Changing Antibiotic Prescribing in a Primary Care Network: The Roleof Readiness to Change and Group Dynamics in Success

Suratha Elango, MD, MSHP[1,2], **Julia E. Szymczak, PhD**[1], **Ian M. Bennett, MD, PhD**[3], **Rinad S. Beidas, PhD**[1], and **Rachel M. Werner, MD, PhD**[1,4]

[1]University of Pennsylvania, Philadelphia, PA

[2]Children's Hospital of Philadelphia, Philadelphia, PA

[3]University of Washington, Seattle, WA

[4]Crescenz VA Medical Center, Philadelphia, PA

Abstract

Overuse of broad-spectrum antibiotics in outpatient pediatrics remains a significant issue and there is limited evidence on how to effectively implement outpatient stewardship interventions. This study examines the relationship between readiness to change and modifiable factors affecting success of a primary care network antibiotic stewardship intervention. A survey designed to measure readiness to accept a health care innovation was administered to 209 clinicians. Practices were split in half into "high" versus "low" readiness to change. Semistructured qualitative interviews were conducted with 2 to 3 clinicians from 6 practices in each readiness group. High readiness practices trended toward greater improvements between years (8% to 26% vs 2% to 10% mean improvement). High readiness practice clinicians described more open communication, active group change process, and supportive underlying group cohesion. Low readiness practice clinicians functioned more independently and were influenced more by external forces but were developing group cohesion through the initiative. System-wide interventions should be appropriately tailored to different levels of readiness to change, specifically addressing group dynamics and their differing foci of influence.

Keywords

antibiotic stewardship; readiness to change; primary care; group dynamics

There is an urgent need to improve the use of antibiotics across clinical settings, especially in outpatient pediatrics where antibiotics are the most common prescription, with the majority written for acute respiratory tract infections (ARTIs).[1] Though overall antibiotic prescribing per child has fallen 25% in the past 20 years, the decreasing trend has stalled, and overuse of broad-spectrum antibiotics remains a significant issue.[2] Antibiotic stewardship, or interventions intended to reduce unnecessary and inappropriate antibiotic prescribing, are increasingly being implemented given growing recognition of antibiotic resistance as an emerging public health threat.[3] Identifying and successfully implementing novel interventions that effectively address the challenges unique to the outpatient setting are needed.[3]

However, implementing interventions to spur change in health care delivery has proven to be a significant challenge. Numerous contextual factors, such as provider attitudes and the system environment, determine the success of any given intervention in a local setting.[4] Previous work has suggested that one important factor is readiness to change.[5] Readiness to change (ie, both the motivation and efficacy of an organization and its members to make an agreed-upon specific change) integrates both individual (eg, attitudes, beliefs, skills) and organizational (eg, shared commitment, information technology infrastructure) factors.[6] Preliminary work suggests provider readiness to change may predict actual change,[7] but further elaboration of the factors that shape this relationship is needed. A better understanding of readiness to change can help organizations appropriately tailor policies and resources to more effectively align with their employees' values and create a more effective implementation environment for sustainable success.

This mixed-methods study of a hospital-affiliated network of pediatric primary care practices was conducted in 2015 while the network implemented an antibiotic stewardship intervention to reduce broad-spectrum antibiotic prescribing. The aim of the study was to examine the relationship between the readiness to change of each practice and the success of the intervention, as well as any potentially modifiable factors and external supports affecting readiness to change.

Methods

Setting and Participants

This study was conducted in the Children's Hospital of Philadelphia (CHOP) primary care network, which implemented an outpatient antibiotic stewardship quality improvement initiative across all of its 30 practices in 2015. This initiative builds on CHOP's previous efforts to decrease broad-spectrum antibiotic use in a small subset of CHOP practices, demonstrating a 20% decrease in broad-spectrum antibiotic prescribing.[8] Although this early initiative was successful in its goal, antibiotic prescribing rates reverted to previous levels once the intervention stopped.[9]

CHOP's primary care network contains 30 pediatric primary care sites (2–30 clinicians per practice) with a total of 209 clinicians (physicians and nurse practitioners). Clinicians in the network have been practicing on average 18 years (SD 10, range 0–50) in total, and on average 12 years (SD 8, range 0–40) at their current site. Two clinician groups each serve 3

distinct geographic locations, resulting in 26 distinct clinician practice groups. These include 3 primary academic and 27 community-based practices. These practices serve children of diverse racial and socioeconomic backgrounds in urban, suburban, and rural settings across southeastern Pennsylvania and New Jersey. The network has a mean practice volume of 26 595 visits per year, and 31% of children in the network receive coverage through Medicaid.

