Impact of a Rapid Respiratory Panel Test on Patient Outcomes

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• ***Context.***—**Evolution of polymerase chain reaction testing for infectious pathogens has occurred concurrent with a focus on value-based medicine.**

Objective.—**To determine if implementation of the FilmArray rapid respiratory panel (BioFire Diagnostics, Salt Lake City, Utah) (hereafter RRP), with a shorter time to the test result and expanded panel, results in different outcomes for children admitted to the hospital with an acute respiratory tract illness.**

Design.—**Patient outcomes were compared before implementation of the RRP (November 1, 2011, to January 31, 2012) versus after implementation of the RRP (November 1, 2012, to January 31, 2013). The study included inpatients 3 months or older with an acute respiratory tract illness, most admitted through the emergency department. Testing before RRP implementation used batched polymerase chain reaction analysis for respiratory syncytial virus and influenza A and B, with additional testing for parainfluenza 1 through 3 in approximately 11% of patients and for human metapneumovirus in less than 1% of patients. The RRP tested for respiratory syncytial virus, influenza A and B, parainfluenza 1 through 4, human metapneumovirus, adenovirus, rhinovirus/enterovirus, and coronavirus NL62.**

Results.—**The pre-RRP group had 365 patients, and the post-RRP group had 771 patients. After RRP implementation, the mean time to the test result was shorter (383 minutes versus 1119 minutes, $P < .001$), and the percentage of patients with a result in the emergency department was greater (51.6% versus 13.4%, $P < .001$). There was no difference in whether antibiotics were prescribed, but the duration of antibiotic use was shorter after RRP implementation ($P = .003$) and was dependent on receiving test results within 4 hours. If the test result was positive, the inpatient length of stay ($P = .03$) and the time in isolation ($P = .03$) were decreased after RRP implementation compared with before RRP implementation.**

Conclusions.—**The RRP decreases the duration of antibiotic use, the length of inpatient stay, and the time in isolation.**

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The Institute of Medicine[1] has identified the need to develop a systems approach to health care delivery, to be a "continuously learning healthcare system." Having real-time access to knowledge provides the opportunity to deliver the best available evidence to guide clinical decisions. Outcomes research has been heralded as a necessary base on which to provide the best decision making. Laboratory medicine is, perhaps, the most analytical of the medical specialties, with a strong focus on technology and result reporting to provide data for clinical decision making. The type of testing offered by a laboratory must be taken in the context of patient outcomes and not as a sole reflection of the aspects of the test system.

Ramers et al[2] were among the first to identify the impact of a laboratory polymerase chain reaction (PCR) test on patient outcomes. They evaluated patient outcomes among children hospitalized at Children's Hospital of San Diego (San Diego, California) who had an enterovirus PCR test on cerebrospinal fluid performed at their hospital during a single calendar year. The study compared outcomes between patients who were enterovirus PCR positive and those who were enterovirus PCR negative. Fifty percent of the patients had enterovirus identified from the cerebrospinal fluid, and 70% had results available before discharge. Patients having a positive enterovirus PCR result before discharge had fewer ancillary tests (26% versus 72%) compared with patients having a negative enterovirus PCR result. Those with a positive enterovirus result also received intravenous antibiotics for less time (2.0 versus 3.5 days) and had shorter hospital stays (42 versus 71.5 hours).

The value of rapid detection of respiratory viruses was highlighted in an outcomes study[3] using a cytospin

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Dr Rogers serves on an advisory board for BioFire Diagnostics FilmArray. The Children's Healthcare of Atlanta microbiology laboratory, under the direction of Drs Jerris and Rogers, has provided samples for testing for the FilmArray gastrointestinal panel and received support from BioFire Diagnostics for a work-motion study. The other authors have no relevant financial interest in the products or companies described in this article.

