentially inappropriate prescribing of antibiotics by providers for patients with influenza in the US ambulatory care setting. The current study also characterized prescribing practices by the type of prescriber, geographic location, patient's age, race, sex, and other variables using the NAMCS (National Ambulatory Medical Care Services) 2016 database.

Materials and Methods

In this retrospective, secondary database analysis research, influenza rates across various demographics were assessed to identify potentially inappropriate prescribing of antibiotics by providers for patients with influenza in the US ambulatory care setting. 2016 NAMCS data, by the National Center of Health Statistics (NCHS), was collected. This database was based on a sample of visits to non-federally employed office-based physicians who are engaged in direct patient care and practice in community health centers. Patients with a primary diagnosis of influenza were extracted from the data using NAMCS ICD-10 codes "J10" and "J11". After selecting the cases, the data were analyzed to see whether any antibiotics were prescribed or whether the prescribing practices were compliant with the 2018 IDSA influenza treatment guidelines. A total of 1,754 patients with a primary diagnosis of influenza were extracted.

Patient sex, race, as well as the source of payment, and the provider type were among the operational factors used in data analysis. Sources of payment were defined as coverage through private insurance, Medicaid, Medicare, or other state-based programs, and self-pay. Data were analyzed using various statistical techniques, such as descriptive statistics, chi-square at a significance level of 0.05. Statistical coding and data analysis were performed using the Statistical Package for Social Sciences (SPSS® 24). For descriptive analysis, means, standard deviations, and chi-square tests were used to explore the relationship between various demographic variables to assess adherence to the guidelines. The extracted data set was checked for integrity, equality, and distribution of the number of records in every phase of analysis. For this study, prescribing was considered to be inappropriate if the patient received an antibiotic for the primary diagnosis of influenza with an ICD-10 code "J10" and "J11". The hypothesis focused on whether the number of non-first- line antibiotics prescribed was related to physician specialty, geographic region, and various patient-specific demographics, such as gender, race, or payment type.

Results

The study population (n=1,753) was almost evenly spread out between males and females with 53.6% being males. Most of the patients were in the age group of 66 and older (43.8%) followed by children below 12 years of age (18.5%). The majority of the patients were white (43.0%), followed by black (20.2%) and Hispanics (15.8%). 35.7% of the patients had private insurance, followed by Medicare (25.7%) and Medicaid (24.9%.) General and Family Practice physicians were the most frequented providers (32.9%), followed by Nurse Practitioners (21.9%), and Pediatricians (17.1%). Most of the visits occurred in the South (46.8%) and West (19.8%) (Table 1).

Table 1: Demographics.

Demographic Variables	Frequency (n)	Percentage
Sex		
Male	978	53.6
Female	776	42.5
Age Range		
Below 12	337	18.5
13-20	177	9.7
21-40	121	6.6
41-65	320	17.5

66 and above	799	43.8
Race		
White	785	43
Black	368	20.2
Asian	180	9.9
Hispanic	289	15.8
Other	132	7.2
Type of Payment		
Medicare	469	25.7
Medicaid	455	24.9
Private	652	35.7
Self-pay/other	178	9.7
Physician Specialty		
General and Family Practice	600	32.9
Pediatrics	312	17.1
Internal Medicine	189	10.4
Nurse Practitioner	399	21.9
Physician Assistant	74	4.1
All other specialties	180	9.9
Region		
Northeast	326	17.9
Midwest	213	11.7
South	854	46.8
West	361	19.8

After analyzing the data, 63.6% of prescriptions turned out to be inappropriate. A Chi-square test was performed to test for any differences among the independent variables for appropriate prescribing. There was no significant difference between males and females about appropriateness, although males appeared to be prescribed more inappropriately (X^2=0.593). There was a significant difference among various age groups, with those aged 66 and older and those aged below 12 years of age prescribed more inappropriately (X^2=0.017). There was also a significant difference among various race groups in terms of appropriate prescribing, White and black patients were prescribed more inappropriately as compared to other races (X^2=0.032). Patients with Medicare, Medicaid, and private insurance were prescribed more inappropriately as compared to self-pay patients (X^2=0.029). There was also a significant difference among various providers in the way they prescribed for the flu condition. Family practice physicians and nurse practitioners appeared to prescribe more inappropriately as compared to the other specialties (X^2=0.001). Furthermore, Chi-square analysis showed that South and West received more inappropriate prescriptions as compared to the other regions (X^2=0.001) (Table 2).

Table 2: Prescribing Patterns.