Intervention

The network undertook an outpatient antimicrobial stewardship program to promote prescribing of narrow-spectrum antibiotics for common pediatric ARTIs (acute otitis media, acute sinusitis, group A streptococcal pharyngitis, community-acquired pneumonia). In October and November 2014, 3 regional medical directors (RMDs), each covering 10 practices, visited each practice to introduce the initiative, provide updates regarding current prescribing guidelines for common ARTIs, and present practice-specific baseline antibiotic prescribing data regarding these guidelines. In December 2014, clinicians gained access to a real-time web-based audit and feedback dashboard, which consolidated antibiotic prescribing rates based on electronic health record data at the practice, provider, and patient levels. The first few months of the intervention were characterized by iterative feedback from clinicians to their appointed RMD about the accuracy of the reports and criteria, resulting in modifications to the inclusion and exclusion criteria. Monthly feedback reports were subsequently emailed to each clinician with a link to the electronic dashboard. Each site designated a practice lead and was provided patient education handouts and posters in January 2015. Finally, an electronic health record decision-support tool and alert were implemented in April 2015.

Study Design

A mixed-methods study of the practices was conducted during implementation of the intervention. First, a survey was administered to assess a practice's readiness to change for the intervention. Second, semistructured interviews were conducted with clinicians at practices that were purposively sampled to vary on readiness to change and antibiotic prescribing rates. The CHOP Institutional Review Board exempted the study.

Survey

The survey instrument was administered electronically to all clinicians using research electronic data capture (REDCap)[10] from February to March 2015. The survey was voluntary but contributed to receipt of Maintenance of Certification credits for participation in the quality improvement project. A link to the survey was distributed by email from a researcher and CHOP clinician (SE) and the respective RMD. An introductory paragraph informed respondents that individual responses would be kept confidential and aggregated by site. A reminder email was sent after 2 weeks, and practice managers also were enlisted to help recruit their clinicians at sites with <50% response rate. The overall response rate was 65% (136/209 clinicians).

The survey was adapted to specify and clarify references to the CHOP initiative from the Organizational Readiness to Change Assessment (ORCA) (see Supplemental Figure S1, available with the article online), a validated survey instrument assessing readiness to change

for an intervention in terms of 3 scales (evidence, context, and facilitation) and a total of 19 subscales.[11] Each item is measured on a 5-point Likert-type scale. The instrument was piloted with 2 CHOP clinicians, and further refined for clarity.

For the present study, the survey responses were scored as follows: on the Likert-type scale possible scores could range from 0 (*don't know*) and 1 (*strongly disagree*) to 5 (*strongly agree*). The 74 individual questions from the 19 subscales were summed for a total possible score of 370 for each clinician. Then an average score was calculated for each practice. The practices were ranked by average total score and then split at the median into "high" or "low" readiness to change practices.

Interviews

Six practices within each high and low readiness to change category were identified for the interviews. Within each category the research team selected a wide representation of 2014 pre intervention rates of appropriate antibiotic prescribing for the 4 ARTIs, as this was the primary outcome measure followed by the intervention. The team introduced this variation into the sample in order to investigate whether social and organizational features of these practices might contribute to the observed associations.

From May to August 2015, interview respondents at the 12 selected practices were recruited by emailing practice managers as well as each individual clinician asking if they would be interested in participating, and interviews were conducted until thematic saturation was reached at each practice (n = 31). Thematic saturation was assessed on an ongoing basis throughout the study in a collaborative manner by the research team. Participants were offered a $20 gift card. All interviews were conducted in person at each participating practice by a trained research assistant. All interviews were recorded, with permission.

