Estimating the clinical impact and costs of implementing a point of care test for influenza A/B and respiratory syncytial virus on an acute paediatric hospital inpatient ward

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BACKGROUND

- Influenza and respiratory syncytial viruses (RSV) are common viral respiratory infections and can be severe in children, causing a high burden on healthcare services. (1,2)
- To reduce nosocomial transmission, patients admitted to hospital with suspected influenza or RSV infection are presumptively isolated until microbiological laboratory confirmation.(3,4) Patients with confirmed influenza or with ILI during active influenza season should be offered antiviral treatment within 48 hours of symptom onset.(5,6)
- Centralised laboratory test reporting can be slow, delaying appropriate management. A new near-patient PCR-based molecular test is available, the Enigma® MiniLab™ FluAB-RSV PCR assay (Enigma Diagnostics Ltd, Salisbury, UK), with a reported sensitivity and specificity, respectively, of 81.8% and 98.9% for influenza A, 100% and 99.8% for influenza B, and 97.7% and 93.4% for RSV.(7,8)

AIMS

- To explore the impact of introducing a high performance point of care test (POCT) for influenza and respiratory syncytial virus (RSV) (Enigma® MiniLab™ FluAB-RSV) compared to standard care of using a laboratory-based respiratory viral panel (RVP) assay on an acute paediatric ward of a large London hospital during influenza season in terms of:
  - Length of stay
  - Reimbursement charges
  - Utilisation and total costs of laboratory tests and drugs
- To estimate the number of patients who are influenza-positive who are appropriately prescribed oseltamivir for influenza before and after introduction of the test.

METHODS

- Data were collected from patients with suspected viral respiratory tract infection on the acute paediatric ward of Guys and St Thomas NHS Foundation Trust, London.
- There were 274 eligible admissions tested during the 2013/14 influenza season when only the RVP was used (period 1), and 300 admissions tested in 2014/15 using both the Enigma® MiniLab™ and the RVP test in parallel (period 2).
- Outcones estimated:
  - Tariff reimbursement charges (total inpatient admission and time spent on the acute ward)
  - Prescription requests from the pharmacy, cost, and oseltamivir and antibiotics prescribed.
  - Proportion of positive results for each virus detected by the RVP in both periods.
- Multivariate regression analyses were run using independent variables as controls to explore the impact of the period (2 versus 1) on each of the outcomes, controlling for potentially confounding patient characteristics.
- We took a healthcare provider perspective, and used national and local costs.

RESULTS

- In the descriptive statistics, only the age at admission (p=0.013), the likelihood of having a complication (p<0.01), and the percentage of admissions in which oseltamivir was prescribed were statistically different between the periods (p<0.01).
- There was no significant difference between the periods for the total length of stay (period 1: mean 2.55 days, median 2.00 days; period 2: mean 3.31 days, median 2.00 days; p=0.22), nor length of stay on the acute paediatric ward (period 1: mean 2.28 days, median 1.65 days; period 2: mean 2.62 days, median 1.70 days; p=0.33). The unadjusted average reimbursement charges were not statistically different between periods.
- Reductions were observed in the reimbursement charge for patients with a negative influenza and RSV test; these differences disappeared when we controlled for top-up service charges (**TABLE 1**). Slight increase were seen in the cost of drugs for admissions for influenza and/or RSV positive patients.

FIGURE 1: PROPORTION OF POSITIVE INFETIONS BASED ON THE RVP RESULTS, BY PERIOD

The proportion of positive results for the nine viruses in the RVP was similar in both periods, suggesting the burden of infection was similar between years.

