Patient Satisfaction and Antibiotic Prescribing for Respiratory Infections by Telemedicine

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abstract

BACKGROUND AND OBJECTIVES: Respiratory tract infections (RTIs) are a common reason for direct-to-consumer (DTC) telemedicine consultation. Antibiotic prescribing during video-only DTC telemedicine encounters was explored for pediatric RTIs.

METHODS: Encounter data were obtained from a nationwide DTC telemedicine platform. Mixed-effects regression was used to assess variation in antibiotic receipt by patient and physician factors as well as the association between antibiotic receipt and visit length or patient satisfaction.

RESULTS: Of 12 842 RTI encounters with 560 physicians, antibiotics were prescribed in 55%. The provider was more likely to receive a 5-star rating from the parent when an antibiotic was prescribed (93.4% vs 80.8%). A 5-star rating was associated with a prescription for an antibiotic (odds ratio [OR] 3.38; 95% confidence interval [CI] 2.84 to 4.02), an antiviral (OR 2.56; 95% CI 1.81 to 3.64), or a nonantibiotic (OR 1.93; 95% CI 1.58 to 2.36). Visit length was associated with higher odds of a 5-star rating only when no antibiotic was prescribed (OR 1.03 per 6 seconds; 95% CI 1.01 to 1.06). Compared with nonpediatricians, pediatric providers were less likely to prescribe antibiotics (OR 0.44; 95% CI 0.29 to 0.68); however, pediatricians received higher encounter satisfaction ratings (OR 1.50; 95% CI 1.11 to 2.03).

CONCLUSIONS: During DTC telemedicine consultations for RTIs, pediatric patients were frequently prescribed antibiotics, which correlated with visit satisfaction. Although pediatricians prescribed antibiotics at a lower rate than other physicians, their satisfaction scores were higher. Further work is required to ensure that antibiotic use during DTC telemedicine encounters is guideline concordant.

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WHAT'S KNOWN ON THIS SUBJECT: An important determinant of patient satisfaction in adult telemedicine encounters for acute respiratory tract infections is receipt of an antibiotic. Little is known about antibiotic prescribing practices during pediatric telemedicine consults and whether antibiotics receipt correlates with patient satisfaction.

WHAT THIS STUDY ADDS: Antibiotics are prescribed frequently during telemedicine encounters for pediatric respiratory infections. Visit satisfaction correlates with antibiotics receipt. Pediatricians prescribed fewer antibiotics than nonpediatricians but had higher satisfaction scores. Work is required to ensure guideline-concordant antibiotic use during pediatric telemedicine consults.

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Direct-to-consumer (DTC) telemedicine connects patients and physicians via mobile applications 24 hours per day. Use of DTC telemedicine is rapidly expanding among both adult and pediatric populations, and patients frequently use the service as an alternative to traditional urgent care.[1–3] Respiratory tract infections (RTIs) are a common reason for seeking care via telemedicine. Previous research in adults diagnosed with RTIs found high rates of antibiotic receipt in DTC telemedicine.[4] Patient encounter satisfaction was strongly associated with antibiotic prescription receipt, and visits that resulted in antibiotics were shorter than those with no prescription, both being incentives for physicians to prescribe antibiotics.[5] During pediatric DTC telemedicine visits for RTIs, antibiotic prescribing rates are reported to be higher than during in-person consultation, and antibiotic management is less likely to be guideline concordant.[6] This is of concern because antibiotic overuse promotes the emergence of antibiotic-resistant bacteria and may have additional untoward consequences.[7]

Knowledge of factors influencing antibiotic prescribing during DTC telemedicine are relevant to antimicrobial stewardship efforts promoting judicious antibiotic use. Therefore, we explored correlates between parent satisfaction with their child's video-only DTC telemedicine consult for acute RTIs and encounter characteristics, focusing on encounter length and whether an antibiotic was prescribed.