A semistructured interview guide (see Supplemental Figure S2, available with the article online) was created that covered each portion of the Consolidated Framework for Implementation Research (CFIR)[4] (intervention characteristics, individual characteristics, inner setting, outer setting, and implementation process). Sections specifically reviewed participants' individual perceptions and reactions to the initiative activities; their group climate and activities around the initiative; and barriers and facilitators to antibiotic stewardship. Then, their most recent individual monthly feedback report was shown and their reactions discussed. Each respondent was asked the same set of questions from the interview guide, with the interviewer probing and redirecting the conversation to elicit more in-depth data or to clarify points as necessary.

Data Analysis

All interview recordings were transcribed and uploaded to NVivo 10.0 qualitative data analysis software (QSR International Pty Ltd, Melbourne, Australia) for management and analysis. The author (SE) and research assistants coded all interview transcripts using a qualitative content analysis approach.[12] First, they read through all transcripts in a process of open coding, recording the most salient themes in the interviews, with CFIR categories as a guide, to be further refined and used during the second stage of axial coding, where they began to generate descriptions of higher order patterns seen emerging in the data. After the

preliminary code list was developed, they reviewed all interview transcripts line by line to determine which codes fit the concepts suggested by the data.

Results

Quantitative Results

Practice Characteristics.—The mean ORCA survey score across the 26 practice groups was 284.6 (SD 24.9; range 241–347). The bottom 13 practice groups by median split, or low readiness to change practices, had a mean score of 264.8 (SD 14.4; range 241–284). The top 13 practice groups, or high readiness to change practices, had a mean score of 304.4 (SD 15.5; range 288–347). The 12 practices sampled for interviews represented a variety of geographies, sizes in terms of number of patients and clinicians (Table 1), and ranges of ARTI diagnosis rates (Table 2).

All practices sampled for interviews improved in their rates of appropriate antibiotic prescribing over the intervention period for all 4 conditions, with all except one above goal targets in 2015. The high readiness practices are noted to have a trend toward larger improvements between years (Table 3).

Qualitative Results

A total of 31 individuals were interviewed, including 26 physicians and 5 nurse practitioners, and were sampled from 6 high readiness and 6 low readiness practices. Illustrative quotes are displayed by strata in Table 4. In general, *all* providers described relatively positive attitudes toward antibiotic stewardship, the intervention, and strong central support infrastructure. The most notable distinguishing characteristics between the high and low readiness to change practices were with regard to the nature and quality of group dynamics including communication, process for change (ie, learning climate), and cohesion.

Group Communication With Regard to Feedback.—High readiness to change practice clinicians often were in regular contact with each other either because of the proximity of their desks, shared lunch hours, the small size of their practice, and/or interactions outside of work. Such shared experiences led to an increased closeness among each other and openness to feedback about their clinical practice (Quotations 1 and 2, Table 4).

Meanwhile low readiness to change practices described more limited general communication among their clinicians and also more independent practice styles (Quotations 3 and 4, Table 4). This seemed to lend itself to less candidness and willingness to discuss individual behaviors (Quotation 5, Table 4).

Group Process for Change: Proactive Versus Passive Effort to Improve.—The high readiness to change practices often took a hands-on, proactive approach as a *group* when it came to dealing with potential problems. One person's problem was seen as the entire group's problem, and in an environment with an apparent positive *learning climate*, there was a constant internal drive to be better, and a feeling that they could succeed

collectively. They generally embraced the initiative regardless of whether or not they had significant room for improvement. One clinician described his/her leadership redirecting the group to fall in line with group norms (Quotation 6, Table 4). They also actively made efforts to use the tools provided to improve their practice, often even looking for additional, larger ways to improve (Quotation 7, Table 4). Furthermore, these practices described coming together for multiple efforts independent of those initiated by the main hospital; for example, making their own handouts or having a practice blog.

The low readiness to change practices, on the other hand, described more passive engagement with the stewardship initiative, relying on the intervention mechanics to move their individual behaviors forward in a positive direction (Quotation 8, Table 4). They also attributed their motivation to the more external stimulus of peer pressure and accountability as the primary driver for any individual behavior change, although it was acknowledged that this had different levels of influence on different people (Quotation 9, Table 4). Perhaps as a result, they were noted to generally have mixed levels of engagement within their practice.

