

Study of the Utility of Respiratory Pathogen panel testing to enhance Antimicrobial Stewardship in pediatric patients with suspected lower respiratory tract infections: a retrospective chart review (SURPASS)

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Introduction

- Multiplex respiratory pathogen panel (RPP) testing provides the ability to simultaneously detect multiple viral and bacterial pathogens, and its implementation was expected to reduce antimicrobial and hospital resource use.
- Introduced in Vancouver Island Health Authority (VIHA) in Dec 2015.
- Use was limited to critically ill patients, inpatients from whom bronchoscopy samples were obtained, and inpatients less than 5 years old.
- Unnecessary antimicrobial usage in children can lead to adverse drug reactions, increased bacterial resistance and potentially altered immune system maturation.^{1,2}
- Antibiotics are the most frequently prescribed medications in children; however, past studies have shown that viral infections cause upwards of 66% of acute respiratory infections in children that are hospitalized, particularly in those under 5 years of age.^{3,4,5,6}
- Clinically, it can be difficult to distinguish between a bacterial and viral lower respiratory tract infection (LRTI), and an accurate diagnosis plays an important role in effective treatment, use of hospital resources, and prediction of disease course.⁷
- Currently available literature on RPP use in pediatric patients provides mixed results on its impact on antimicrobial and hospital resource use, which is something we wanted to further evaluate.

Study Objectives

- To evaluate the effect of a multiplex RPP on antimicrobial prescribing in pediatric inpatients with suspected LRTI.
- To assess differences in the use of hospital resources since the implementation of multiplex RPP testing.

Methods

Design

- Retrospective chart review
- Multi-center: all sites in VIHA

Population:

- **Group 1 (Intervention group):** patients tested with RPP between Dec 1st, 2016 and Jan 19th, 2017
- **Group 2 (Control group):** patients tested for influenza & RSV without the use of RPP between Dec 1st, 2014 and Mar 31st, 2015

Inclusion Criteria (both of the following)

- Inpatients at hospitals throughout VIHA
- Less than 5 years of age OR admitted to pediatric intensive care unit (PICU)

Exclusion Criteria (any of the following)

- Greater than 18 years of age
- Neonates (less than one month of age)
- Patients who died during LRTI admission

Statistical Methods

- T-test for equality of means (primary outcome)
- Normal distribution 95% confidence intervals (secondary outcomes)
- Non-parametric 95% confidence interval for median (secondary outcome)

Outcome Measures

Primary outcome:

- Duration of antimicrobial therapies received in the intervention group compared to the control group

Secondary Outcomes:

- Duration of antibiotic treatment in the intervention group compared to the control group
- Duration of antiviral treatment in the intervention group compared to the control group
- Length of hospital stay of patients in the intervention group compared to the control group
- Proportion of patients who received a chest radiograph in the intervention group compared to the control group
- Proportion of patients readmitted to hospital within 30 days of discharge in the intervention group compared to the control group

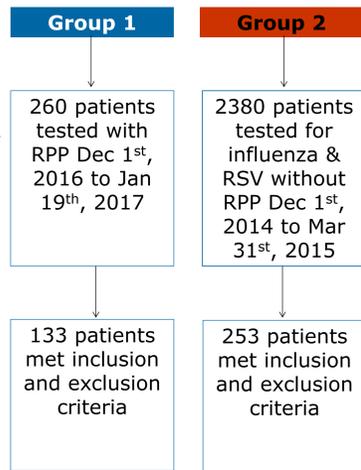


Figure 1: Patient identification

Luminex NxTAG® Multiplex RPP

Table 1: Pathogens Detected

	Pathogen		
Virus	Influenza A	Coronavirus 229E	Rhinovirus/Enterovirus
	Influenza A subtypes (H1, 2009 H1N1, H3)	Coronavirus NL63	Adenovirus
	Influenza B	Coronavirus OC43	Bocavirus
	Respiratory Syncytial Virus A & B	Coronavirus HKU-1	
	Parainfluenza 1, 2, 3, & 4	Human Metapneumovirus	
Atypical Bacteria	Chlamydia pneumoniae	Legionella pneumophila	Mycoplasma pneumoniae



