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Predictors of Injudicious Antibiotic Seeking Behavior

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Abstract: Injudicious use of antibiotics has been defined as use in a manner not consistent with Center for Disease Control and Prevention (CDC) guidelines including using an antibiotic for a viral infection and not finishing the prescribed round of antibiotics. Injudicious use has become a global problem contributing to resistant strains of bacteria that have been linked to serious illnesses in children and adults, increased mortality rates, increased costs outlaid by parents and healthcare providers and longer treatment protocols The purpose of this study was to discover what parental factors are associated with injudicious use of antibiotics. Parents with children age 14 and under completed a questionnaire regarding injudicious antibiotic use with participants recruited over a two-month period. Ethnicity, income, and education were significant predictors of injudicious antibiotic use. ANOVA revealed less injudicious use with females, Caucasians, and parents with higher incomes. Our study identified ethnic minorities, low parental income, less than a high school education and being male as risk factors for injudicious antibiotic seeking behavior by parents. Educational outreach is needed for parents regarding the proper use of antibiotics.

Keywords: Antibiotics, injudicious use, parental knowledge, antibiotic-seeking behavior.

INTRODUCTION

Injudicious use of antibiotics has been defined as use in a manner not consistent with Center for Disease Control and Prevention (CDC) guidelines [1,2] including using an antibiotic for a viral infection and not finishing the prescribed round of antibiotics [3]. This injudicious use has become a global problem contributing to resistant strains of bacteria that have been linked to serious illnesses in children and adults, increased mortality rates, increased costs outlaid by parents and healthcare providers and longer treatment protocols [1,2, 4-8]. Resistance has occurred as the result of bacteria that has undergone adaptations giving them the ability to survive in the presence of antibiotics by rapidly reintroducing them to the extracellular environment through efflux pumps, neutralizing the antibiotic agent so it is no longer harmful, and disabling the antibiotic before it is able to work [9]. While all populations experience injudicious antibiotic use and infection by resistance organisms, it is children in particular who experience the highest rates of both antibiotic use and resistant infections [10,11]. Therefore, one area of promise is interventions aimed at parents [8,12].

Factors identified by other study authors as reasons for injudicious use are parental expectations combined with physicians reporting feeling parental pressure for an antibiotic prescription [13,14]. Parental expectations and pressure may be due to misconceptions in some parents. While other study authors [1,15,16] have reported that 54-93% of parents understood viruses were responsible for the common cold, significantly less understood that antibiotics were not effective for viruses, with one study reporting that 60% of parents had not even heard of bacterial resistance [15]. Also, other study authors [16] suggest that antibiotic use in children and parental antibiotic seeking behavior is associated with parental sociodemographic factors such as educational levels, income, and ethnicity.

Finally it should be noted that few studies exist that identify parental factors associated with injudicious use and parental antibiotic seeking behavior and results for public health interventions targeted at decreasing injudicious antibiotic use have been equivocal [17]. Studies are needed to help identify parents more prone to improper use of antibiotics in order to have more targeted interventions. Therefore, the purpose of this study was to discover what parental factors might be associated with injudicious use of antibiotics.

MATERIALS AND METHODS

A cross-sectional convenience sample of parents with children age 14 years and under, who were present on two randomly selected playgrounds in the Atlanta Georgia area were recruited for this study. Participants were recruited during a two month period with playgrounds repeatedly visited on both weekdays and weekends so as not to exclude parents who work outside the home. All adults that received the survey were assisted by a research assistant and invited to participate in the study. The decision to limit the age of children

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to fourteen years and under was an attempt to acquire the perceptions of parents still attending physician appointments with the child and therefore could accurately disclose how many times their child had been prescribed antibiotics in the last year, and how much information they feel the primary care practitioner informs them about antibiotics. All parents were recruited in the same manner, with a scripted invitation explaining the study. Parents were asked to participate in a short, anonymous survey about parental attitudes toward antibiotic use in their children. Exclusion criteria included participants who could not read English, parents with all children over 14 years, and people who were not the parent or primary guardian of the child to be included in the study. This study adhered to the *Declaration of Helsinki* and all participants meeting eligibility criteria were informed of the requirements of the study and gave oral consent to preserve their anonymity, which was approved by the university IRB.