Group Cohesion: Preexisting Versus Developing.—Many clinicians described the initiative as helping to not only draw attention to antibiotic prescribing behaviors but also cultivating everyone to be "on the same page." Those from high readiness to change practices seemed to draw on a preexisting level of shared practice behavior as a source of strength as they addressed some of the challenges to antibiotic stewardship—patient/family pressures (Quotation 10, Table 4).

Meanwhile several from the low readiness to change and low prescribing practices described the behaviors of other providers as potentially causing challenges when different members of their practice prescribed different antibiotics for the same condition. However, they found it especially helpful that *through the initiative* individual prescribing habits were starting to align (Quotation 11and 12, Table 4).

Discussion

This study examined how practice-level readiness to change manifested itself in the implementation of an anti-biotic stewardship intervention and primarily found notable differences in the role that the group versus external context took on in influencing individual depth of engagement as well as motivation for behavior change. High readiness to change practices had strong and open intra-group communication, a positive learning climate characterized by a proactive and internally motivated *group* approach to change, and a cohesive group dynamic that reinforced their efforts. On the other hand, low readiness to change practices saw providers functioning more independently and, therefore, change efforts relied more on external influences and forces, but ultimately there were mixed and weaker levels of engagement. Though within a year all practices were able to meet the goal targets of narrow-spectrum antibiotic prescribing rates for ARTIs, the high readiness to change practices are noted to have trended toward more substantial improvements.

Organizational readiness is composed of 3 components: the organization's motivation to adopt an innovation, innovation-specific capacities, and general organizational capacities.[13]

It is important to note that there was overall affirming motivation for antibiotic stewardship in general, perhaps because of recent national efforts (the Centers for Disease Control and Prevention, and President Obama), and for the intervention, as it was fairly minimally intrusive. Furthermore, the innovation capacity was rather strong as the main hospital and central leadership committed resources and their efforts across the network to the success of the initiative. And so, it is not surprising that this study primarily found variation in terms of organizational capacities, or a practice's ability to implement *any* innovation. Supporting previous work,[7] the present study's quantitative prescribing data suggest that high readiness to change practices tend to have greater improvements, as indicated by their degree of increase in narrow-spectrum antibiotic prescribing rates.

This study also revealed how group dynamics shape organizational capacities,[14] and clarifies their influence in readiness to change. Much of the previous literature often emphasizes the importance of *either* the individual or group as the ultimate point of focus in implementing change.[15] The present study shows that *both* are important, and their degree of importance is dependent on their context. At the least, this study supports the benefits of tailoring implementation strategies to address the unique needs of implementation efforts.[16] In places where the group environment was not as strong, then the individual behavior is the primary point of change and external forces such as peer pressure have a strong influence. Meanwhile, in places where the group environment was strong, the group was the primary locus of change and they took on change efforts with ease when they saw room for improvement, often in ways that reinforced each other.

Interestingly low readiness practices also seemed to benefit from a level of group cohesion that was *created* through the intervention. Previous work has proposed that building organizational communication and relationships *between* colleagues can positively influence implementation.[17] Open communication, or more specifically communication characterized by psychological safety (ie, a shared belief held by members of a team that the team is safe for interpersonal risk taking), has been shown to facilitate team learning and performance. [18,19] Organizations characterized as learning organizations where employees eagerly engage in experimentation and risk taking without fear of failure have been shown to have enhanced implementation effectiveness.[20] Such behavior was present in this study's high readiness to change practices but lacking in the low readiness to change practices. Though the low readiness practices were more influenced by external forces in the short term, their mixed levels of engagement raise concerns about the potential for future sustainability, especially given previous work with antibiotic stewardship in this network.[9,21] It appears that they could benefit from support in developing their learning climate for both the intervention at hand as well as future endeavors. With the growing body of evidence supporting team dynamics for successful implementation as well as improvement efforts, potential tools include Team STEPPS as well as leadership coaching to foster inclusiveness, psychological safety, and engagement.[22,23] Future work is needed to see the impact of targeting such efforts on low readiness to change practices as well as on sustainability.

This study has several limitations. First, this intervention was characterized by a strong central infrastructure pushing the intervention forward at each site, which may not be generalizable in other implementation efforts. However, the practices represented a spectrum

of characteristics (eg, location, size), thus enhancing generalizability. Second, the survey (administered 2 months into the start of the intervention) and interviews (conducted 5–8 months into the intervention) were retrospective, capturing individuals after they had perhaps already adjusted to the intervention.

