Rhinovirus is the most common virus and rhinovirus-C is the most common species in paediatric intensive care respiratory admissions

To the Editor:

Acute respiratory illnesses (ARIs) account for 10–15% of all admissions to the paediatric intensive care unit (PICU) [1]. Historically, respiratory syncytial virus was reported to be the most common viral pathogen resulting in admission to the PICU [2]. Recent studies, using more sensitive molecular techniques, have shown that rhinoviruses may be the most frequent virus detected in respiratory admissions to a PICU [3–5].

We have previously reported that the rhinovirus-C species is associated with more frequent respiratory admissions [6, 7]. There has been no study reported to date examining the prevalence of each rhinovirus species in children admitted with an ARI to the PICU.

The aim of this study was to determine the prevalence of different viruses, in particular rhinovirus species, in children admitted to a PICU with an ARI.

Patient information was obtained retrospectively from the hospital computer database as part of an audit on all children admitted with an ARI to the PICU at Princess Margaret Hospital (PMH), Perth, Australia, between March 2009 and July 2011.

We compared these data collected with those from a concurrent prospective study running at PMH examining the mechanisms of acute viral respiratory infections in children (MAVRIC) [7]. The MAVRIC study enrolled children presenting to the emergency department with acute asthma, bronchiolitis and pneumonia. We compared our PICU cohort with all cases with the above ARIs not requiring PICU admission that were recruited to the MAVRIC study over the same timeframe.

Detection of common respiratory viruses from nasopharyngeal aspirate (NPA) samples were completed as previously described [6, 8–10].

From March 2009 to July 2011, 260 children, in total, were admitted to the PICU with an ARI. Of this cohort, 229 (88.1%) had an NPA performed. The mean±SD age was 2.8±4.0 (range 0–16) years and the most common respiratory diagnoses were acute asthma (n=63; 27.5%), bronchiolitis (n=67; 29.3%) and pneumonia (n=44; 19.2%).

Rhinovirus was the most frequent virus detected; being present in 94 (41.0%) of the NPA samples. respiratory syncytial virus was identified in 50 (21.8%) samples.

Based on the analysis of prevalence of rhinovirus species, rhinovirus-C was the most common rhinovirus species detected, being present in 51 (22.3%) of the 229 samples (figure 1). Rhinovirus-A species was found in 40 (17.5%) and rhinovirus-B in 4 (1.7%) of the overall PICU cohort.

Of the overall 260 patients admitted to PICU with an ARI, 31 (11.9%) did not have an NPA taken. The demographics of these patients were compared with those PICU respiratory admissions that had an NPA

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This is first report to examine the role of different RV species in ARIs in children admitted to paediatric ICU. Our study found that RV-C is the most common RV species in paediatric intensive care respiratory admissions. http://ow.ly/P6EN30k9UnX

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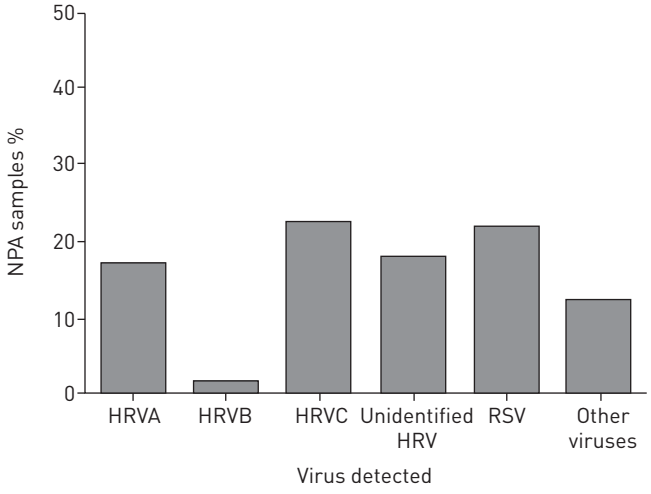

FIGURE 1 Rhinovirus species (HRV) detected compared with respiratory syncytial virus (RSV) and other viruses in the paediatric intensive care unit group. NPA: nasopharyngeal aspirate.

taken. The children who did not have an NPA performed were older (6.41±5.34 *versus* 2.8±4.0 years; p<0.001) and more likely to have a diagnosis of pneumonia (35.5% *versus* 19.2%; p=0.01).