Results

Table 2: Baseline Characteristics

Characteristic	Group 1 (Intervention) n = 133	Group 2 (Control) n = 253
Age – yr, mean (median)	1.39 (1.05)	1.59 (0.96)
Male sex – no. (%)	80 (60.2)	144 (56.9)
Weight – kg, mean (median)	9.84 (10.0)	9.94 (9.0)
Chronic respiratory condition – no. (%)	34 (25.6)	45 (17.9)
Immunocompromised state – no. (%)	0 (0)	7 (2.8)
Positive lab test result – no. (%)	114 (85.7) (100% viral positives)	137 (54.8)
Inpatient at VGH – no. (%)	84 (63.2)	145 (57.3)

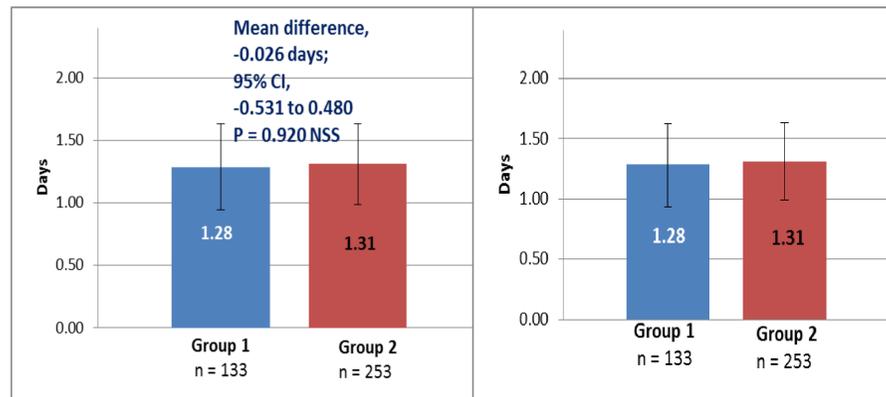


Figure 2: Mean duration of antimicrobial therapy received

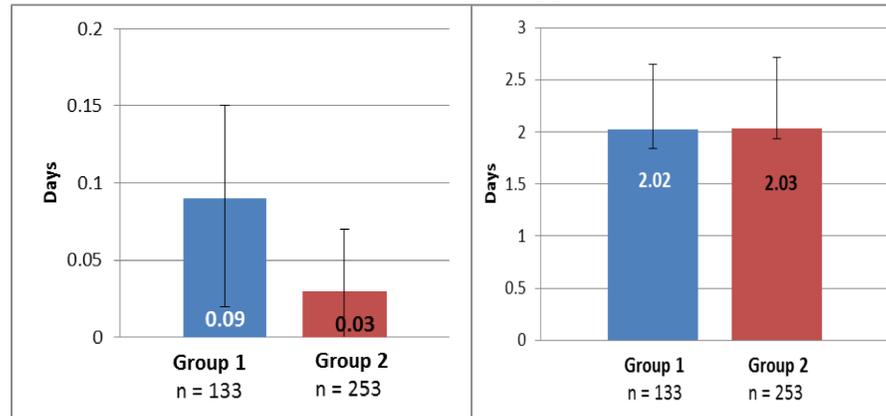


Figure 4: Mean duration of antiviral therapy received

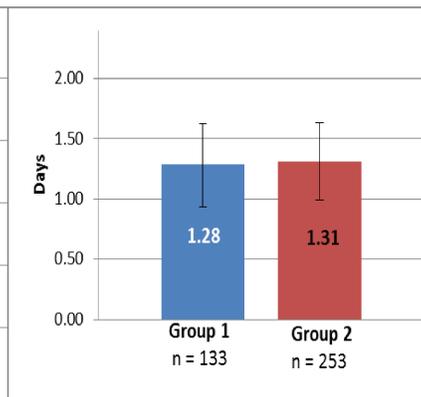


Figure 3: Mean duration of antibiotic therapy received

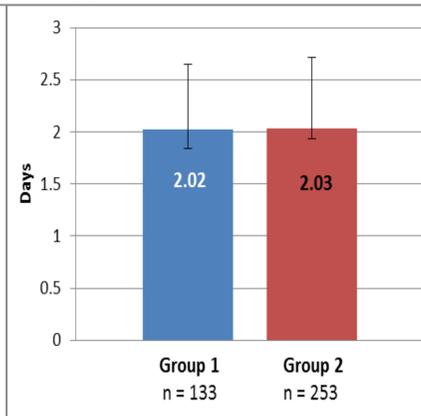


Figure 5: Median length of stay

Results (continued)