Prescribing Pattern Based on Demographic Variables	Appropriate Prescribing (n=592, 32.4%)	Inappropriate Prescribing (n=1161, 63.6%)	Significance (p)
Sex			
Male	325(54.9%)	652(56.2%)	0.593
Female	267(45.1%)	509(43.8%)	
Age Range			
Below 12	135(22.8 %)	202(17.4%)	0.017
13-20	56(9.5%)	121(10.4%)	
21-40	52(8.8%)	69(5.9%)	
41-65	99(16.7 %)	220(18.9%)	
66 and above	250(42.2 %)	549(47.3%)	

Race			
White	287(48.5 %)	498(42.9%)	0.032
Black	115(19.4%)	252(21.7%)	
Asian	43(7.3 %)	137(11.8%)	
Hispanic	106(17.9%)	183(15.8%)	
Other	41(6.9%)	91(7.8%)	
Type of Payment			
Medicare	140(23.6%)	329(28.3%)	0.029
Medicaid	144(24.3%)	311(26.8%)	
Private	253(42.7%)	398(34.3%)	
Self-pay/other	55(9.3%)	123(10.6%)	
Physician Specialty			
General and Family Practice	192(32.4%)	407(35.1%)	0
Pediatrics	100(16.9%)	212(18.3%)	
Internal Medicine	80(13.5%)	109(9.4%)	
Nurse Practitioner	156(26.4%)	243(20.9%)	
Physician Assistant	27(4.6%)	47(4.0%)	
All other specialties	37(6.3%)	143(12.3%)	
Region			
Northeast	121(20.4%)	205(17.7%)	0
Midwest	72(12.2%)	141(12.1%)	
South	282(47.6%)	571(49.2%)	
West	117(19.8%)	244(21.0%)	

Discussion

In the current study, inappropriate prescribing was defined as prescribing an antibiotic agent for a patient with a primary diagnosis of influenza. This study revealed not only significant differences in antibiotic prescribing practices among various demographics and physician specialties, but also a lack of adherence to IDSA guidelines for influenza treatment. Patients younger than 12 and older than66 represented the majority of inappropriate prescribing cases. These two age groups were the most susceptible to inappropriate prescribing practices, which is supported by the existing literature [14]. The age group of 66 and older have multiple comorbidities and are prone to community-acquired infections. Thus, this finding can be contributed to the precaution of preventing superinfections or prescribing prophylactically to prevent a potential infection in this age group. Another reason could be that most elderly have Medicaid or other types of government-based insurance plans covering their prescriptions. They would be less likely to pay out of pocket for their antibiotic prescriptions. This reasoning is reinforced by the finding that patients with self-pay were prescribed the least number of antibiotic agents. The fact that self-pay patients are more apprehensive towards the need of having to pay for their medications, they are likely to be more conservative in spending and adopt other mitigation strategies, such as over-the-counter medications and home remedies.

The finding that patients younger than 12 were one of the age groups being prescribed most antibiotic agents could possibly point toward the desire and, in some instances, the pressure from the parents to prescribe antibiotics. This could be due to a common perception amongst the general population that antibiotics hasten the treatment and recovery.Whites and African Americans were prescribed the greatest number of antibiotic agents, which can be attributed to the fact that they represented the majority of the study population. Also, these groups are covered by either private or public insurance plans, which provides the ability for them to pay for their prescriptions, as opposed to other groups.

The majority of the study population visited family practices, physicians, and nurse practitioners, as their primary providers. Not surprisingly, these two types of providers also prescribed most antibiotics. Generally, they are perceived as the gatekeepers of our healthcare system, and the patients are more likely to visit them, as opposed to other provider specialties. Thus, they are under pressure to prescribe more, as the general public perceives prescribing medications as a higher-quality treatment. South and West had more cases of inappropriate prescribing due to representing the majority of the study population. This corresponds to the findings from other studies about South being one of the geographical areas with poor health outcomes [15].

The present study was limited by the operational definitions of the study variables and the data collection period. Another limitation was the number of ambulatory care visits during the year 2016, as the variable selection was based on the available NAMCS database. Furthermore, the patients were assumed to have an initial diagnosis of influenza, rather than a recurrent visit. As no allergy information was available in the database, the patients might have not been prescribed antibiotic agents due

to the allergy. Due to the limitations of a secondary database, there was no way to identify whether the prescribed agent was for any concurrent infections.

Conclusion

Adherence to IDSA influenza treatment guidelines is critical, because influenza is a self-limiting condition, and, in most cases, antibiotics are not needed. Inappropriate antibiotic prescribing, such as prescribing when it is not needed, and prescribing the wrong agent, wrong dose or duration, promotes bacterial resistance, which is one of the major healthcare crises [16]. Furthermore, inappropriate prescribing utilizes scarce healthcare resources, which could otherwise be used for the much-needed cases resulting in overutilization and increased healthcare costs. Therefore, appropriate prescribing should be addressed more explicitly by healthcare providers, insurance groups, and policy makers.

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