Conclusions

This mixed-methods study looked at the relationship between practice readiness to change for an antibiotic stewardship intervention and modifiable factors affecting its success. In this study, the level of readiness-to-change did trend toward the level of improvement, and group dynamics strongly influence readiness to change. Depending on the strength of the group atmosphere, individual behavior and change were differentially influenced by their group and external pressures. Though at times it may be easier to exert external incentives and guidelines across a system, concerns about sustainability have been raised, as the behavior change may not be as effectively internalized in weak group settings. This study suggests that it may be worth investing the time and resources into strengthening the learning climate and group dynamics in such settings for the intervention itself, as well as any future initiatives. Similarly, strong group settings may not need to focus as much on external pressures. Prospectively diagnosing readiness to change and the strength of group dynamics can help appropriately tailor supportive elements for an intervention.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

1. Hersh AL, Shapiro DJ, Pavia AT, Shah SS. Antibiotic prescribing in ambulatory pediatrics in the United States. Pediatrics 2011;128:1053–1061. [PubMed: 22065263]

2. Vaz LE, Kleinman KP, Raebel MA, et al. Recent trends in outpatient antibiotic use in children. Pediatrics 2014;133:375–385. [PubMed: 24488744]

3. Hyun DY, Hersh AL, Namtu K, et al. Antimicrobial stewardship in pediatrics: how every pediatrician can be a steward. JAMA Pediatr 2013;167:859–866. [PubMed: 23857121]

4. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci 2009;4:50. [PubMed: 19664226]

5. Weiner BJ, Lewis MA, Linnan LA. Using organization theory to understand the determinants of effective implementation of worksite health promotion programs. Health Educ Res 2009;24:292–305. [PubMed: 18469319]

6. Holt DT, Helfrich CD, Hall CG, Weiner BJ. Are you ready? How health professionals can comprehensively conceptualize readiness for change. J Gen Intern Med 2010;25(suppl 1): 50–55. [PubMed: 20077152]

7. Hagedorn H, Heideman PW. The relationship between baseline organizational readiness to change assessment subscale scores and implementation of hepatitis prevention services in substance use disorders treatment clinics: a case study. Implement Sci 2010;5:46. [PubMed: 20546584]

8. Gerber JS, Prasad PA, Fiks AG, et al. Effect of an outpatient antimicrobial stewardship intervention on broad-spectrum antibiotic prescribing by primary care pediatricians: a randomized trial. JAMA 2013;309:2345–2352. [PubMed: 23757082]

9. Gerber JS, Prasad PA, Fiks AG, et al. Durability of benefits of an outpatient antimicrobial stewardship intervention after discontinuation of audit and feedback. JAMA 2014:312:2569–2570. [PubMed: 25317759]

10. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009;42:377–381. [PubMed: 18929686]

11. Helfrich CD, Li YF, Sharp ND, Sales AE. Organizational readiness to change assessment (ORCA): development of an instrument based on the Promoting Action on Research in Health Services (PARIHS) framework. Implement Sci 2009;4:38. [PubMed: 19594942]

12. Mayring P Qualitative content analysis. Forum Qual Soc Res 2000;1(2):1–7.

13. Scaccia J, Cook B, Lamont A, Wandersman A, Beidas R. A practical implementation science heuristic for organizational readiness: r = mc2. J Community Psychol 2015;43:484–501. [PubMed: 26668443]

14. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Q 2004;82:581–629. [PubMed: 15595944]

15. Beidas RS, Marcus S, Aarons GA, et al. Predictors of community therapists' use of therapy techniques in a large public mental health system. JAMA Pediatr 2015;169: 374–382. [PubMed: 25686473]

16. Powell BJ, Beidas RS, Lewis CC, et al. Methods to improve the selection and tailoring of implementation strategies. J Behav Health Serv Res 2017;44:177–194. [PubMed: 26289563]

17. Safran DG, Miller W, Beckman H. Organizational dimensions of relationship-centered care: theory, evidence, and practice. J Gen Intern Med 2006;21(suppl 1): S9–S15.