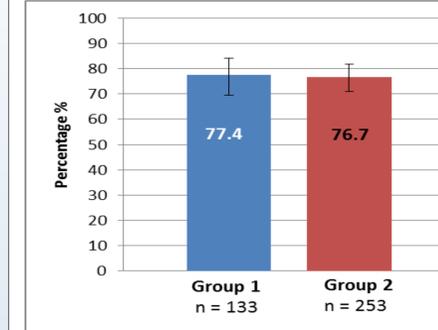


Figure 6: Proportion of patients who received a chest radiograph

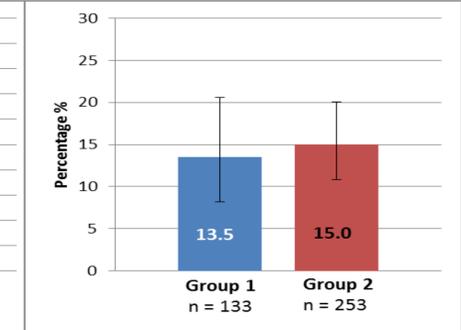


Figure 7: Proportion of patients readmitted to hospital within 30 days of discharge

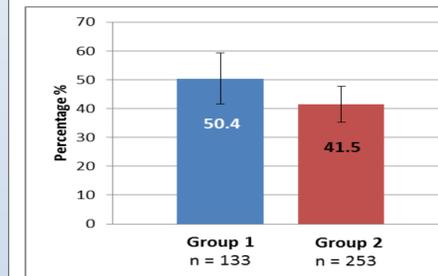


Figure 8: Proportion of patients who had antimicrobial therapy initiated in the hospital

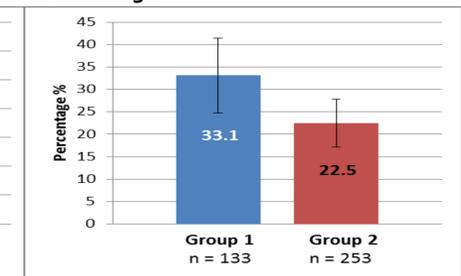


Figure 9: Proportion of patients who went home on antimicrobial therapy

Discussion

- Our study found antimicrobial duration, length of stay, utilization of chest radiographs, and re-admission within 30 days to all be negligibly different between group 1 and group 2.
- Counterintuitively, a higher proportion of children in group 1 had antimicrobial therapy initiated (50.4%) than in group 2 (41.5%) throughout their hospital admission. Also, a higher proportion of children in group 1 were discharged on antimicrobial therapy (33.1%) than in group 2 (22.5%).
- Prescribers' lack of familiarity with the test may have prevented them from using test results to change their practice. Potential suspicion of poly-microbial infections may have played a role as well, as concomitant viral and bacterial infections are common in the pediatric population.⁸ Lastly, multiplex RPP testing may have been reserved by prescribers for children that they deemed to be sicker due to a limited quantity of tests being available.
- The possibility of quickly and accurately differentiating between a viral and bacterial infection is an important one, especially as bacterial resistance continues to grow.
- Multiplex RPP testing has the potential to play a vital role in enhancing antimicrobial stewardship and saving hospital resources; however, for now it appears that its utility requires further exploration.

Limitations

- Retrospective nature of the study
- Limited generalizability (health authority specific)
- Comparison of different influenza seasons
- Antimicrobial durations limited to in-hospital

Conclusion

- Based on our analysis, the introduction of multiplex RPP testing in the pediatric inpatient population did not appear to significantly reduce antimicrobial use, hospital length of stay, use of chest radiographs, or re-admission within 30 days.
- Further education is warranted in regards to interpreting results of multiplex RPP testing and how these results may be used to spare antimicrobial and hospital resource usage if this test continues to remain available.

Next Steps:

- Dissemination of results and educational sessions regarding multiplex RPP testing for pediatricians.
- Evaluation of the optimal population in which to use this finite resource to ensure maximal clinical benefit in the most cost effective manner.