BRIEF REPORT

Provider Knowledge, Attitudes, and Practices Regarding Bronchiolitis and Pneumonia Guidelines

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ABSTRACT

BACKGROUND AND OBJECTIVES: Practice guidelines have been published for bronchiolitis and community-acquired pneumonia (CAP), but little is known about pediatricians' knowledge of and attitudes toward these guidelines since their publication.

METHODS: We surveyed pediatric providers at 6 children's hospitals in the New York City area. Two vignettes, an infant with bronchiolitis and a child with CAP, were provided, and respondents were asked about management. Associations between respondent characteristics and their reported practices were examined using χ^2 and Fisher's exact tests. Associations between questions probing knowledge and attitude barriers relevant to guideline adherence and reported practices were examined using Cochran-Mantel-Haenszel relative risk estimates.

RESULTS: Of 283 respondents, 58% were trainees; 57% of attending physician respondents had finished training within 10 years. Overall, 76% and 45% of respondents reported they had read the bronchiolitis and CAP guidelines, respectively. For the bronchiolitis vignette, 40% reported ordering a chest radiograph (CXR), and 38% prescribed bronchodilators (neither recommended). For the CAP vignette, 38% prescribed ceftriaxone (not recommended). Study site, level of training, and practice locations were associated with nonrecommended practices. Site-adjusted knowledge and attitude barriers were used to identify that those who agreed CXRs were useful in managing bronchiolitis were more likely to order CXRs, and those who felt bronchodilators shortened length of stay were more likely to prescribe them. Concerns about ampicillin resistance and lack of confidence using local susceptibility patterns to guide prescribing were associated with ordering ceftriaxone.

CONCLUSIONS: Provider-level factors and knowledge gaps were associated with ordering nonrecommended treatments for bronchiolitis and CAP.

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Dr Gold conceptualized and designed the study, supervised data collection at all sites, conducted the initial analyses, drafted the initial manuscript, and approved the final manuscript as submitted; Drs Hametz, Sen, and Saiman helped conceptualize and design the study, interpreted the data, and reviewed and revised the final manuscript as submitted; Mr Maykowski conducted the data analyses, interpreted the data, and reviewed and revised the final manuscript as submitted; and Drs Leone, Lee, Gagliardo, Hymes, and Biller recruited subjects and collected data at their respective sites and reviewed and revised the final manuscript as submitted; and all authors approved the final manuscript as submitted.

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In 2006, the American Academy of Pediatrics (AAP) published guidelines for the management of bronchiolitis and revised them in 2014.[1,2] These guidelines specifically recommended not routinely ordering chest radiographs (CXRs), steroids, or bronchodilators. In 2011, the Infectious Diseases Society of America (IDSA) and the Pediatric Infectious Diseases Society (PIDS) published guidelines for the management of community-acquired pneumonia (CAP) in children. These guidelines recommended the use of narrow-spectrum antibiotics, such as penicillin or ampicillin, to target pneumococci, instead of broader-spectrum third-generation cephalosporin agents, such as ceftriaxone.

Despite multi-institutional[3] and multiple single-institution efforts[4] aimed at improving adherence to the guidelines, overuse of CXRs and bronchodilators in bronchiolitis remains common, and antibiotic prescribing for CAP remains highly varied.[5–10] Our objectives with this study were to (1) assess the knowledge, attitudes, and self-reported practices of pediatricians regarding the management of bronchiolitis and CAP and (2) identify barriers to guideline adherence that could inform the development of interventions used to improve adherence.

METHODS

Study Design, Sites, and Respondents

In this multicenter study, we used an anonymous online survey tool (www.surveymonkey.com) to assess knowledge of and attitudes toward the bronchiolitis and CAP guidelines and to assess self-reported management using case vignettes. Study sites included 6 tertiary-care children's hospitals in the New York City metropolitan area. Between February 2014 and June 2015, the survey was distributed electronically at each site for 1 month. Eligible respondents were physicians who frequently provided care for children who were hospitalized, including residents in pediatrics, family medicine, and pediatric emergency medicine (PEM); fellows in PEM, academic pediatrics, pediatric critical care medicine (PCCM), and pediatric infectious diseases (PIDs); and attending physicians in general pediatrics, hospital medicine, PEM, PCCM, and PID. Each site received local international board review approval.