METHODS

Patients

In June 2015, the Cleveland Clinic entered an agreement to use a national telemedicine platform for its online health care needs. Consistent with its academic research focus, the Cleveland Clinic negotiated a data use agreement to allow analysis of data from the platform, which serves all 50 states and is not Cleveland Clinic specific. The platform connects patients and physicians 24 hours per day to address minor, urgent medical problems through synchronous video visits. When patients access the service, the interface collects demographic information. Encounters were not associated with any particular insurer or employer, and patients without insurance coverage can pay out of pocket. The typical visit cost was $59. If multiple providers are available, patients may select a specific provider or specialty, and younger patients are generally routed to providers with family medicine or pediatrics training. Further description of the platform has been published.[2] Our study includes visits conducted between July 2016 and July 2018 for patients 19 years and younger. Approval was granted by the institutional review board of the Cleveland Clinic.

Diagnoses

RTI diagnoses were identified via encounter *International Classification of Diseases, 10th Revision* codes, as recorded by the provider. RTIs were categorized as pharyngitis and/or tonsillitis, sinusitis, bronchitis and/or bronchiolitis, otitis media, influenza, or other viral infections (laryngitis, rhinitis, cough, viral upper respiratory tract infection [URI], or URI not otherwise specified). Because there were <50 patients with a bronchiolitis diagnosis, bronchiolitis and bronchitis were combined into a single category, aligning our diagnostic categories with a national outpatient survey.[8] The data set did not include any patients with pneumonia. Asthma was not considered an RTI. Pharyngitis, the most common RTI, was used as the reference category. Data were administrative only, with no access to charts.

Patient Characteristics

Telemedicine patients provided their age and sex. Geographic location was determined by patient-reported US state, which was grouped into census-defined regions. Drug allergy data were not available.

Physician Characteristics

The telemedicine platform provided specialty (family medicine, internal medicine, emergency medicine, or pediatrics) and state of residence for each physician, which we grouped into census-defined regions. For adjusted analyses, we dichotomized specialty according to whether the provider was a pediatrician or nonpediatrician.

Encounter Characteristics

Characteristics included prescription outcome, visit duration, and patient satisfaction. Whether the patient received a prescription was determined by the presence of a National Drug Code number for the encounter. We categorized medication receipt as antibiotic, antiviral, other medication, or nothing. Visit duration was recorded by the system in minutes. At the conclusion of the encounters, parents were prompted to rate their satisfaction with their telemedicine physician on a scale of 0 to 5 stars, with 5 stars being the most satisfied. Because satisfaction data are highly skewed, we dichotomized responses as 5 vs <5 stars. This corresponds to the way Medicare assesses patient satisfaction through its publicly reported measures.[9]

Statistical Analysis

We generated distributions of key variables by sample characteristics, including distributions of patients receiving an antibiotic or rating their telemedicine physician as 5 stars. Using mixed-effects logistic regression, accounting for clustering by physician, we assessed differences in the odds of antibiotic receipt by

patient, physician, and encounter characteristics. In similar analyses, we assessed differences in the odds of receiving azithromycin versus another antibiotic and differences in the odds of a telemedicine physician being rated 5 stars versus not. We then used mixed-effects linear regression to assess differences in encounter length by patient, physician, and encounter factors, including prescription outcome. We generated adjusted estimates for all models using the postestimation "predict" command. For physicians with at least 10 encounters, we generated adjusted mean satisfaction scores and adjusted mean antibiotic prescribing scores and assessed the correlation between the 2 for each physician. In particular, we wanted to see if some physicians managed to attain high satisfaction despite a low prescribing rate. All analyses were conducted in Stata 14 (Stata Corp, College Station, TX).