18. Edmondson AC. Psychological safety and learning behavior in work teams. Adm Sci Q 1999;44:350–383.

19. Edmondson A, Bohmer R, Pisano G. Disrupted routines: team learning and new technology implementation in hospitals. Adm Sci Q 2001;46:685–716.

20. Klein KJ, Knight AP. Innovation implementation: overcoming the challenge. Curr Dir Psychol Sci 2005;14: 243–246.

21. Szymczak JE, Feemster KA, Zaoutis TE, Gerber JS. Pediatrician perceptions of an outpatient antimicrobial stewardship intervention. Infect Control Hosp Epidemiol 2014;35(suppl 3):S69–S78. [PubMed: 25222901]

22. King HB, Battles JB, Baker DP, et al. Team STEPPS: Team Strategies and Tools to Enhance Performance and Patient Safety Advances. In: Advances in Patient Safety: New Directions and Alternative Approaches Vol 3—Perform Tools. Rockville, MD: Agency for Healthcare Research and Quality; 2008:5–20.

23. Nembhard IM, Edmondson AC. Making it safe: the effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. J Organ Behav 2006;27:941–966.

Table 1.

2015 Practice Characteristics.

	High Readiness to Change Practices	Low Readiness to Change Practices
ORCA survey (n = 26)	304.4 (SD 15.5; range 288–347)	264.8 (SD 14.4; range 241–284)
Practices sampled for interviews		
Geography	2 rural, 3 suburban, 1 urban	2 rural, 2 suburban, 2 urban
Average total patients	7112 (SD 2748; range 2943–11 172)	10 468 (SD 7359; range 3643–24 279)
% Medicaid	21.2% (SD 9.1%; range 11% to 36%)	32.2% (SD 23.0%; range 13% to 76%)
No. clinicians	6 (SD 2.3; range 2–9)	10.7 (SD 9.8; range 3–30)
No. interviewed	2.4 (SD 0.9; range 1–3.5)	2.7 (SD 0.5; range 2–3)

Abbreviation: ORCA, Organizational Readiness to Change Assessment.

Table 2.

Total Diagnosis Rate (Total # Diagnosed/Total # Patients) of Practices for Common Pediatric Acute Respiratory Tract Infections.

		High Readiness to Change Practices	Low Readiness to Change Practices	P
2014	Otitis (SD)	8.1% (2.9%)	7.7% (3.5%)	.87
	Sinusitis (SD)	4.1% (2.2%)	2.8% (2.0%)	.32
	Pharyngitis (SD)	4.5% (1.5%)	5.3% (2.4%)	.51
	Pneumonia (SD)	0.7% (0.4%)	0.6% (0.2%)	.59
2015	Otitis (SD)	8.8% (3.6%)	7.6% (3.0%)	.56
	Sinusitis (SD)	4.0% (2.6%)	2.5% (2.1%)	.29
	Pharyngitis (SD)	3.7% (1.3%)	4.8% (2.0%)	.29
	Pneumonia (SD)	0.6% (0.2%)	0.5% (0.2%)	.38
% Change	Otitis (SD)	0.68% (1.6%)	−0.15% (1.1%)	.30
	Sinusitis (SD)	−0.12% (0.44%)	−0.35% (0.8%)	.55
	Pharyngitis (SD)	−0.82% (0.5%)	−0.48% (1.3%)	.57
	Pneumonia (SD)	−0.02% (0.2%)	−0.03% (0.1%)	.87

Table 3.

Narrow-Spectrum Antibiotic Prescribing Rate (# Appropriate Prescribing/Total # Diagnosed) of Practices for Common Pediatric Acute Respiratory Tract Infections.

		High Readiness to Change Practices	Low Readiness to Change Practices	P
2014	Otitis (SD)	84.3% (9.1%)	89% (7.5%)	.35
	Sinusitis (SD)	86.2% (16.5%)	89% (9.4%)	.72
	Pharyngitis (SD)	87.5% (19.0%)	95% (4.7%)	.37
	Pneumonia (SD)	68.2% (28.8%)	82% (15.6%)	.33
2015	Otitis (SD)	95% (1.5%)	92.3% (5.7%)	.30
	Sinusitis (SD)	97% (2.9%)	94.7% (4.6%)	.32
	Pharyngitis (SD)	95.8% (2.6%)	96.5% (3.3%)	.71
	Pneumonia (SD)	94.2% (6.0%)	92% (6.4%)	.56
% Change	Otitis (SD)	10.7% (8.4%)	3.3% (2.4%)	.07
	Sinusitis (SD)	10.8% (13.8%)	5.7% (7.3%)	.44
	Pharyngitis (SD)	8.3% (17.1%)	1.5% (1.8%)	.35
	Pneumonia (SD)	26% (25.3%)	9.7% (12.1%)	.18

Table 4.