Statistical Analysis

Reliability for the Lowman score was compared to the Taylor score using a Pearson correlation and a Cronbach's alpha to determine internal consistency. Additionally a small group of participants (n=30) were asked if they would be willing to take the surveys a second time within two days of completing the survey the first time to measure test-retest reliability with twenty participants agreeing. The first and second rounds for the Lowman measure were compared using a Cronbach's alpha, Pearson correlation and an intraclass correlation. ANOVA was used to calculate differences in the Lowman score with variables of gender, ethnicity, parent's age (after a median split), education, household income, pre-existing health conditions, whether they had health insurance, and what capacity they were involved in the medical field. A step-wise linear regression was calculated to find significant predictors of injudicious use of antibiotics using the same variables of interest. All variables in the ANOVA and multiple regression were ascertained from previously published studies. Descriptive statistics were calculated regarding the participants and the scores for the Lowman measure. The Statistical Package for the Social Sciences software for Windows (version 18.0, SPSS Inc, Chicago, IL) was used to perform the statistical analysis of the data. Statistical significance was set a-priori at .05.

RESULTS

One-hundred fifteen people were approached with 15 refusals. Ten parents did not complete the questionnaire yielding a final sample size of 90 people. The sample consisted of 58% females, 9% Asian, 12% African American and 7% Hispanic with 47% of participants having college

Lowman Antibiotic Use Survey

Instructions for Questionnaire Completion

Please answer every question even if some questions seem to be similar. Please make sure to respond to each question based the answer the best represents your understanding of using antibiotics

		Yes	No	Unsure
1.	Do antibiotics have harmful effects?	☐	☐	☐
2.	Has your child's primary care provider explained the differences between bacterial and viral infections to you?	☐	☐	☐
3.	Have you heard of antibiotic resistant bacteria?	☐	☐	☐
4.	Has your child's primary care provider explained that taking antibiotics may have long term risks?	☐	☐	☐
5.	Should a child take all the antibiotic pills they are prescribed even if they feel better before they are gone?	☐	☐	☐
6.	Should primary care providers prescribe antibiotics each time your child is sick?	☐	☐	☐
7.	Can viruses be cured with antibiotics?	☐	☐	☐
8.	Can bacterial illnesses be cured with antibiotics?	☐	☐	☐
9.	Has your child's primary care provider discussed the difference between bacteria and viruses to a point where you have a good understanding of the difference between them?	☐	☐	☐
10.	Have you ever pressured your child's primary care provider to give your child a prescription for antibiotics?	☐	☐	☐
11.	Has your child's primary care provider discussed the risks of antibiotic use with you to a point where you understand the risks and can make an informed decision about antibiotic use?	☐	☐	☐
12.	Has your child's primary care provider given you enough information about antibiotics for you to make an informed decision about antibiotic use?	☐	☐	☐
13.	Do you feel your cultural/ethnic background has influenced your antibiotic seeking behavior?	☐	☐	☐
14.	Do you feel your cultural/ethnic background has influenced your knowledge of antibiotic use?	☐	☐	☐

	Highly Unlikely	Somewhat Unlikely	Some-what Likely	Quite Likely	Highly Likely
1. If your child's primary care provider gave you a prescription for your sick child but asked you to wait two days before filling it to see if your child would get better, how likely is it that you would wait?	☐	☐	☐	☐	☐
2. How much more likely would you be to seek antibiotics from your child's primary care provider if your child were in a great deal of pain from an infection?	☐	☐	☐	☐	☐
3. If your child was sick but your child's primary care provider explained that antibiotics could not cure the infection, how likely is it that you would be content with leaving without an antibiotic even though your child was still sick?	☐	☐	☐	☐	☐
4. If your child was sick but your child's primary care provider explained that antibiotics could not cure the infection and sent you away without them, what is the likelihood that you would seek a second opinion from another primary care provider?	☐	☐	☐	☐	☐
5. If your primary care provider would not prescribe antibiotics for your child when you believed your child needed them, how likely would you be to permanently switch to another primary care provider who was more willing to prescribe antibiotics?	☐	☐	☐	☐	☐

	Never	Rarely	Often	Frequently	Always
1. How often do you pressure your child's primary care provider for antibiotics?	☐	☐	☐	☐	☐
2. How often do you go to see your child's primary care provider and suggest a diagnosis during the examination? (For Example: "I think my child may have strep" or "Don't you think my child may have strep?)	☐	☐	☐	☐	☐
3. How often do you resist the diagnosis of a viral illness because you believe the diagnosis to be incorrect? (For Example: "It's just that this has been going on for such a long time")	☐	☐	☐	☐	☐

degrees. Nine percent had some education beyond college and 36% had received professional or graduate school degrees. All participants had health insurance. Demographic information is presented in Table **1**.