RESULTS

The final sample included 12 842 completed patient encounters provided by 560 physicians. Table 1 shows, for each characteristic, the percentage of patients who received antibiotics and the percentage of parents rating the visit as 5 stars. The most common RTI diagnoses were pharyngitis (29%) and sinusitis (23%). Fifty-three percent of patients were of female sex; 9% of patients were <3 years old, and 53% were aged 10 or older. The geographic distribution of physicians was similar to that of patients. Overall, 55% of children with an RTI diagnosis received an antibiotic prescription. Antivirals were prescribed in 7% of encounters. Nonantibiotic prescriptions were prescribed in 11% of encounters. Common nonantibiotic prescriptions included oral steroids (47%) and fluticasone nasal spray (20%); less commonly prescribed medications included Tessalon and/or benzonatate, montelukast, and promethazine.

TABLE 1 Sample Characteristics and Percentage Receiving Antibiotics and Rating Care as 5 Stars

N = 12 842	N (%)	Encounters Getting Antibiotic,[a] N (%)	Encounters Rated as 5 Stars,[b] N (%)
Prescription outcome			
Antibiotic	7074 (55)	—	6595 (93)
Antiviral	933 (7)	—	862 (92)
Nonantibiotic	1436 (11)	—	1272 (89)
None	3399 (26)	—	2732 (80)
URI diagnosis			
Pharyngitis	3702 (29)	2825 (76)	3322 (90)
Sinusitis	2970 (23)	2729 (92)	2756 (93)
Bronchitis and/or bronchiolitis	688 (5)	424 (62)	615 (89)
Otitis media	546 (4)	522 (96)	517 (95)
Influenza	784 (6)	17 (2)	717 (91)
Other URI[c]	4152 (32)	600 (14)	3534 (85)
Patient sex			
Female	6765 (53)	3775 (56)	6037 (89)
Male	6077 (47)	3342 (55)	5424 (89)
Patient age, y			
0–2	1216 (9)	446 (37)	1060 (87)
3–9	4812 (37)	2694 (56)	4356 (90)
10–19	6814 (53)	3977 (58)	6045 (89)
Patient region			
Northeast	1316 (10)	682 (52)	1179 (90)
Midwest	4932 (38)	2941 (60)	4326 (88)
South	4518 (35)	2347 (52)	4108 (91)
West	2076 (16)	1147 (55)	1848 (89)
Physician specialty			
Family medicine (n = 315)	9438 (73)	5305 (56)	8408 (89)
Internal medicine (n = 97)	551 (4)	299 (54)	468 (85)
Emergency medicine (n = 69)	940 (7)	561 (60)	823 (88)
Pediatrics (n = 79)	1913 (15)	952 (50)	1762 (92)
Physician region			
Northeast	2048 (16)	958 (47)	1775 (87)
Midwest	2905 (23)	1676 (58)	2591 (89)
South	5476 (43)	3214 (59)	4971 (91)
West	2413 (19)	1269 (53)	2124 (88)

—, not applicable.
[a] Proportion of sample characteristic getting antibiotic.
[b] Proportion of sample characteristic rating care as 5 stars.
[c] Includes rhinitis, cough, laryngitis, viral URI, and URI not otherwise specified.

Family medicine doctors provided the majority of care across all age groups (0–2 years: 69.2%; 3–9 years: 74.0%; and 10–19 years: 73.9%). A higher percentage of the youngest patients were seen by pediatricians (0–2 years: 23.6%; 3–9 years: 18.2%; and 10–19 years: 11.0%). Internal medicine physicians tended to see older patients (0–2 years: 0.6%; 3–9 years: 0.9%; and 10–19 years: 7.4%); only 7 patients <3 years old were seen by an internist.