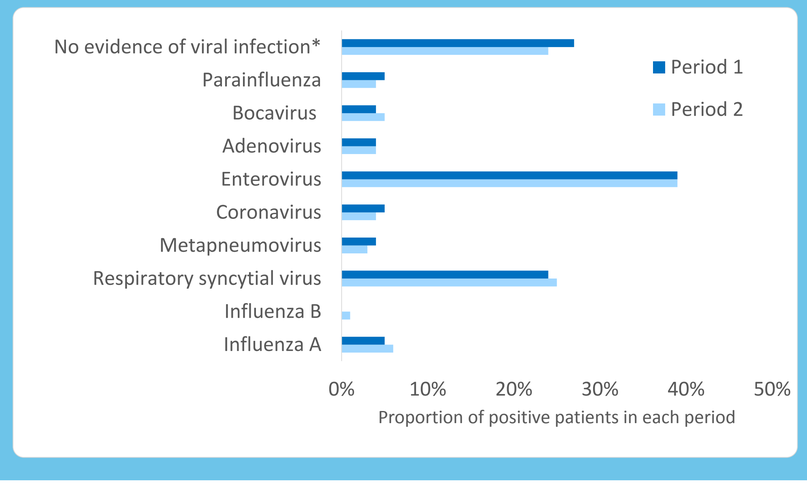


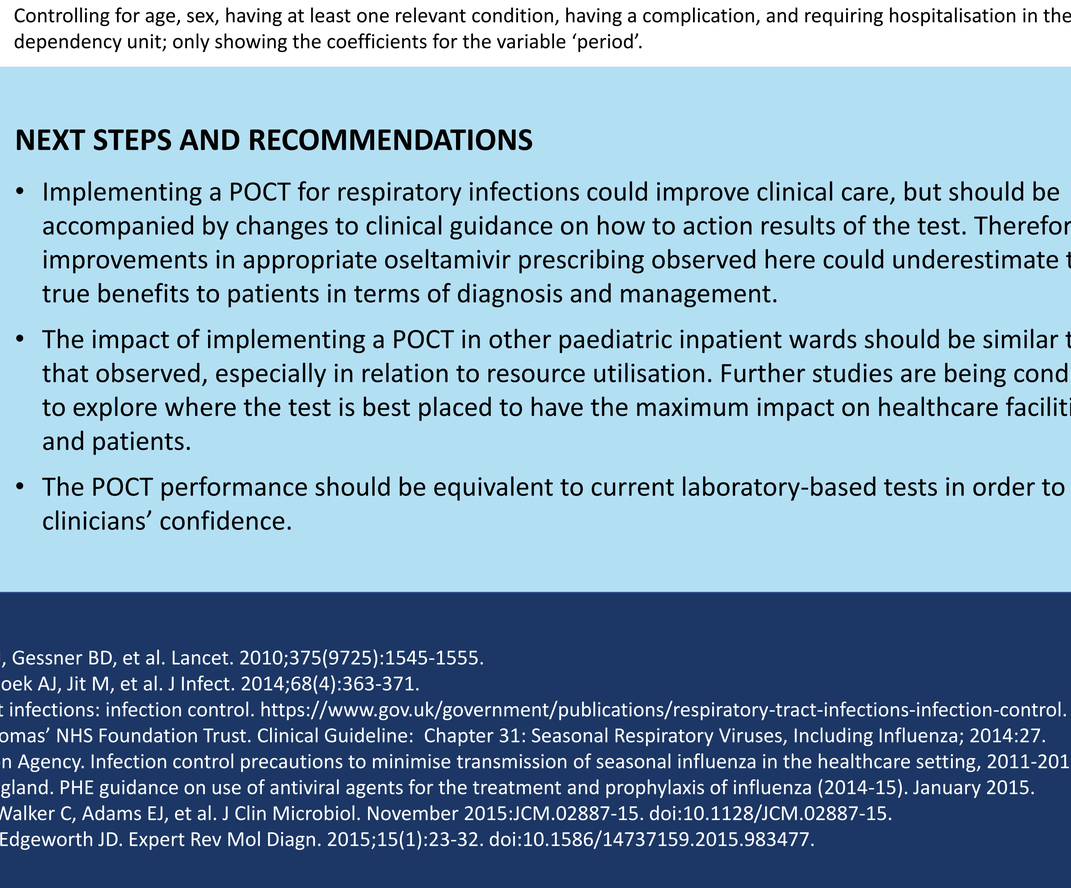
TABLE 1: AVERAGE REIMBURSEMENT CHARGE AND DRUG COST SAVINGS BY TYPE OF PATIENT FOR PERIOD 2 COMPARED TO PERIOD 1

Characteristics	Not controlling for top-up services*				Controlling for top-up services*			
	Admissions with influenza +/- RSV		Admissions without influenza and RSV		Admissions with influenza +/- RSV		Admissions without influenza and RSV	
	Savings**	p	Savings**	p	Savings**	p	Savings**	p
Reimbursement for total admission	-£50	0.70	£165	0.05	£93	0.61	£1,013	0.48
Reimbursement for stay on the acute paediatric ward	-£74	0.53	£148	0.05	£76	0.67	£591	0.51
Cost of drugs	-£13	<0.01	-£2	0.78	-£13	<0.01	-£7	0.47

Negative savings imply an additional cost in the second period with regards to the first period; *Controlling for age, sex, having at least one relevant condition, having a complication, and requiring hospitalisation in the high-dependency unit; **Only showing the coefficients for the variable 'period'. The coefficients for the other variables are available upon request.

TABLE 2: OSELTAMIVIR PRESCRIBED BY PERIOD

- During period 2, there was a significant increase in oseltamivir prescribing for admissions that were positive for influenza (13% to 40%, p=0.02), and a small increase in non-influenza patients (4% to 5%, p<0.01). We observed no change in antibiotic prescribing between periods.



Controlling for age, sex, having at least one relevant condition, having a complication, and requiring hospitalisation in the high-dependency unit; only showing the coefficients for the variable 'period'.

DISCUSSION

- During period 2, reimbursement charges decreased for patients who were negative for influenza and/or RSV. As no change in length of stay between periods was observed, this suggests changes in reimbursement may occur due to improved admission coding. The POCT provides additional information on microbiological results that might improve coding practices.
- Changes to coding and the distribution of HRG codes can affect the quantity of HRG codes that attract top-up services and thus additional reimbursement; including a shift in respiratory HRG codes which are ineligible for top-up services (borderline significant change in respiratory HRG codes observed between periods: 51% and 59%, p=0.06).
- In period 1 over 85% of patients with influenza did not receive oseltamivir. A POCT can significantly increase appropriate oseltamivir use in a paediatric hospital, perhaps as a confirmed diagnosis at admission allows clinicians to start patients on antivirals earlier.

NEXT STEPS AND RECOMMENDATIONS

- Implementing a POCT for respiratory infections could improve clinical care, but should be accompanied by changes to clinical guidance on how to action results of the test. Therefore, the improvements in appropriate oseltamivir prescribing observed here could underestimate the true benefits to patients in terms of diagnosis and management.
- The impact of implementing a POCT in other paediatric inpatient wards should be similar to that observed, especially in relation to resource utilisation. Further studies are being conducted to explore where the test is best placed to have the maximum impact on healthcare facilities and patients.
- The POCT performance should be equivalent to current laboratory-based tests in order to win clinicians' confidence.

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