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Table 1. Diagnoses of Patients in the Study Groups Before and After Rapid Respiratory Panel (RRP) Implementation		
Diagnosis	Pre-RRP, No. (%) (n = 365)	Post-RRP, No. (%) (n = 771)
Asthma	55 (15.1)	116 (15.1)
Bronchiolitis and RSV pneumonia	137 (37.5)	207 (26.9)
Fever	5 (1.2)	8 (1.0)
Infection of the upper respiratory tract	17 (4.7)	75 (9.7)
Major respiratory infection and inflammation	5 (1.4)	14 (1.8)
Other infections and parasitic diseases	4 (1.1)	2 (0.3)
Pneumonia not elsewhere classified	59 (16.2)	205 (26.6)
Pulmonary edema and respiratory failure	39 (10.7)	83 (0.8)
Respiratory diagnosis of NEC except signs	2 (0.6)	3 (0.4)
BPD and other chronic respiratory disease arising in perinatal period	19 (5.2)	13 (1.7)
Respiratory signs, symptoms, and minor diagnoses	11 (3.0)	13 (1.7)
Respiratory system diagnosis with ventilator support	4 (1.1)	5 (0.7)
Viral illness	8 (2.2)	27 (3.5)

Abbreviations: BPD, bronchopulmonary dysplasia; NEC, necrotizing enterocolitis; RSV, respiratory syncytial virus.

fluorescent antibody test compared with culture and other methods. The cytospin fluorescent antibody test decreased the time for identification of viral pathogens by 3 days. The authors stated that the "rapid reporting resulted in physicians having access to information sooner, enabling more appropriate treatment."[3(p2824)] The hospital length of stay (LOS) for patients with respiratory pathogens identified was decreased by 5 days using the cytospin fluorescent antibody technology, and the authors predicted hospital savings of $144 332 per year.

Since the article published in 2000 by Barenfanger et al,[3] marked improvements have been made in laboratory testing for respiratory pathogens. Most notable was the use of PCR amplification testing, which increases the sensitivity of viral detection and has the potential to improve diagnostic turnaround. Comparison of analytical aspects of the FilmArray rapid respiratory panel (BioFire Diagnostics, Salt Lake City, Utah) (hereafter RRP) with similar tests for respiratory pathogens has been reported by several authors, and the RRP has been noted for its accuracy, expanded panel, and short test turnaround time.[4–6]

Xu et al[7] reported the impact of the RRP on clinical outcomes in children seen in the emergency department (ED) and tested for influenza. Providing a test result for influenza A and B, which is part of the panel, within 1½ hours using the RRP resulted in 81% of patients diagnosed as having influenza being given oseltamivir before discharge or within 3 hours of discharge from the ED. They also estimated saving 900 hours of ED time because of the rapid turnaround of results.

In 2012, the Children's Healthcare of Atlanta (Atlanta, Georgia) (hereafter Children's) laboratory began offering an expanded multiplex PCR test on the RRP platform with a potential turnaround time of 1½ hours from the time of receipt of the specimen, replacing a limited PCR panel offered before that time, which was run once a day, 7 days a week, during the peak of respiratory virus season. The RRP simplifies processing, allowing the test to be performed by laboratory staff 24 hours a day, 7 days a week. This test offers the detection of respiratory syncytial virus (RSV), influenza A and B, rhinovirus/enterovirus, parainfluenza 1 through 4, human metapneumovirus, adenovirus, and coronavirus NL62.

The use of the new panel resulted in an improved turnaround time and a broadened panel of pathogens. We evaluated herein whether there was an association between patient outcomes and test method, comparing outcomes before and after RRP implementation.

MATERIALS AND METHODS

This was a retrospective analysis of laboratory and outcome data for patients with an uncomplicated acute respiratory tract illness admitted to the hospital who were tested for respiratory pathogens during the peak of respiratory virus season at Children's. One group included patients tested from November 1, 2011, to January 31, 2012 (pre-RRP), and another group included patients tested from November 1, 2012, to January 31, 2013 (post-RRP). To enrich for patients with an acute respiratory tract illness, we limited our data set to patients who were aged 3 months to 21 years and who had either a respiratory panel collected in the ED and then were admitted to the hospital or who were tested for respiratory pathogens after admission to the hospital. The study group was further limited to patients who were discharged within 7 days of admission to enrich for those with an acute episode and who had a diagnosis code associated with a respiratory illness. Diagnosis related groups (DRGs) included in the samples studied are listed in Table 1. Subjects with significant comorbidities such as malignancies and underlying neurologic disorders were also excluded. If there was more than one sample collected on a patient, only the first test result was used for the analysis. Patients with coinfections were also excluded.