Patient, physician, and encounter characteristics associated with an antibiotic prescription in the multivariable model appear in Table 2. Results in this and subsequent sections are also expressed in an alternative format by using an adjusted proportion (AP) model, and are presented within the supplemental tables. Adjusted prescribing rates varied by diagnosis and were high (Supplemental Table 5): sinusitis (92.1%), otitis media (96.0%), pharyngitis (76.7%), and bronchitis and/or bronchiolitis (62.0%). Compared with patients with an encounter diagnosis of pharyngitis, patients with otitis media (odds ratio [OR] 7.77; 95% confidence interval [CI] 4.93 to 12.2)

TABLE 2 Differences in Odds of Antibiotic Receipt and Azithromycin Receipt

	Adjusted Odds of Antibiotic Receipt		Adjusted Odds of Azithromycin Receipt	
	OR	95% CI	OR	95% CI
URI diagnosis				
Pharyngitis	1.00	—	1.00	—
Sinusitis	4.47	3.76 to 5.33	0.76	0.62 to 0.93
Bronchitis and/or bronchiolitis	0.49	0.40 to 0.60	8.95	6.82 to 11.7
Otitis media	7.77	4.93 to 12.2	0.64	0.42 to 0.96
Influenza	0.003	0.002 to 0.006	0.61	0.12 to 3.19
Other RTI	0.03	0.03 to 0.04	2.23	1.68 to 2.96
Patient sex				
Female	1.00	—	1.00	—
Male	0.99	0.89 to 1.10	0.91	0.77 to 1.07
Patient age, y				
0–2	1.00	—	1.00	—
3–9	1.51	1.23 to 1.87	2.61	1.64 to 4.15
10–19	1.30	1.06 to 1.60	3.69	2.33 to 5.84
Patient region				
Northeast	1.00	—	1.00	—
Midwest	1.05	0.85 to 1.29	0.84	0.59 to 1.18
South	0.89	0.72 to 1.09	0.91	0.65 to 1.29
West	1.16	0.91 to 1.47	0.86	0.58 to 1.26
Physician specialty				
Nonpediatrics	1.00	—	1.00	—
Pediatrics	0.44	0.29 to 0.68	0.80	0.50 to 1.29
Physician region				
Northeast	1.00	—	1.00	—
Midwest	1.28	0.81 to 2.04	0.98	0.59 to 1.63
South	1.82	1.23 to 2.69	1.22	0.79 to 1.90
West	1.51	0.94 to 2.41	1.04	0.63 to 1.73
Visit duration (OR per 6 s)	0.95	0.93 to 0.97	1.01	0.98 to 1.05

—, not applicable.

or sinusitis (OR 4.47; 95% CI 3.76 to 5.33) were more likely to receive an antibiotic, whereas patients with a diagnosis of bronchitis and/or bronchiolitis (OR 0.49; 95% CI 0.40 to 0.60) or other RTI (OR 0.03; 95% CI 0.03–0.04) were less likely to receive it. Patients given the diagnosis of influenza on the basis of reported symptoms were least likely to receive antibiotics (OR 0.003; 95% CI 0.002 to 0.006), but 81% of them received an antiviral. The odds of receiving an antibiotic were increased for older children compared with those aged 0 to 2 (age 3–9: OR 1.51 [95% CI 1.23 to 1.87]; age 10–19: OR 1.30 [95% CI 1.06 to 1.60]). Compared with nonpediatricians (AP 56.4%; 95% CI 55.8 to 57.2), pediatric providers prescribed antibiotics at a lower rate (AP 49.8%; 95% CI 48.1 to 51.5). Physicians from the South were more likely to prescribe antibiotics than physicians from the Northeast (OR 1.82; 95% CI 1.23 to 2.69). Longer visits were less likely to result in an antibiotic prescription (OR per 6 seconds 0.95; 95% CI 0.93 to 0.97). Patient sex and patient geographic location were not associated with receipt of antibiotics.