Survey Instrument

The survey, developed by a team of pediatricians (hospitalists, an intensivist, and an infectious diseases specialist), aimed to assess respondents' knowledge and attitudes regarding the AAP guidelines for bronchiolitis and the IDSA and PIDS guidelines for CAP and to assess their self-reported practices by asking respondents to select various management options for 2 cases. Presented in each case vignette was a patient who was moderately ill who required hospitalization, without comorbid conditions or risk factors for severe disease. After the vignette description of an infant with bronchiolitis, respondents were asked if they would order bronchodilators, a CXR, steroids, and/or antibiotics (none of which are recommended for bronchiolitis). After the vignette description of a child with CAP, respondents were asked if they would prescribe ceftriaxone (not recommended) or ampicillin (recommended).

The survey was also used to assess potential barriers to adherence to the guidelines by using the knowledge, attitudes, and practice paradigm developed by Cabana et al.[11–13] Respondents' familiarity with the guidelines, agreement with specific recommendations, confidence in their ability to follow selected recommendations (self-efficacy), and perceptions of patients' benefits (outcome expectancy) were assessed. Both multiple choice format and Likert scales were employed in the survey. Respondent characteristics were collected.

The survey was pilot tested by physicians at local hospitals in several disciplines. Revisions were made to improve clarity and shorten the survey, which took 10 to 15 minutes to complete.

Statistical Analysis

Responses to Likert-scale questions were transformed into dichotomous responses because of small sample size (ie, "strongly agree" and "agree" became "agree;" "strongly disagree" and "disagree" became "disagree"). Survey responses that indicated ordering nonrecommended practices[2,7,11,14] were summarized by using frequencies and percentages for categorical variables. χ^2 and Fisher's exact tests were used to test for associations between respondents' characteristics, including study site and level of training, and ordering nonrecommended tests and therapies. Because respondents were asked to select all that apply, each practice location was analyzed as a binary variable (eg, respondents who practiced in an ICU versus those who did not).

To assess possible barriers to guideline adherence, we examined the association of responses to questions assessing knowledge, attitudes, and awareness of recommendations and ordering

TABLE 1 Overall Respondent and Attending Physician Characteristics, $N = 283$

Characteristic	*n* (%)
Site[a]	
1	84 (29.7)
2	47 (16.6)
3	48 (16.7)
4	39 (13.8)
5	37 (13.2)
6	28 (10.0)
Level of training[a]	
Trainee (resident or fellow)[b]	165 (58.3)
Attending physician	118 (41.7)
Years since attending physicians' training completed[c]	
0–5	37 (31.4)
6–10	30 (25.4)
11–20	29 (24.6)
≥21	22 (18.6)
Attending physicians' practice location[c,d]	
Inpatient floor(s)	67 (56.8)
ICU	35 (29.7)
Emergency department	29 (24.6)
Outpatient clinics	36 (30.5)

[a] Column percent of all 283 respondents.
[b] Trainees of the following disciplines are represented: residents in pediatrics ($n = 126$), family medicine ($n = 8$), and emergency medicine ($n = 9$); fellows in general pediatrics ($n = 4$), PEM ($n = 9$), PIDs ($n = 1$), and PCCM ($n = 8$).
[c] Column percent of 118 attending physicians only.
[d] More than 1 practice site could be selected.

nonrecommended practices using Cochran-Mantel-Haenszel relative risk estimates, adjusted by site, to characterize these bivariable relationships, while not introducing multiple comparisons nor necessitating adjustment for multiple factors simultaneously. All statistical analyses were conducted in SAS 9.4 (SAS Institute, Inc, Cary, NC).

RESULTS

A total of 283 respondents from the 6 sites completed the survey for an overall response rate of 28.2%. Respondent characteristics are described in Table 1. All 6 sites had pediatric hospitalists, trainees caring for pediatric patients, board-certified PEM providers, and PICUs.

Bronchiolitis

In all, 76% of respondents reported they had read the AAP guidelines for bronchiolitis. The guidelines were rated by 53% of respondents as "important/very important" in guiding management, whereas 97% rated their personal experience as "important/very important." Although 83% of respondents agreed with the guideline recommendation that CXRs were not useful, 40% reported they would "routinely" order a CXR for the infant described in the vignette. There were site differences for ordering a CXR, and attending physicians in practice >10 years were more likely to do so (Table 2). Although 94% of respondents agreed that bronchodilators do not shorten length of stay, 40% of respondents would order a bronchodilator for the infant in the vignettes.