Pre-RRP Testing

The patients in the pre-RRP group were tested according to physician orders using PCR analysis of nasopharyngeal samples collected on flocked nasal swabs (Healthlink, Murrieta, California). The basic testing panel consisted of influenza A, influenza B, and RSV (Focus Diagnostics, Cypress, California). Eleven percent of patients were also tested for parainfluenza 1 through 3 (Hologic Gen-Probe [Prodesse], San Diego, California), and less than 1% of patients were also tested for human metapneumovirus (Hologic Gen-Probe [Prodesse]). Testing was performed in the Children's laboratory 7 days a week, with daily results available by 1 PM.

Post-RRP Testing

Patient samples in the post-RRP group were collected in the same manner as in the pre-RRP group. The RRP included influenza A, influenza B, RSV, rhinovirus/enterovirus, adenovirus, coronavirus NL62, human metapneumovirus, and parainfluenza 1 through 4. Although *Mycoplasma pneumoniae*, *Bordetalla pertussis*, and *Chlamydophila pneumoniae* were also tested for by the RRP, data for the use in the detection of these organisms had not been validated internally, and results were not made available to the ordering physician. Thus, results for these bacterial pathogens are excluded from the analysis. These data were collected during the early phases of implementing the RRP, with an intention to perform testing as soon as possible after receipt of the specimen but

Table 2. Demographic Comparison of the Study Groups Before and After Rapid Respiratory Panel (RRP) Implementation

Variable	Pre-RRP (n = 365)	Post-RRP (n = 771)
Sex, No. (%)		
Male	203 (55.6)	445 (57.7)
Female	162 (44.4)	326 (42.3)
Race/ethnicity, No. (%)[a]		
White/Hispanic	182 (49.9)	369 (48.1)
Black	135 (37.1)	300 (39.1)
Asian	6 (1.7)	27 (3.5)
Other	7 (1.9)	6 (0.8)
Unknown/declined	34 (9.3)	65 (8.5)
Age, mean (SD), y	3.1 (3.3)	3.9 (4.3)

[a] Some information was unavailable.

Table 3. Results of Rapid Respiratory Panel (RRP) Testing

Variable	Pre-RRP (n = 365)	Post-RRP (n = 771)
Positive result, No. (%)	216 (59.8)	597 (77.9)
Organism	**No. (% of Positive)**	**No. (% of Positive)**
Respiratory syncytial virus	213 (98.6)	289 (48.4)
Influenza A	0	82 (13.7)
Influenza B	0	10 (1.6)
Parainfluenza 1–3	3 (1.4)	21 (3.5)
Parainfluenza 4	Not performed	1 (0.002)
Human metapneumovirus	0	57 (9.6)
Adenovirus	Not performed	4 (0.7)
Rhinovirus/enterovirus	Not performed	126 (21.1)
Coronavirus NL63	Not performed	7 (1.2)

not on all shifts. Georgia state law requires medical technologists to perform all tests in the laboratory, and there were not medical technologists staffing all shifts when the panel was implemented.

The pre-RRP group and the post-RRP group were compared, as well as intragroup comparisons within the post-RRP group. Outcomes assessed were the time to the reported test result, whether the test result was available in the ED before admission, the LOS in the ED before admission, the LOS in the hospital, the antibiotics prescribed, the duration of antibiotic use, and the time in isolation following admission.

Statistical analyses were conducted using STATA 12 (StataCorp LP, College Station, Texas). Tests for skew/kurtosis, diagnostic plots, multicollinearity, and the correlation between independent and dependent variables were conducted as a first step to determining the reliability of the analysis. After systematic removal of data outliers, no additional data transformations were required. Next, inferential statistics, including Student *t* tests and Pearson χ^2 tests, were performed to evaluate the differences in clinical outcomes between the samples before and after RRP implementation. Last, a series of multivariate logistic and linear regression models were run to determine the impact of RRP implementation on clinical outcomes, while controlling for relevant demographic factors such as sex, race/ethnicity, and age.