The most commonly prescribed antibiotics were amoxicillin (55%), amoxicillin clavulanate (17%), azithromycin (12%), cefdinir (6%), and penicillin (3%). Because azithromycin is infrequently recommended to treat URIs in children, and variations in its use may suggest suboptimal antibiotic selection, we explored azithromycin use specifically.[10] Adjusted rates of azithromycin use were higher for older children and varied by RTI diagnosis (Supplemental Table 5); use was highest for bronchitis and/or bronchiolitis and lowest for otitis media (Table 2). Compared with patients with pharyngitis, azithromycin was more likely to be prescribed to patients diagnosed with bronchitis and/or bronchiolitis (OR 8.95; 95% CI 6.82 to 11.7) or other RTIs (OR 2.23; 95% CI 1.68 to 2.96) and less likely to be prescribed to patients with sinusitis (OR 0.76; 95% CI 0.62 to 0.93), otitis media (OR 0.64; 95% CI 0.42 to 0.96), or influenza (OR 0.61; 95% CI 0.12 to 3.19). Compared with the youngest age group, azithromycin was used more frequently relative to other antibiotics in children 3 to 9 years old (OR 2.61; 95% CI 1.64 to 4.15) and 10 to 19 years old (OR 3.69; 95% CI 2.33 to 5.84).

Independent predictors of parent satisfaction appear in Table 3. The AP of parents who rated their provider as 5 stars varied according to prescription outcome (Supplemental Table 6): 80.8% (95% CI 90.5 to 81.1) for no medication, 88.9% (95% CI 88.7 to 89.2) for nonantibiotic, 92.6% (95% CI 92.4 to 92.9) for antiviral, and 93.5% (95% 93.4 to 93.6) for antibiotic. The observed correlation between medications and patient satisfaction was similar in the pediatrician-only subsample for antibiotics (OR 3.56; 95% CI 2.21 to 6.07) and nonantibiotic prescriptions (OR 2.78; 95% CI 1.26 to 6.13), but the association was not significant for antiviral agents (OR: 0.77; 95% CI 0.28 to 2.11). RTI diagnosis, provider geographic location, patient sex, patient age, and visit duration were not associated with parent satisfaction. We found a strong correlation (r = 0.45; P = .001) between individual physicians' adjusted satisfaction ratings and adjusted antibiotic prescribing rate (Fig 1). The correlation between satisfaction and antibiotic prescribing was similar for pediatricians and nonpediatricians (r = 0.55 vs 0.47; P = .587). For encounters in which antibiotics were prescribed, there was no association between visit length and parent satisfaction.

TABLE 3 Differences in Odds of Parent Rating Child's Physician as 5 Stars Versus Not

	OR	95% CI
Prescription outcome		
Nothing	1.00	—
Antibiotic	3.38	2.84 to 4.02
Antiviral	2.56	1.81 to 3.64
Nonantibiotic	1.93	1.58 to 2.36
URI diagnosis		
Pharyngitis	1.00	—
Sinusitis	1.18	0.98 to 1.43
Bronchitis and/or bronchiolitis	1.01	0.76 to 1.35
Otitis media	1.37	0.91 to 2.06
Influenza	1.35	0.92 to 1.98
Other RTI	1.03	0.86 to 1.22
Patient sex		
Female	1.00	—
Male	0.98	0.87 to 1.10
Patient age, y		
0–2	1.00	—
3–9	1.16	0.94 to 1.43
10–19	0.92	0.75 to 1.13
Patient region		
Northeast	1.00	—
Midwest	0.71	0.56 to 0.89
South	1.03	0.82 to 1.30
West	0.96	0.75 to 1.25
Physician specialty		
Not pediatrics	1.00	—
Pediatrics	1.50	1.11 to 2.03
Physician region		
Northeast	1.00	—
Midwest	1.08	0.78 to 1.48
South	1.19	0.90 to 1.59
West	1.08	0.78 to 1.50
Visit duration (OR per 6 s)	1.01	0.99 to 1.03

—, not applicable.

However, for encounters not resulting in antibiotics, longer visit length was associated with a higher odds of the parent rating the physician as 5 stars both in the overall sample (OR 1.03 per 6 seconds; 95% CI 1.01 to 1.06) and in encounters with pediatricians only (OR 1.09 per 6 seconds; 95% CI 1.01 to 1.18).