Themes Identified in Interviews With Illustrative Quotes.

Theme	High Readiness to Change Practices	Low Readiness to Change Practices
Group communication with regard to feedback	(1) "I think we're also very collaborative here … we're very open to kind of taking advice from each other as well as feedback from even the nursing staff and things like that. I think people feel comfortable speaking up and saying their opinions about things and then kind of moving forward. So I think it's a pretty open culture here." (Participant 27)	(3) "We work really hard. And then we each have families and lives and kids or parents. And so—people only talk when they complain." (Participant 8)
	(2) "I don't know how the other practices run their [provider meetings]—how much physician communication they have, but we really sit down at least once a month and talk. But that exchange is really, I think, makes a big difference." (Participant 19)	(4) "But I think out here, people tend to do more of their own thing. … I think that some of the people … may be a little more apt to want to stick to what they were used to or what they typically like to prescribe." (Participant 11)
		(5) Interviewer: "And have you said anything to them bout that (incorrect prescribing)?" Interviewee: "Not really. I probably should, but I don't … I shouldn't keep quiet, but everybody has their patterns and they've been here much longer than I have. So who am I to go and tell them what they should and shouldn't do?" (Participant 18)
Group process for change—proactive versus passive effort to improve	(6) "I think there is some frank eye-rolling when [they] came out to present to us because my group was like, we already know this. We're so brilliant. We're so awesome. And I think leadership has helped be like, we still need to do this. Let's get our numbers better. … There's been other things in our office where our numbers aren't good, and we tackle it right away and have a meeting, and how can we do this and what can we do?" (Participant 6)	(8) "What processes (help)? It's just the close monitoring. Because it's something that we weren't thinking about at all. … So now we've got a process in place that watches things for us and keeps data for us, sends us reports, monitors things closely. So, it calls attention to it now, where we didn't have that attention before.… [It's] gonna hopefully push us more in that positive direction." (Participant 10)
	(7) "We have talked about it at a couple of meetings and … looking over our numbers together and seeing if one particular person may have had a lower percentage for that quarter, what had happened … if we're all kind of doing the same thing? … That kind of helps with system-based errors as well, if there's something in our EMR that isn't picking up or something else that may have been missed." (Participant 24)	(9) "Well, you're held accountable. Because you may like Omnicef a lot and wanna prescribe it because it's easier and it's—the parents don't complain. They like it, too. But if you have to be held accountable to all the other 10 people in your practice, that might deter some— [well] some people may not be deterred by that [but] I might be more apt because I'm newer. … And to the other practices … because now other people know what we're doing, and we know what they're doing, too." (Participant 11)
Group cohesion—preexisting versus developing	(10) "I try to explain to parents. Well, this is what I'm concerned about and this is the best medicine for this. And even if they say, well, we tried this 5 years ago, and it didn't work. I'll say … that if you asked everyone else here, that would be something else that they would say [and] we've been able to maybe convince some parents to use amoxicillin for things that maybe we would have had a challenge with before." (Participant 27)	(11) "I mean if that's always what they've gotten in the past, and you're someone they've never met, they can give you a real tough fight. … And that I think is the biggest barrier, is kind of convincing the families to do a more narrow spectrum. … But I think as we're all changing, that's made it easier and easier since hopefully we're not going to set up those precedents with new patients." (Participant 1)
		(12) "I think because we all come from different places. … I think sometimes … you develop a habit to prescribe something without even thinking about it. And it's helpful just to kind of regroup and be on the same page when we are prescribing antibiotics, so that families don't feel that one physician prescribes this if I ask them, while the other doesn't. That way we're all on the same page, and we're all doing the same thing and it's helpful." (Participant 14)