RESULTS

Nine hundred seventy-two samples were tested for respiratory pathogens before RRP implementation between November 1, 2011, and January 31, 2012, and 2473 samples were tested for respiratory pathogens after RRP implementation between November 1, 2012, and January 31, 2013. After excluding 607 pre-RRP patients and 1702 post-RRP patients who did not meet inclusion criteria, 365 patients from the pre-RRP era and 771 patients from the post-RRP era had DRGs consistent with hospitalization for an acute respiratory tract illness. These diagnoses, including frequency, are listed in Table 1. Because there were large numbers of patients excluded from the analysis, a detailed explanation of exclusion criteria is given.

Children's is a tertiary referral center and cares for patients with serious illnesses such as different types of cancer, various transplants, acute and chronic neurologic illnesses, and other patients with illnesses that require long-term care. The long-term care involves both inpatient and ED services for any acute deterioration in their conditions, which includes acute febrile and respiratory illnesses that could be due to infections. This group of patients with chronic illnesses, when admitted, had extended LOS, and their management included antibiotics as part of their treatment protocols. A systematic review of the DRGs of patients who had samples collected for respiratory pathogen testing was undertaken along with care providers (pediatricians), and it was decided to exclude the patients with the following diagnoses or disease categories: patient with transplants, patients with tracheostomy and similar conditions, and patients with chronic malignant, neurologic, hematologic, and other systemic conditions such as cardiac transplant, acute myeloid leukemia, cystic fibrosis, and sickle cell disease. A review of patient medical records with the DRG pulmonary edema and respiratory failure was found to identify patients with acute respiratory tract infections, and these patients were included in the study group. Furthermore, as per the treatment protocol at Children's, all infants younger than 3 months with acute respiratory tract illnesses are given antibiotics. Therefore, to enrich the study population for patients with an acute respiratory tract illness who were not treated per protocol, 140 DRGs were excluded, and we limited our data set to patients who were aged 3 months to 21 years, had a respiratory panel collected in the ED, and then were admitted to the hospital or who were tested for respiratory pathogens after admission to the hospital. The study group was further limited to patients who were discharged within 7 days of admission to precisely account for those with an acute episode, which resulted in the exclusion of a significant population of inpatients from the study group.

The study groups did not differ in the distribution of sex or race/ethnicity (Table 2). The mean age of 3.1 years (range, 4 months to 21 years) in the pre-RRP group was younger than the mean age of 3.9 years (range, 4 months to 21 years) in the post-RRP group ($P = .01$). The control variables (demographics) had no impact on subsequent models run; therefore, simple regression models were used for final analysis.

Two-hundred sixteen results (59.8%) were positive in the pre-RRP group, while 597 results (77.9%) were positive in the post-RRP group ($P < .001$) (Table 3). The virus detected most commonly was RSV both before and after RRP implementation. However, influenza A was found in 82 positive post-RRP samples (13.7%), while the virus was absent from positive pre-RRP samples. Viruses detected in the post-RRP group that were not tested for in the pre-RRP group include rhinovirus/enterovirus (126 [21.1%]), coronavirus NL62 (7 [1.2%]), and adenovirus (4 [0.7%]). Parainfluenza 1 through 3 were tested for in both groups, with 3 positive samples (1.4%) in the pre-RRP group compared with 21 positive samples (2.7%) in the post-RRP group. Parainfluenza 4 was only tested for in the post-RRP

Table 4. Outcomes Before and After Rapid Respiratory Panel (RRP) Implementation Regardless of Whether the Test Result Was Positive or Negative