To understand the impact of antibiotic prescribing on encounter length, we modeled encounter length as a function of patient and physician characteristics as well as prescription receipt (Table 4, Supplemental Table 7). The mean encounter length was 6.4 minutes (median 5.5 minutes; interquartile range 3.9–8.2 minutes). Encounters in which an antibiotic was prescribed were 0.14 minutes shorter (95% CI −0.27 to −0.01), and encounters in which a nonantibiotic prescription was provided were 0.47 minutes longer (95% CI 0.32 to 0.63), than when nothing was prescribed. Compared with encounters for pharyngitis, encounters for sinusitis, bronchitis and/or bronchiolitis, influenza, and other RTIs were longer. Physicians spent less time with older children between the ages of 10 and 19 (−0.31 minutes; 95% CI −0.45 to −0.15). Patients from the Midwest, the 1 geographic region where parents were less likely to give their provider a 5-star rating, spent less time with their providers (−0.19 minutes; 95% CI −0.36 to −0.03). Physicians from the Northeast spent more time with their patients than physicians from other regions. Pediatricians spent 1.04 minutes (95% CI 0.74 to 1.34) longer with patients than did nonpediatricians.

DISCUSSION

In this retrospective review of pediatric patients with RTIs treated via video-only DTC telemedicine, antibiotics were prescribed in more than half of the encounters, and receipt of an antibiotic correlated strongly with visit satisfaction. In fact, receipt of an antibiotic was the strongest single predictor of satisfaction, and a physician's antibiotic prescribing rate was highly correlated with their overall satisfaction ratings. Interestingly, parents were more satisfied when their children's care was provided by a pediatrician despite the fact that pediatricians prescribed fewer antibiotics, but among pediatricians, those who prescribed more antibiotics had higher satisfaction ratings. Visits at which antibiotics were prescribed tended to be shorter, presenting a second incentive for physicians to prescribe unnecessary antibiotics.

The findings of this study mirror the results of a similar study in adult DTC telemedicine.[4] In that study, prescribing rates were even higher, but the associations with satisfaction and visit length were similar. The comparatively lower prescription rates for children may represent parents' eagerness to avoid certain antibiotic side effects, a lower rate of comorbid conditions among children, or the impact of pediatricians' practices. Several other studies have observed a correlation between antibiotic prescribing in ambulatory practice and patient satisfaction.[11,12] Among general practitioners in England, antibiotic prescribing volume was a strong predictor of doctor satisfaction and practice satisfaction and the strongest predictor of overall satisfaction.[11] One explanation is that dissatisfaction arises from discordance between