Over the duration of this study, 181 emergency department ARI cases were recruited to the MAVRIC study and these subjects were compared with the cohort admitted to the PICU. Patients admitted to the PICU were more likely to stay in hospital longer (23.7±54.5 *versus* 1.4±1.39 days; p<0.001) and have a co-morbidity (n=88, 38.4% *versus* n=0; p<0.001) compared with emergency department ARI cases admitted to the ward.

Subjects admitted to the PICU *versus* emergency department ARI cases were less likely to have a diagnosis of asthma (27.5% *versus* 66.8%, respectively; p<0.001) but more likely to have a diagnosis of pneumonia (19.6% *versus* 5.6%, respectively; p<0.001). Rhinovirus-C was the most common rhinovirus species detected in both sets of hospital cases. There was no statistical difference identified between the two groups with any particular virus.

Of the 229 children admitted to the PICU who had NPA, 24 (10.5%) had a co-infection with another virus. Comparing clinical outcomes of the children who had a co-infection with the children with one virus detected, there was no statistically significant difference between the two groups.

This study shows that rhinovirus is the most common virus identified in children admitted to a PICU with an ARI and rhinovirus-C is the most frequent rhinovirus species detected in children positive for rhinovirus. Importantly, our data show that rhinovirus-C is a common viral pathogen detected in PICU ARI admissions and as common, or perhaps even more common than respiratory syncytial virus.

This is the first study to systematically examine relationships between respiratory viruses and different rhinovirus species in children admitted to a PICU with an ARI and, to our knowledge, is the largest study in a PICU population using RT-PCR rhinovirus molecular typing methods. Previous studies either did not include rhinovirus typing and used older virological detection methods [2] or were too small to report specifically on the prevalence of rhinovirus species [3, 4].

Our research group has previously demonstrated that rhinovirus-C-related wheezing episodes in preschool children are associated with an increased risk of previous and subsequent respiratory hospital admissions compared with other rhinovirus species [7]. Recent experimental evidence established that rhinovirus-C species has the ability to grow equally well at both 34°C and 37°C [11] which helps to explain why rhinovirus-C species are frequently found in severe lower respiratory illnesses in children.

Major strengths in this study include the use of up-to-date, highly sensitive PCR techniques and that it included a number of different respiratory diagnoses over different seasons. The findings in our study are strengthened by the inclusion of a control group. Although there were some differences in the clinial demographics between the two groups reported, the MAVRIC ARI cases provide corroborating evidence on the frequency of different viruses in children admitted to the PICU with an ARI.

In this study, viral detection data was not available on 31 (11.9%) of the overall PICU respiratory admissions. These children were older and more likely to have a diagnosis of pneumonia. NPAs are not routinely performed on older children given the level of discomfort associated with the procedure. Both the PICU and emergency department ARI cohorts where an NPA was performed were mainly younger pre-school children admitted with either bronchiolitis or asthma. Previous studies have demonstrated a

similar frequency and distribution of rhinovirus infections in preschool children with wheezing disorders verifying our findings [7, 12–15]. A subsection analysis was required to determine rhinovirus species as 91 (40%) of the collected NPAs were no longer available for rhinovirus typing. Given the size of this sub-analysis and that the availability of these specimens was random, the data reported could be expected to represent the profile of the distribution of different rhinovirus species in children admitted to the PICU with an ARI.

In conclusion, this is the first report examining the role of different rhinovirus species in ARIs in children admitted to a tertiary PICU. Rhinovirus was the most common virus detected and rhinovirus-C was the most prevalent rhinovirus species detected. Rhinovirus-C was also the most common rhinovirus species detected in children admitted to the PICU with a diagnosis of either acute asthma or bronchiolitis. Importantly, rhinovirus-C was as commonly detected in PICU admissions as respiratory syncytial virus.

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