Variable	Pre-RRP (n = 365)	Post-RRP (n = 771)	*P* Value
Time to test result, mean (SD), min	1119 (492)	383 (293)	<.001
PCR results received in ED before admission, No. (%)	49 (13.4)	398 (51.6)	<.001
Antibiotic prescribed, No. (%)	268 (73.4)	555 (72.0)	.61
Antibiotic use, mean (SD), d	3.2 (1.6)	2.8 (1.6)	.003
Inpatient LOS, mean (SD), d	3.4 (1.7)	3.2 (1.6)	.16
ED LOS, mean (SD), min	256 (97)	282 (115)	.002
Time in isolation, mean (SD), h	73 (41)	70 (38)	.27

Abbreviations: ED, emergency department; LOS, length of stay; PCR, polymerase chain reaction.

group and was identified in one patient (0.002%). Human metapneumovirus was tested for in less than 1% of samples in the pre-RRP group, and all were negative. After RRP implementation, the number of samples positive for human metapneumovirus was 57 (9.5%).

Outcome measures were assessed between various groups in the data set. Groups compared were (1) those tested before and after RRP implementation regardless of whether the test result was positive or negative, (2) those tested before and after RRP implementation based on positive or negative result, and (3) those tested after RRP implementation only.

Pre-RRP and Post-RRP Groups Regardless of Whether the Test Result Was Positive or Negative

The mean time to the test result was 1119 minutes (range, 250–3705 minutes) in the pre-RRP group compared with 383 minutes (range, 72–3143 minutes) in the post-RRP group ($P < .001$) (Table 4). The LOS in the ED increased by 26 minutes in the post-RRP group ($P = .002$), and the percentage of patients who received PCR results in the ED before admission increased from 13.4% (n = 49) in the pre-RRP group to 51.6% (n = 398) in the post-RRP group ($P < .001$). The number of patients receiving antibiotics and the inpatient LOS did not differ in the 2 groups. However, the duration of antibiotic use decreased for patients in the post-RRP group by 0.4 day ($P = .003$). There were no deaths or admissions to the ICU in either group.

The analysis above was repeated with patients who were positive only for RSV, which provides a homogeneous population to analyze with respect to the respiratory pathogen and, presumably, illness. Results were similar, with the post-RRP group showing a shorter test turnaround time ($P < .001$), more patients with a result in the ED ($P < .001$), a longer ED stay ($P = .01$), and a decreased duration of antibiotic use by 0.4 day ($P = .02$).

Pre-RRP and Post-RRP Groups, With Analysis of Patients Based on Positive or Negative Result

Table 5 compares the pre-RRP and post-RRP groups in light of whether the test result was negative or positive. The decreased time to the test result, the increase in the percentage of patients receiving PCR results before admission, and the increased ED LOS remained significant regardless of the viral result being positive or negative. The inpatient LOS was shorter for the group with a positive viral test result following implementation of the RRP (3.5 days pre-RRP versus 3.2 days post-RRP, $P = .03$). In comparison, there was no difference in the inpatient LOS for patients with a negative result regardless of whether the test was before or after RRP implementation ($P = .88$). In addition, patients with a positive viral test result in the post-RRP group were prescribed antibiotics for less time (3.2 days pre-RRP versus 2.7 days post-RRP, $P < .001$) and were in isolation for a shorter period (82 hours pre-RRP versus 75 hours post-RRP, $P = .03$) than patients tested before RRP implementation. These differences were not seen with patients who had a negative result. Because of the possibility that the absence of influenza before RRP implementation could confound the analysis, we performed a subanalysis that removed patients with influenza. The results were similar. Patients who were positive for viruses other than influenza before and after RRP implementation showed significantly decreased time to the test result, more PCR results received in the ED, and shorter duration of antibiotic use compared with patients who were viral negative. The inpatient LOS and the time in isolation were both decreased in patients having a positive result compared with patients having a negative result, but statistical significance was not maintained.

