Lack of Knowledge of Antibiotic Risks Contributes to Primary Care Patients' Expectations of Antibiotics for Common Symptoms

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ABSTRACT

Patient expectations of receiving antibiotics for common symptoms can trigger unnecessary use. We conducted a survey (n = 564) between January 2020 to June 2021 in public and private primary care clinics in Texas to study the prevalence and predictors of patients' antibiotic expectations for common symptoms/illnesses. We surveyed Black patients (33%) and Hispanic/Latine patients (47%), and over 93% expected to receive an antibiotic for at least 1 of the 5 pre-defined symptoms/illnesses. Public clinic patients were nearly twice as likely to expect antibiotics for sore throat, diarrhea, and cold/flu than private clinic patients. Lack of knowledge of potential risks of antibiotic use was associated with increased antibiotic expectations for diarrhea (odds ratio [OR] = 1.6; 95% CI, 1.1-2.4) and cold/flu symptoms (OR = 2.9; 95% CI, 2.0-4.4). Lower education and inadequate health literacy were predictors of antibiotic expectations for diarrhea. Future antibiotic stewardship interventions should tailor patient education materials to include information on antibiotic risks and guidance on appropriate antibiotic indications.

INTRODUCTION

Patients often receive antibiotic prescriptions to treat common viral symptoms/illnesses, such as respiratory tract infection,[1-6] cold/flu,[7,8] and diarrhea,[9,10] despite guidelines recommending against these practices.[11-15] Individuals' knowledge, beliefs, and expectations may contribute to inappropriate antibiotic use.[3,7-9,16,17] These prior studies, however, did not examine the independent effects of knowledge of antibiotic risks and sociodemographic factors on patient expectations of antibiotics for common symptoms/illnesses. This study examined the (1) prevalence of patient antibiotic expectations for acute diarrhea, sore throat, cold/flu, sinus infection, and bronchitis symptoms/illnesses, (2) differences in the prevalence of patient antibiotic expectations between primary care patients in a public and private health care system, and (3) predictors of patients' antibiotic expectations for each symptom/illness.

METHODS

A survey was administered between January 2020 to June 2021 in 6 public primary care clinics and 2 private emergency departments serving sociodemographically diverse patients in Harris County, Texas.[18] We provided the details on the survey development in a prior publication.[18] The maximum expected prevalence of non-prescription antibiotic use based on prior US-based studies was 30%. To obtain a precision of 0.05 and adjust for possible nonresponse, we selected 564 respondents.[18] Participating clinic staff provided a recruitment flyer to every patient who checked in for a visit. Patients interested in participating approached study coordinators who were present in the waiting areas. The surveys were conducted in person when permitted during the COVID-19 pandemic (n = 197) and by telephone (n = 367) when coordinators were not permitted to be inside the clinic (March 2020-May 2020). Participants were offered a payment of $15. Children aged under 18 years and those unable to answer the survey questions were excluded.[18] The Institutional Review Board for Baylor College of Medicine approved this protocol (H-45709).

Table 1. Patient Sociodemographic, Symptom/Illness Characteristics by Health Care System, and Differences Between the Public and Private Health Care Systems (χ^2 *P* Value <0.05)