Site-adjusted respondent knowledge and attitudes associated with ordering appropriate practices for the bronchiolitis vignette is presented in Table 3. Those who would order a CXR were more likely to agree it was useful in routine management than those who would not (34% vs 4%; $P < .0001$). The majority of respondents were confident that they knew when a CXR was indicated. However, 29% of respondents who reported they were confident and agreed that a CXR was not useful for the routine management of bronchiolitis nonetheless reported they would order a CXR for the infant in the vignette.

CAP

Overall, 45% of respondents reported that they had read the PIDS and/or IDSA guidelines for CAP. The majority cited national guidelines (95%) and/or their personal experience (94%) as "important/very important" in guiding management of CAP. Overall, 83% of respondents agreed with guideline recommendations that ampicillin provides adequate antimicrobial coverage for CAP. However, when ordering antibiotics for the child in the vignette, 60% prescribed ampicillin, 33% prescribed ceftriaxone, 5% prescribed both, and 2% prescribed another antimicrobial agent. Both study site and years since completion of training were associated with ordering ceftriaxone (Table 2).

Site-adjusted respondent knowledge and attitudes associated with ordering appropriate therapy for the child in the CAP vignette are presented in Table 4. Those who ordered ceftriaxone were less likely to be aware that it was not recommended

TABLE 2 Association of Respondent Characteristics and Ordering of Nonrecommended Diagnostics and Therapeutics for Bronchiolitis and for CAP

Characteristic	*n*	Order CXR for Bronchiolitis,[a] *n* (%)	*P*	Order Bronchodilators for Bronchiolitis,[a] *n* (%)	*P*	Order Ceftriaxone for CAP,[a] *n* (%)	*P*
Site	283	114 (40)	.0024	106 (38)	<.0001	106 (38)	<.0001
1	84	29 (35)		46 (55)		27 (32)	
2	47	21 (45)		9 (19)		8 (17)	
3	48	15 (31)		8 (17)		32 (67)	
4	39	18 (46)		14 (36)		4 (10)	
5	37	10 (27)		11 (30)		13 (35)	
6	28	21 (75)		18 (64)		22 (79)	
Level of training	283		.86[b]		.0065[b]		.90[b]
Trainees	165	60 (36)		62 (38)		60 (36)	
Attending	118	48 (41)		34 (29)		46 (39)	
Attending physicians	118						
Years since training completed			.0008[b]		.94[b]		.0236[b]
≤10	67	19 (28)		19 (28)		23 (34)	
≥11	51	29 (57)		15 (29)		23 (45)	
Practice location[c]							
Inpatient units	67	20 (30)	.0061	15 (22)	.08	25 (37)	.67
ICU	35	25 (71)	<.0001	7 (20)	.17	18 (51)	.07
Emergency department	29	12 (41)	.93	14 (48)	.0077	10 (35)	.57
Outpatient clinics	36	16 (44)	.58	11 (31)	.78	15 (42)	.69

[a] Row percent within strata.
[b] Adjusted by site.
[c] Analyzed as binary (ie, practices in an inpatient unit versus does not practice in an inpatient unit).

TABLE 3 Knowledge and Attitudes Regarding Management of Bronchiolitis and Adherence to AAP Guidelines for Bronchiolitis

Domain and/or Concepts Explored	Practice				RR_{CMH} (95% CI)[a]	*P*
	Order CXR: Yes, *n* (%) 114 (40.3)	Order CXR: No, *n* (%) 169 (59.2)	Order Bronchodilators: Yes, *n* (%) 106 (37.5)	Order Bronchodilators: No, *n* (%) 177 (62.5)		
Knowledge and/or agree bacterial superinfection frequent concern	18 (15.8)	15 (8.9)	—	—	1.34 (0.96–1.87)	.1225
Knowledge and/or agree CXR useful in routine management	39 (34.2)	7 (4.1)	—	—	4.24 (2.13–8.45)	<.0001
Self-efficacy and/or confident in identifying patients who benefit from CXR	92 (80.7)	141 (83.4)	—	—	0.89 (0.63–1.25)	.51
Knowledge and/or know bronchodilators should not be used routinely	—	—	95 (89.6)	174 (98.3)	0.49 (0.36–0.68)	.0018
Attitude and/or feel bronchodilators shorten length of stay	—	—	12 (11.3)	5 (2.8)	2.06 (0.96–4.37)	.0079
Self-efficacy and/or confident in ability to monitor response to bronchodilators	—	—	103 (97.2)	167 (94.4)	1.39 (0.51–3.78)	.48