Post-RRP Group, With Analysis Based on the Time to a Positive Test Result

Given that the test turnaround time was variable in the post-RRP group, the inpatient LOS and the duration of

Table 5. Outcomes Before and After Rapid Respiratory Panel (RRP) Implementation Based on Whether the Test Result Was Positive or Negative

Variable	Viral Negative			Viral Positive		
	Pre-RRP (n = 145)	Post-RRP (n = 169)	*P* Value	Pre-RRP (n = 216)	Post-RRP (n = 597)	*P* Value
Time to test result, mean (SD), min	1129 (511)	377 (275)	<.001	1113 (482)	385 (298)	<.001
PCR results received in ED before admission, No. (%)	26 (17.9)	89 (52.7)	<.001	23 (10.7)	309 (51.8)	<.001
ED LOS, mean (SD), min	248 (232)	277 (122)	.03	262 (98)	284 (113)	.02
Antibiotic prescribed, No. (%)	109 (75.2)	136 (80.5)	.26	157 (72.7)	416 (69.7)	.41
Antibiotic use, mean (SD), d	3.1 (1.6)	3.1 (1.7)	.99	3.2 (1.6)	2.7 (1.5)	<.001
Inpatient LOS, mean (SD), d	3.2 (1.6)	3.2 (1.6)	.88	3.5 (1.8)	3.2 (1.6)	.03
Time in isolation, mean (SD), h	60 (36)	43 (36)	.13	82 (43)	74 (38)	.03

Abbreviations: ED, emergency department; LOS, length of stay; PCR, polymerase chain reaction.

Table 6. Length of Stay (LOS) and Antibiotic Use Based on the Time (<4 Hours Versus >6 Hours) From Receipt of the Sample in the Laboratory to the Rapid Respiratory Panel Polymerase Chain Reaction Test Result

Variable	<4 Hours			>6 Hours		
	Negative (n = 75)	Positive (n = 272)	*P* Value	Negative (n =209)	Positive (n = 469)	*P* Value
Inpatient LOS, mean (SD), d	3.0 (1.6)	3.1 (1.6)	.65	3.2 (1.4)	3.3 (1.6)	.57
Antibiotic use, mean (SD), d	3.2 (1.9)	2.7 (1.4)	.04	3.0 (1.4)	2.8 (1.7)	.47

antibiotic use were also evaluated based on the length of time it took to provide a test result. Patients having the respiratory panel results reported in less than 4 hours were compared with patients having the respiratory panel results reported in greater than 6 hours (Table 6). The inpatient LOS did not change when the test result was reported at less than 4 hours versus at greater than 6 hours. However, patients who had a positive result reported within 4 hours received antibiotics for a half-day less than patients who had a negative result. If the test result was received in greater than 6 hours, this difference in the duration of antibiotic use between patients positive versus negative for the viral respiratory panel was not seen.

Financial Analysis

The estimated savings in the LOS and antibiotic use was calculated. These calculations were based on the true cost of either the antibiotic or hospital LOS and were not related to billing or reimbursement because this varies largely between institutions. A comparison of the patients who were viral positive after RRP implementation versus the patients who were viral positive before RRP implementation identified a decreased LOS by about a quarter of a day and decreased antibiotics administered for approximately a half-day in the post-RRP group. This equates to savings of $231 in hospital costs and $17 in antibiotic use per patient. Comparing the RRP with the Focus Diagnostics, Inc Flu A/B and RSV Kit (Cypress, California), the cost of the testing between the pre-RRP and post-RRP samples increased by $18 per test. If the Focus Diagnostics, Inc Flu A/B and RSV Kit was run along with the Hologic Gen-Probe (Prodesse) parainfluenza 1 through 3 and human metapneumovirus, the cost of the testing using the RRP was $178 less per sample.

COMMENT

The model for health care reimbursement in the United States is changing, with increased focus on a value-based delivery model rather than a volume-based model.[8] The Institute of Medicine[1] made 10 recommendations to design a path toward continuously learning health care in America, identifying essentials to become an environment focused on efficient, patient-centered care. Our retrospective study was designed to ask whether implementation of a new test for respiratory pathogens, which expands the number of viruses detected and decreases the length of time to the test result, has an impact on patient outcomes. Our study demonstrated that implementation of the RRP impacts outcomes for patients with a positive test result. Specifically, patients with viral pathogens detected by the RRP had earlier discontinuation of antibiotics, decreased LOS, and reduced time in isolation compared with patients tested the prior year with a viral panel run once a day and reporting fewer pathogens.