Patient characteristics	All Clinics (n = 564) n (%)	Public Clinics (n = 409) n (%)	Private Clinics (n = 155) n (%)	Public vs Private Clinics *P* Value
Median age, y [range]	49.7 [19-92]	53 [19-77]	41 [19-92]	*P* **<0.001**
Gender/Sex				*P* = 0.180
Female	407/564 (72.2)	302/409 (73.8)	105/155 (67.7)	
Male	157/564 (26.8)	107/409 (26.2)	49/155 (31.6)	
Race and ethnicity				*P* **<0.001**
Hispanic	263/564 (46.6)	222/409 (54.3)	41/155 (26.5)	
Non-Hispanic Black/African American	186/564 (33.0)	144/409 (35.2)	42/155 (27.1)	
Non-Hispanic White	89/564 (15.8)	32/409 (7.8)	57/155 (36.8)	
Other[a]	26/564 (4.6)	11/409 (2.7)	15/155 (9.7)	
Education				*P* **<0.001**
Less than high school	92/564 (16.3)	82/409 (20.0)	10/155 (6.5)	
High school or GED	225/564 (39.9)	184/409 (45.0)	41/155 (26.5)	
Some college and above	247/564 (43.8)	143/409 (35.0)	104/155 (67.1)	
Health insurance status				*P* **<0.001**
Private or Medicare	207/564 (36.7)	94/409 (23)	113/155 (72.9)	
Medicaid or county financial assistance program	319/564 (56.6)	308/409 (75.3)	11/155 (7.1)	
Self-pay	38/564 (6.7)	7/409 (1.7)	31/155 (20)	
Survey language preference				*P* **<0.001**
Spanish	155/564 (27.5)	143/409 (35)	12/155 (7.7)	
English	409/564 (72.5)	266/409 (65)	143/155 (92.3)	
Country of birth				*P* = 0.230
United States	360/564 (63.8)	243/409 (59.4)	117/155 (75.5)	
Other[b]	204/564 (36.2)	166/409 (40.6)	38/155 (24.5)	
Knowledge of any risks associated with antibiotic use				*P* = 0.738
No. Lacking knowledge of the risks	210/564 (37.2)	146/409 (35.7)	53/155 (34.2)	
Yes. Has knowledge of the risks, as follows:	354/564 (62.8)	255/409 (62.3)	99/155 (63.9)	
Anything related to antibiotic resistance	105/354 (29.7)	63/255 (24.7)	42/99 (42.4)	*P* **<0.001**
Antibiotics may kill friendly/good bacteria	31/354 (8.8)	20/255 (7.8)	11/99 (11.1)	*P* = 0.324
Antibiotic side effects (rash, diarrhea or nausea)	270/354 (76.3)	206/255 (80.8)	64/99 (64.6)	*P* **<0.002**
It is unhealthy to take medicine in general	25/354 (7.1)	19/255 (7.5)	6/99 (6.1)	*P* = 0.653
Other[c]	29/354 (8.2)	26/255 (10.2)	3/99 (3.0)	*P* = **0.028**

continues

GED = general educational development.

Note: Bolded = significant *P* value (<0.05).

[a] Other includes "mixed" race and Asian.
[b] Other includes all reported countries outside the United States. These include 1 Columbia, 1 Costa Rica, 6 Cuba, 1 Dominican Republic, 14 El Salvador, 6 Guatemala, 15 Honduras, 131 Mexico, 2 Nicaragua, 1 Panama, 1 Peru, and 3 Venezuela (countries are listed in alphabetical order).
[c] Other category includes respondents that reported antibiotics interacting with other medications/alcohol and reported antibiotics to cause urinary tract infection.

To assess patient expectations of antibiotics for each symptom/illness, we stated, "When you have (specific symptom/illness)": "Taking antibiotics will help you get better quickly," and "You should take antibiotics to avoid getting sicker." Patients responded on a 5-point Likert scale ranging from 1-strongly agree to 5-strongly disagree, which we dichotomized into 1-expectation (combining strongly agree and agree responses) and 0-no expectation (combining undecided, disagree, or strongly disagree) of antibiotics. Patients responding with N/A were not included in the analyses. See **Supplemental Appendix** for the survey instrument.

Patient sociodemographic factors, antibiotic risk(s) knowledge, and health literacy are detailed in **Table 1**. Individuals answering "Yes" to "Do you know about any risk associated with antibiotic use?" were considered knowledgeable (**Supplemental Appendix**). Patients who acknowledged knowing about antibiotic risks were asked to specify, and their responses included knowledge of resistance, disruption of the microbiome, adverse side effects/interactions, and concerns regarding taking medications in general (**Table 1**). Health literacy was measured using a validated brief health literacy screening tool.[19,20]

We used χ^2 tests to compare patient characteristics and antibiotic expectations for each symptom/illness between health care systems. If symptoms/illnesses significantly differed between the clinics, we applied a multivariable logistic regression analysis with each symptom/illness as a separate outcome, and education, health care system, antibiotic risk knowledge, and health literacy were predictor variables (**Table 2**). All statistical analyses were conducted using SPSS version 28 (IBM Corp).