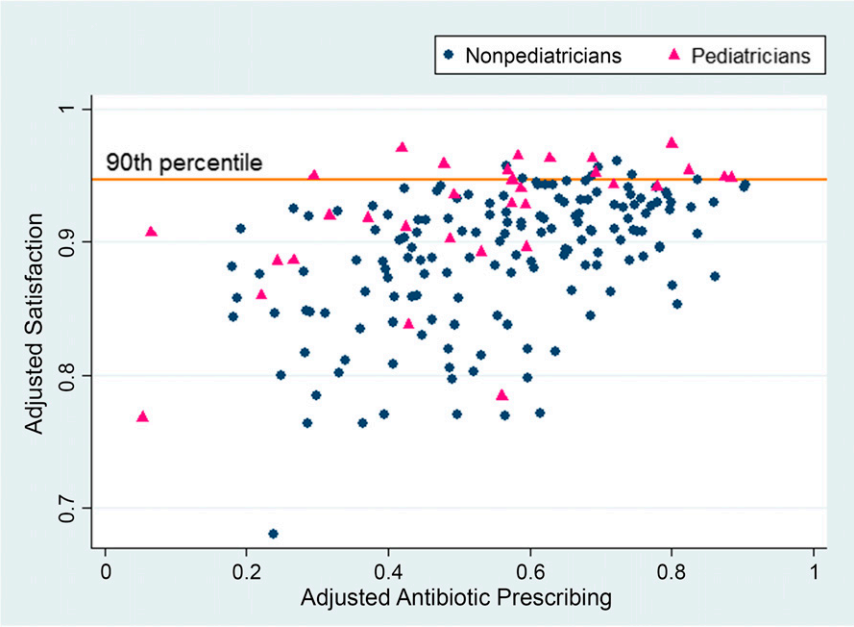

FIGURE 1
Scatterplot of individual physicians' adjusted satisfaction ratings and adjusted antibiotic prescribing rates (overall: $r = 0.45$ [$P < .001$]; nonpediatricians: $r = 0.47$ [$P < .001$]; pediatricians: $r = 0.55$ [$P < .001$]).

a patient's expectations and the physician's clinical judgment. This dissatisfaction may be mitigated when the patient and provider have an established relationship,[13] and patients are less likely to receive an antibiotic from their primary care physician. In particular, when parents suggest a diagnosis or express resistance to a viral diagnosis, physicians may perceive them as expecting an antibiotic. Such parents may actually be seeking reassurance that their children are not seriously ill or that seeking medical care was appropriate[14] and may be willing to partner with health care providers in the judicious use of antibiotics.[15] Comfort with this approach may require an existing relationship, which is unlikely during DTC telemedicine encounters. The high satisfaction scores that accompanied influenza cases, particularly those in which an antiviral was prescribed, suggest that patients are looking for definitive treatment, not necessarily an antibiotic per se.

The high rates of antibiotic prescribing for RTIs observed in pediatric telemedicine consults suggest a need for antimicrobial stewardship efforts because most RTIs require no antibiotics.[7] National outpatient data from ambulatory care visits indicate that antibiotic prescribing rates for children with RTIs are high: sinusitis (84.7%), otitis media (82.0%), pharyngitis (56.2%), and bronchitis and/or bronchiolitis (55.2%).[8] The prescribing rates observed among the pediatric telemedicine providers in this study were even higher: sinusitis (92.1%), otitis media (96.0%), pharyngitis (76.7%), and bronchitis and/or bronchiolitis (62.0%). Adherence to stringent criteria for making the diagnosis of RTIs, such as acute otitis media, acute bacterial sinusitis, and streptococcal pharyngitis, is essential to judicious antibiotic prescribing.[7] Although national guidelines provide these criteria,[16–18] fulfilling them during a video-only telemedicine consultation is challenging. In particular, the diagnosis of streptococcal pharyngitis requires microbiologic confirmation, and the diagnosis of acute otitis media requires otoscopic examination, neither of which was available through the video-only telemedicine platform used here. It is worth noting that the Centor criteria, a point system developed to assist in diagnosing streptococcal pharyngitis in adults, has been shown to be ineffective at predicting group A streptococcal culture results in children.[17,19,20] Although it is possible that diagnostic uncertainty would require physicians to under-prescribe antibiotics, instead referring patients to seek care via another setting (eg, urgent care), the observed high rates of antibiotic prescribing among telemedicine providers caring for children suggest otherwise.

The choice of antibiotic was also suboptimal. Whereas three-quarters of children received penicillin, 12% were treated with azithromycin, which is not recommended as first-line treatment of pediatric URIs when an antibiotic is indicated.[10] The AP of children receiving azithromycin was 46.5% for bronchitis and/or bronchiolitis, 9.4% for pharyngitis, 6.6% for sinusitis, and 5.7% for otitis media. Concerns with macrolide antibiotic use in pediatric RTIs include their broad spectrum of activity, disruption of the intestinal microbiome, and emerging resistance in *Streptococcus pneumoniae* and *Streptococcus pyogenes*.[16–18] In this regard, azithromycin is not recommended for treatment of otitis media or sinusitis and in streptococcal pharyngitis should be reserved for patients with penicillin allergy. Azithromycin was used more frequently in older children and in those with bronchitis who were treated with antibiotics. Because our data set did not contain information on antibiotic allergy, we cannot determine if history of penicillin allergy contributed to azithromycin use. Nonetheless, antimicrobial stewardship efforts may be indicated, especially for bronchitis and/or