Hersh et al[9] reported antibiotic use in 70% of children seen in pediatricians' offices with an upper respiratory tract infection and recommended that guidelines be developed to promote the judicious use of antibiotics based on accurate diagnosis. Our study showed that identifying viral pathogens within 4 hours of receipt of the sample in the laboratory decreases the duration of antibiotic use in children hospitalized for an acute respiratory tract illness. A decrease in the duration of antibiotic use was not identified in the group of infants and children who received their test results after 6 hours, indicating that in our population it was necessary for a rapid test result for the physician to act on the result in a measurable way. During the study years, there was no protocol directing antibiotic use in infants and children 3 months or older with an acute respiratory tract illness, so the data reflect the value of the rapid result, with an expanded panel of pathogens, in a setting without a defined protocol. It is unclear if adoption of a standardized treatment protocol would strengthen the association of the findings in the study with a rapid result.

Inpatient LOS was favorably impacted after RRP implementation compared with before RRP implementation, but this difference was seen only when comparing patients with a positive test result. Patients with a negative result had no difference in the LOS, while patients with a positive result were discharged about 6 hours earlier when using the RRP. The reason for this is not clear. One possibility is that, because a viral pathogen was identified in a shorter amount of time after RRP implementation, the caregivers were more comfortable discharging patients with a specific diagnosis based on identification of a viral pathogen compared with patients without a virus identified. Another possibility relates to the difference in influenza pathogens. The year before implementation of the RRP, there were no children with influenza in our study. In the group of excluded patients, only 2 had influenza A and none had influenza B. This was due to an extensive immunization campaign in the Atlanta area following pandemic flu the previous year. The year the RRP was instituted, influenza A and B comprised approximately 17% of the positive results. It is possible that these represented the children discharged earlier following treatment for influenza. We tried to address the impact the difference in cases with influenza had by performing the same analysis with removal of the patients who were positive for influenza. All results were the same as in the entire group, with the exception that statistical significance was not achieved for the LOS and the time in isolation, although both trended downward in the post-RRP group.

The length of time in isolation was also different among patients with a positive result in the pre-RRP group versus the post-RRP group. It was outside of the scope of this study to identify the type of isolation and, therefore, the impact on the patient outcomes. One other difference in the groups before and after RRP implementation was the length of time in the ED, but this difference occurred regardless of whether the test result was positive or negative. The post-RRP group

had a mean increase in the length of time in the ED. It is possible that clinicians were waiting for the result before admission to the hospital. It is equally possible that the patient volumes after RRP implementation were sufficiently higher than in the previous year, resulting in longer wait times in the ED before admission.

Because our study was retrospective, it is an evaluation of how implementation of a test with improved turnaround and broader diagnostic capacity affects patient care. Several limitations exist. The first is the number of patients excluded from the analysis. We chose to specifically limit the study population to children with an acute respiratory tract illness admitted to the hospital who were not on a predefined protocol. Because antibiotics are routinely administered to infants younger than 3 months with symptoms of acute respiratory tract infections and because those with significant comorbidities were outliers, they were excluded from the analysis. Owing to the patient population seen in our ED, this resulted in a large number of exclusions. However, these exclusions, which were made by assessment of diagnosis codes and focused medical record review, allowed as homogeneous a population as possible to assess the impact of a change in testing. In addition, the test was performed in the laboratory at times when staffing was available, which resulted in variability in the time to the test result and the ability to assess whether there was any difference in patient care based on the time to a test result. However, these variables afforded the opportunity for assessment of impact related to a change in test method.

In summary, the RRP impacted patient care, resulting in less antibiotic use and shorter time in the hospital following admission. Further refinement to include standardized testing 24 hours a day, 7 days a week, to ensure less than a 2-hour turnaround time and the development of practice guidelines based on the results will be next steps to ensure that this test is used to its fullest potential.

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