Table 1. Patient Sociodemographic, Symptom/Illness Characteristics by Health Care System, and Differences Between the Public and Private Health Care Systems (χ^2 *P* Value <0.05) *(continued)*

Patient characteristics	All Clinics (n = 564) n (%)	Public Clinics (n = 409) n (%)	Private Clinics (n = 155) n (%)	Public vs Private Clinics P Value
Health literacy[d]				*P = 0.260*
Adequate	391 (69.3)	278 (68.0)	113 (72.9)	
Inadequate	173 (30.7)	131 (32.0)	42 (27.1)	

Patient characteristics	All Clinics n/N (%)	Public Clinics n/N (%)	Private Clinics n/N (%)	Public vs Private Clinics (P Value)
Taking antibiotics will help to alleviate symptoms quickly or prevent getting sicker[e]				
Sore throat	370/559 (65.6)	289/405 (71.4)	81/154 (52.6)	*P* **<0.001**
Diarrhea	205/505 (36.3)	165/397 (41.6)	40/153 (26.1)	*P* **<0.001**
Cold or flu	361/560 (64.0)	274/406 (67.5)	87/154 (56.5)	*P* **= 0.02**
Sinus infection	406/538 (72.0)	301/392 (76.8)	105/146 (71.9)	*P = 0.240*
Bronchitis	369/473 (83.9)	261/333 (78.4)	108/140 (77.1)	*P = 0.770*
Overall (any symptom/illness)	512/550 (93.1)	377/399 (94.5)	135/151 (89.4)	*P* **= 0.040**

GED = general educational development.

Note: Bolded = significant *P* value (<0.05).

[a] Other includes "mixed" race and Asian.

[b] Other includes all reported countries outside the United States. These include 1 Columbia, 1 Costa Rica, 6 Cuba, 1 Dominican Republic, 14 El Salvador, 6 Guatemala, 15 Honduras, 131 Mexico, 2 Nicaragua, 1 Panama, 1 Peru, and 3 Venezuela (countries are listed in alphabetical order).

[c] Other category includes respondents that reported antibiotics interacting with other medications/alcohol and reported antibiotics to cause urinary tract infection.

[d] Individuals answering "Yes" to: "Difficulty understanding written information," "Confidence in filling out medical forms by yourself," or "Someone helps you read clinic or hospital materials."[19,20]

[e] Individuals answering "Yes" to either question, "When you have (diarrhea, sore throat, cold/flu, sinus infection, or bronchitis symptoms), taking antibiotics will help you get better quickly" or "When you have (diarrhea, sore throat, cold/flu, sinus infection, or bronchitis symptoms), you should take antibiotics to avoid getting sicker."

RESULTS

Of those surveyed, approximately 84% believed that antibiotics would improve bronchitis, followed by sinus infections (72%), sore throat (66%), cold/flu (64%), and diarrhea (36%). The proportions of patients who believed antibiotics would improve diarrhea, sore throat, and cold/flu symptoms were higher among public than private clinic patients (*P* ≤0.02). Univariate regression results are presented in the Supplemental Table. In the multivariate regression analysis, the health care system was associated with patient antibiotic expectations after adjusting for sociodemographic factors. Compared with private, public clinic patients were nearly twice as likely to expect antibiotics for diarrhea (odds ratio [OR] = 1.8; 95% CI, 1.2-2.8; *P* = 0.009), sore throat (OR = 2.2; 95% CI, 1.5-3.2; *P* <0.001), cold/flu (OR =1.5; 95% CI, 1.0-2.3; *P* = 0.002), and overall (OR = 1.6; 95% CI, 1.1-2.3; *P* <0.016). Educational level predicted patient antibiotic expectations for diarrhea, with patients with less than a high school education expecting antibiotics 2 times more than college-educated patients (95% CI, 1.2-3.5; *P* = 0.01). Additionally, patients with adequate health literacy were 30% less likely to

expect antibiotics to help treat diarrhea (*P* = 0.04) (Table 2). Sex, race/ethnicity, health insurance, survey language, and country of birth were not significantly associated with patient antibiotic expectations for these symptoms.

Overall, 37% of patients lacked knowledge of antibiotic risks. The proportion of patients with knowledge of antibiotic resistance was higher in private compared with public clinic patients, and the proportion of patients with knowledge of antibiotic side effects was lower in private vs public clinic patients (Table 1). Lack of knowledge about antibiotic risk(s) was significantly associated with increased antibiotic expectations for diarrhea (OR = 1.6; 95% CI, 1.1-2.4; *P* = 0.01) and cold/flu symptoms (OR = 2.9; 95% CI, 2-4.4; *P* <0.001) and was marginally associated with sore throat symptoms (*P* = 0.06) (Table 2).