CI, confidence interval; CMH, Cochran-Mantel-Haenszel; RR, relative risk; —, not applicable.
[a] Adjusted by site.

first-line therapy, more concerned about resistance to ampicillin, and less confident in their ability to use local resistance patterns to guide prescribing. However, 18% of respondents who were aware that ceftriaxone was not recommended first-line therapy, agreed that ampicillin provided adequate coverage for pneumococci and were confident in their ability to use local resistance patterns; nonetheless, they reported they would order ceftriaxone.

DISCUSSION

In this multicenter survey of pediatricians' knowledge, attitudes, and practices regarding clinical guidelines, we identified provider-level factors associated with self-reported ordering of nonrecommended tests and treatments to manage bronchiolitis and CAP. We also found discordance between some respondents' knowledge of and attitudes toward the guidelines with their self-reported practices for managing the cases described in the vignettes. It is suggested in these findings that the dissemination of guidelines and education may result in only modest improvements in guideline adherence, and other strategies to change behavior may be needed.

In considering potential strategies to promote behavior change, it is also suggested in our findings that reliance on personal experience, rather than reading guidelines, should be considered as a factor that is associated with inappropriate management. Although the vast majority (>95%) of respondents considered their personal experience important or very important in guiding their management of bronchiolitis and CAP, fewer had read the CAP (45%) or bronchiolitis (76%) guidelines, suggesting that lack of familiarity with guidelines and reliance on personal experience is associated with prescribing nonrecommended treatments.

Level of training was associated with ordering CXRs for bronchiolitis in that

TABLE 4 Knowledge and Attitudes Regarding Management of CAP and Adherence to AAP Guidelines for Bronchiolitis

Domain and/or Concept Explored	Antimicrobial Prescribed[a]		RR_{CMH} (95% CI)[b]	*P*
	Ampicillin, *n* (%) 170 (60.1)	Ceftriaxone, *n* (%) 93 (32.9)		
Knowledge and/or aware ceftriaxone is not recommended first-line therapy	166 (97.6)	47 (50.5)	0.13 (0.050–0.311)	<.0001
Knowledge and/or concerned about resistance to ampicillin	41 (24.1)	53 (57.0)	1.52 (1.222–1.900)	<.0001
Attitude that or considers ampicillin an inadequate therapy for CAP	3 (1.8)	38 (40.9)	8.08 (2.780–23.338)	<.0001
Self-efficacy and/or confident in ability to use local antibiotic resistance patterns to guide antibiotic prescribing	145 (85.3)	62 (66.7)	0.69 (0.511–0.930)	.0028
Self-efficacy and/or confident in ability to determine when to use broad-spectrum antibiotics	146 (85.9)	73 (78.5)	0.86 (0.665–1.116)	.21

CI, confidence interval; CMH, Cochran-Mantel-Haenszel; RR, relative risk.
[a] Thirteen respondents selected both ampicillin and ceftriaxone, and 7 selected neither agent. These 20 respondents were excluded from this analysis.
[b] Adjusted by site.

attending physicians who finished training >10 years ago were more likely to order a CXR. We speculate that older practitioners experience "clinical inertia," defined as failure to enact an appropriate care plan despite potential recognition of a recommended course of action.[15,16]

There are limitations to our findings. Although the response rate was not dissimilar from other electronic surveys of physicians, and no specific response bias was identified, the response rate was low, and this may skew our findings because a self-selecting group may have preferentially chosen to respond. In addition, the AAP revised the bronchiolitis guidelines in 2014, which was during the study period. We could not assess the impact of this revision. With respect to the specific recommendations assessed by the survey, in 2006, bronchodilators were not routinely recommended, although there was the option of a one-time trial, whereas in 2014, bronchodilators were not recommended.

With this multicenter survey-based study, we sought to examine physicians' knowledge of and agreement with national guidelines for bronchiolitis and CAP. We found a discordance between provider awareness and agreement with guidelines and self-reported provider practices. Authors of future studies and quality improvement programs should focus on interventions that promote behavior change.

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