TABLE 4 Differences in Encounter Length by Encounter Characteristics and Prescription Outcome (in Minutes)

	Estimate	95% CI
Prescription outcome		
Nothing	Reference	—
Antibiotic	−0.14	−0.27 to −0.01
Antiviral	−0.11	−0.35 to 0.13
Nonantibiotic	0.47	0.32 to 0.63
RTI diagnosis		
Pharyngitis	Reference	—
Sinusitis	0.17	0.05 to 0.28
Bronchitis and/or bronchiolitis	0.45	0.25 to 0.66
Otitis media	−0.21	−0.43 to 0.01
Influenza	0.39	0.11 to 0.67
Other RTI	0.62	0.48 to 0.75
Patient sex		
Female	Reference	—
Male	0.07	−0.01 to 0.15
Patient age, y		
0–2	Reference	—
3–9	−0.04	−0.20 to 0.11
10–19	−0.30	−0.46 to −0.15
Patient region		
Northeast	Reference	—
Midwest	−0.19	−0.36 to −0.03
South	−0.05	−0.21 to 0.11
West	0.06	−0.13 to 0.24
Physician specialty		
Nonpediatrics	Reference	—
Pediatrics	1.04	0.74 to 1.34
Physician region		
Northeast	Reference	—
Midwest	−1.68	−2.18 to −1.18
South	−1.29	−1.77 to −0.81
West	−1.45	−1.96 to −0.30

—, not applicable.

bronchiolitis, which in children is typically viral in origin.[21]

Given its limitations for making certain diagnoses, antibiotic prescribing should be substantially lower in telemedicine. Patients suspected of certain diagnoses should be referred to an urgent care center for appropriate testing. It is important to note that the term "telemedicine" encompasses a wide range of models, ranging from text-only electronic encounters to consultations, that incorporate novel technologies that might potentially include the capacity for diagnosing or ruling out problems (such as acute otitis media and streptococcal pharyngitis) by using tools that are potentially equivalent or better than those used for in-person care.

Our study has several additional limitations that impact our ability to fully understand antibiotic prescribing in this setting. An important question is to what extent telemedicine physicians adhered to specific national guidelines from professional societies when making an RTI diagnosis.[16–18] Unfortunately, our data set did not provide us with the ability to review charts to validate the appropriateness of prescribing practices. Among adult patients, we demonstrated coding bias, wherein physicians who prescribe more antibiotics are more likely to code URIs as conditions for which antibiotics may be reasonable (eg, sinusitis).[2] In this regard, it would be difficult to determine the appropriateness of antibiotic prescribing practices from diagnostic codes alone. Additional limitations include the use of data from only 1 company and the lack of follow-up data on clinical outcomes or adverse events related to antibiotic use. Finally, we do not have data on whether patients filled their prescriptions. In some situations, physicians may provide patients with a back-up antibiotic prescription to be used if symptoms do not improve in 48 to 72 hours.[22,23] It is possible that some prescriptions were meant as back-up prescriptions.

CONCLUSIONS

DTC telemedicine offers a convenient means to access timely care for minor medical conditions. In general, parents who sought care for their children's respiratory infection via video-only DTC telemedicine reported a high degree of encounter satisfaction. However, antibiotic prescribing rates were high, and satisfaction was influenced by whether antibiotics were prescribed. Pediatricians prescribed fewer antibiotics than did other providers, yet parents were happier when care was provided by a pediatrician. Understanding this finding could inform antibiotic stewardship efforts. Telemedicine providers should recognize limitations in the technology and strive to provide guideline-concordant care, making referrals to urgent care when appropriate.

ABBREVIATIONS

AP: adjusted proportion
CI: confidence interval
DTC: direct-to-consumer
OR: odds ratio
RTI: respiratory tract infection
URI: upper respiratory tract infection

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