DISCUSSION

We found high proportions of patients expecting antibiotics to treat bronchitis, followed by sinus infection, sore throat, cold/flu, and diarrhea. Patients from the public health care system had significantly higher antibiotic expectations for the symptoms/illnesses studied. Lack of knowledge of antibiotic risks was associated with higher expectations of receiving antibiotics for sore throat and diarrhea.

Our results align with prior studies indicating that patients have high expectations of antibiotics for minor illnesses and have limited knowledge of risks.[17,21] Other studies have shown that patients with high antibiotic expectations and limited knowledge of risks also expressed trust in clinical advice, including willingness to consider alternative/non-antibiotic treatment options if counseled appropriately and involved in shared decision making.[17,22] In addition, patient-clinician counseling on patient-level adverse outcomes (eg, *C. difficile* infection and severe drug interactions/complications) may be more impactful than discussing societal harms or antibiotic resistance.[16,23]

Our study may not be fully generalizable to outpatients in less sociodemographically diverse urban areas of the United States. Additionally, public clinic patients may be more psychosocially and medically complex, affecting their antibiotic

Table 2. Multivariate Results. Sociodemographic Predictors of Patient Expectations of Antibiotics for Diarrhea, Sore Throat, Cold/Flu, and Overall (Any Symptom/Illness)

| | Expectation of Antibiotics to Alleviate or Prevent Symptoms: | | | | | | | |
| | Diarrhea | | Sore Throat | | Cold/Flu | | Overall[a] | |
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value
Sociodemographic predictors[b]								
Education	Overall	0.010	Overall		Overall	–	Overall	–
Some college and above	1 (reference)	–	1 (reference)	–	1 (reference)	–	1 (reference)	–
High school or GED	0.9 (0.6-1.4)	0.700	–	–	–	–	–	–
Less than high school	2.0 (1.2-3.5)	0.010	–	–	–	–	–	–
Health care system								
Private	1 (reference)	–	1 (reference)	–	1 (reference)	–	1 (reference)	–
Public	1.8 (1.2-2.8)	0.010	2.2 (1.5-3.2)	< 0.001	1.5 (1.0-2.3)	0.002	1.6 (1.1-2.3)	0.016
Knowledge of any risks associated with antibiotic use								
Yes. Has knowledge of the risks[c]	1 (reference)	–	1 (reference)	–	1 (reference)	–	1 (reference)	–
No. Lacking knowledge of the risks	1.6 (1.1-2.4)	0.010	1.4 (1.0-2.1)	0.06	2.9 (2.0-4.4)	< 0.001	–	–
Health literacy								
Inadequate[d]	1 (reference)	–	1 (reference)	–	1 (reference)	–	1 (reference)	–
Adequate	0.7 (0.4-0.9)	0.040	–	–	–	–	–	–

GED = general educational development.

[a] Overall includes any symptom or illness, including diarrhea, sore throat, cold/flu, sinus infection, and bronchitis.

[b] Predictors identified in the univariate analyses, but not significant in multivariate analyses, include age, sex/gender, race and ethnicity, health insurance status, survey language preference, and country of birth.

[c] Risks include anything related to antibiotic resistance; antibiotics may kill friendly/good bacteria; side effects (eg, rash, diarrhea, or nausea); it is unhealthy to take medicine in general; and "Other" category (eg, antibiotics interacting with other medications/alcohol, and antibiotics cause urinary tract infections).

[d] Individuals answering "Yes" to: "Difficulty understanding written information," "Confidence in filling out medical forms by yourself," or "Someone helps you read clinic or hospital materials."[19,20]

expectations.[24] Though questions were phrased neutrally, a social desirability response bias may have occurred. Lastly, patient antibiotic expectations may have been impacted by unforeseen contextual changes associated with the COVID-19 pandemic.[25,26]

CONCLUSIONS

Differences in patient education, knowledge of harms/risks, health literacy, and the health care system impact inappropriate patient expectations of antibiotics for common symptoms. Future stewardship interventions to reduce inappropriate patient antibiotic expectations should (1) inform patients of the symptoms/illnesses that antibiotics treat and (2) emphasize the individual harms/risks (or harms/risks to others close to an individual) of antibiotics.[17,23] Using these findings, we are developing a patient-clinician antibiotic education tool to educate and empower patients on proper antibiotic use and assist clinicians in discussing alternative (non-antibiotic) treatment options with their patients.

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Key words: antibiotic use; antimicrobial stewardship; primary care; antibiotic risks; patient expectations

🖰 **Supplemental materials**

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