The Lowman scores averaged 61.34 with a SD of 6.22. The average participant age was 38.89 years (SD = 5.68). A Pearson correlation between the Lowman and Taylor measures was calculated (r^2=0.922, p=0.0001) as well as Cronbach's alpha (r^2=0.964) and an intraclass correlation (r^2=0.931) revealing high internal consistency with the Lowman measure. A stepwise linear regression was calculated to find the independent variables with the greatest influence on the Lowman score. The regression reported that ethnicity (beta = 3.776, p=.0001), income (beta = 2.156, p=.034), and education (beta = 1.449, p=.012) were significant predictors of the Lowman score and all other variables were not significant. Results for the regression are presented in Table **2**.

ANOVA revealed significant differences with the Lowman measure between genders (p=.011) with males (Lowman score = 60.74, SD=6.408) scoring lower than females (61.74, 6.098), differences in ethnicity (p=.002) with post-hoc (LSD) reporting that Caucasians (Lowman score = 62.95, 5.233) scoring higher than Asians (56.25, 4.367), African Americans (57.09, 7.300), and Hispanics (58.50, 8.916), and income (p=.008) with post-hoc (LSD) reporting that parents with incomes below $30,000 (Lowman score = 53.33, 10.693) having lower scores than all other income brackets. Medical capacity (p=.883), preexisting condition (p=.704), and education (p=.619) were not significantly different. A median split for age was calculated and demonstrated no significant difference (p=.890) in scores of those classified as older (median age of 30 and above) or younger (below the median age of 30). Results are presented in Table **2**.

DISCUSSION

Increases in antibiotic resistance have occurred over the last few decades with a need to discover what factors might be associated with injudicious use of antibiotics. Though parental pressure on physicians has been described as being an important factor in injudicious antibiotic use [1,2,4-8] few studies have been conducted identifying the characteristics of parents who might practice injudicious antibiotic seeking behavior. Our study discovered that parents who were male, an ethnic minority, and had an income less than $30,000 were more likely to score lower on the Lowman measure. Additionally, ethnicity, income and education levels were significant predictors of scores on the Lowman measure agreeing with the limited studies in this area [1,8]. Interesting findings were that parents in the medical profession, age of

Table 1. Demographic Variables for Study Participants

Variable	N (%)	Lowman Score (SD)	P-value
Gender, n (%)			.011
Females	52(57.8)	61.74 (6.10)	
Males	38(42.2)	60.74 (6.41)	
Age of parents, y±SD	38.59(5.68)		.890
Younger Parents (below 30 years)		56.20 (6.56)	
Older Parents (30 years and above)		59.34 (4.95)	
Ethnicity, n (%)			.002
African American	11(12.2)	57.09 (7.30)	
Asian	8(8.9)	56.25 (4.37)	
White	65(72.2)	62.95 (5.23)	
Hispanic	6(6.7)	58.50 (8.92)	
Education Level, n, (%)			.619
Some High School	1(1.1)	44.00 (N/A)	
High School Graduate	1 (1.1)	60.00 (N/A)	
Some College	6(6.7)	59.33 (6.12)	
College Graduate	42(46.7)	61.26 (5.66)	
Some Professional/Graduate School	8(8.9)	66.25 (6.07)	
Professional/Graduate School Graduate	32(35.6)	61.19 (6.13)	
Income, n, (%)			008
$0-29,999	3(3.3)	53.33 (10.69)	.
$30,000-49,999	5(5.6)	59.80 (9.12)	
$50,000-69,999	8(8.9)	60.12 (5.82)	
$70,000-89,999	21(23.3)	59.33 (5.59)	
$90,000 and above	53(58.9)	62.92 (5.52)	
Job in Medical Setting, n, (%)			.883
None	80(88.9)	60.91 (6.31)	
Physician	5(5.6)	65.00 (4.40)	
Nurse	5(5.6)	66.50 (1.73)	
Preexisting Condition, n, (%)			.704
Preexisting Condition	9 (10.0)	61.44 (6.02)	
No preexisting Condition	81 (90.0)	61.33 (6.28)	

the parents, and parents of children who had a preexisting medical condition did not have significant differences in the Lowman measure and were not significant predictors which disagrees with previous studies [1,8].

Our study found that parents who were male scored lower on the Lowman measure. Some research suggests that women are more likely to be caregivers for sick children and are traditionally the parent who takes the child to the primary care provider (PCP) when the child is ill [1,19]. Secondly, one study author [18] reported a previous prescription or similar infection or illness that did not require a prescription for antibiotics was a strong predictor of parents not request-

Table 2. Results of the Significant Predictors in a Step-Wise Linear Regression

Variable	Beta	t-value	P-value
Ethnicity	3.776	4.217	.0001
Income	2.156	2.167	.034
Education	1.449	2.593	.012

ing an antibiotic for a viral infection from their PCP or another physician. This could also explain why mothers scored higher on the Lowman measure, as they may have been the primary caregiver and therefore have more experience with antibiotic use. Though a literature search did not reveal any studies using gender as variable with injudicious antibiotic use, the findings of Collette, *et al.* [1] and Baucher at al., [19] may help support these findings. If mothers are normally the primarily caregiver for sick children it is fairly intuitive that mothers would have more experience and knowledge of the proper use of antibiotics simply due to more time spent with physicians who prescribe antibiotics. More experience with a variety of physicians in this instance may be a stronger influence on antibiotic seeking behavior but gender may be a proxy variable. It should be noted that though the differences in the Lowman measure between men and women were statistically significant, the real difference were relatively small. More research is needed to further elucidate the role gender may play in injudicious antibiotic seeking behavior.

Limited research has been published suggesting that ethnicity may play a role in injudicious use of antibiotics [20]. One study [21] found that Hispanic and African American parents had more expectations for antibiotics than Caucasian parents which our study supports as Caucasians scored higher than Asians, African Americans and Hispanics on the Lowman measure. It is possible that a part of why some parents are more likely to seek antibiotics is because they are not informed about the difference in types of illness that require them. This possibility is supported by past research that indicated that minority parents were less likely to receive sufficient information from PCPs and be encouraged to participate in medical decision making [1]. It should noted however that Mangione-Smith *et al.* [21] reported that socioeconomic status (SES) was a significant predictor and may be a covariate that is a stronger predictor than ethnicity. In our study income was a significant predictor of a low score on the Lowman measure with parents who had incomes below $30,000 scoring significantly lower than other income brackets. The findings of ethnic differences may be compounded by SES differences suggesting more studies that can more elucidate differences in ethnicity and SES factors.

Another interest finding of our study is that both income and education were significant predictors of the Lowman measure. Income and educational level are often associated with each other [22] as higher levels of education tend to be associated with higher levels of income. Formal education has been reported in previous studies to help reduce injudicious antibiotic seeking behavior and has been associated with changing parental beliefs and expectations along with community health education outreaches [23-25]. Both forms of education in previous studies have seemingly improved the knowledge of parents seeking antibiotics and when appropriate use of antibiotics might occur. The single greatest means to reduce injudicious use, suggested by other study authors [23,26] is through parent-physician interaction with a health education component by a health educator, the physician, and/or the physician's other medical staff. One study author [3] suggests that parent education within the context of the physician's office should include activities that increase knowledge of both disease and the role antibiotics might play and health education about antibiotic resistance and how it can affect disease outcomes including information about compliance. Multiple interventions may be necessary before a change in attitude may occur, with messages delivered through various forms of media during the office visit to supplement the parent-physician interaction. Additionally, one study author [27] has reported that the greatest impact on increasing awareness, knowledge and attitudes about injudicious use may be in parents from lower income brackets as study results suggest they may be more likely to change their understanding with a strong patient-physician and health educator interaction.

Finally, other study authors [24,28] have reported that parent's age, parent's with medical training, and children with preexisting conditions were factors that could influence antibiotics seeking behavior. Our study did not support those findings.

There were a few limitations of this study, namely the sample size was small with 90 participants and it was cross-sectional limiting its generalizability. Secondly, ethnic minorities were underrepresented in this sample with data collection occurring in one geographical area. Finally, most participants were from higher income brackets. Because participants were recruited for this study, there is a potential for bias since they knew they were being surveyed. We attempted to overcome this bias by assuring participants their opinions were valued and through reassurance of confidentially and anonymity regarding their results. Lastly, our study identified ethnic minorities, low parental income, less than a high school education and maleness as risk factors for injudicious antibiotic seeking behavior by parents.

CONFLICTS OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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