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## Brief report

## Are identity badges and lanyards in pediatrics potentially contaminated with viral pathogens?



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## Key Words:

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Identity (ID) badges and lanyards worn by pediatric health care workers (HCWs) have been shown to be potential vectors of nosocomial bacterial infections. This cross-sectional study determined the contamination of ID badges and lanyards worn by pediatric HCWs with common respiratory and gastrointestinal viruses. The results showed that ID badges and lanyards are not significantly contaminated with common respiratory or gastrointestinal viruses and are unlikely to be a significant vector for nosocomial infection.

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Inanimate objects worn and used by health care workers (HCW), such as neckties and stethoscopes, have been shown to be reservoirs for potential pathogens.<sup>1</sup> Of particular concern in the pediatric setting are identity (ID) badges and lanyards. Many pediatric HCWs use them not only for identification but also as a distraction tool during examination or procedures. Children have an increased tendency to place these items in their mouth as HCWs lean over to examine or care for them, with children up to 6 years old having a hand-to-mouth frequency of 9.5 contacts per hour.<sup>2</sup> This therefore completes the chain of transmission for a potential nosocomial infection.

Kotsanas et al have demonstrated that ID badges and lanyards worn by HCWs may harbor pathogenic bacteria; however, such colonization has not yet been implicated in a bacterial outbreak.<sup>3</sup> Similar findings have been described in the United Kingdom, which has already implemented a bare below the elbows policy in

an attempt to reduce opportunistic pathogen transfer.<sup>4,5</sup> There is a paucity of comparative data suggesting that ID badges may be similarly contaminated with viral pathogens. However, given the higher incidence of viral infections in pediatrics—up to 50% of preterm infants screened during their hospital stay had viruses detected in their nasopharynx<sup>6</sup>—further evaluation of the viral burden and potential for nosocomial transmission of prevalent viruses are of both clinical and economic significance.

The principal aim of this study was to determine the contamination rates of ID badges and lanyards worn by pediatric HCWs with common respiratory and gastrointestinal viruses to evaluate their potential as vectors for both nosocomial and patient-to-patient transmission of viruses.

## METHODS

A cross-sectional study was performed on 2 occasions (October 2012 and August 2013) on a total of 99 ID badges and lanyards from pediatric HCWs (6 medical students, 24 junior and 34 senior medical staff, and 35 nursing and allied health staff) working on

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pediatric medical wards or the pediatric emergency department at Monash Children's Hospital, Australia. The study was repeated over sequential years to account for seasonal variability. Sampling was performed in the middle of the day to allow for maximum opportunity for pathogen transfer during morning clinical activities.

Only lanyards worn around HCW's neck were sampled because these were purported to have maximum contact with patients compared with ID badges fastened to a belt without a lanyard. All lanyards were hospital issued cloth based and 2-cm wide. ID badges were of uniform design and made from white polyvinyl chloride, with additional laminated cards attached to the lanyard behind the ID cards in some staff. One swab sample was collected from each HCW using a flocced nylon nasopharyngeal swab, premoistened with viral transport media (BD, Sparks Glencoe, MD). The use of flocced nasopharyngeal swabs is known to have a sensitivity of 98.4% when compared with nasopharyngeal aspirates<sup>7</sup> and 79%-89% when compared with respiratory washings.<sup>8</sup> The front and back surfaces of ID badges (regardless of the number of badges they carried) and distal 2 cm of lanyards were sampled with the same swab and placed in universal transport media.

For comparison, total respiratory and fecal results on pediatric patients in Monash Children's Hospital during January 2012-December 2013 were obtained using the clinical laboratory information system. During the study period, a total of 2,977 respiratory swabs and 2,425 fecal swabs were sent, with a total of 1,688 and 112 positive respiratory and fecal swabs, respectively. Clinical samples taken during this period were used for direct comparison with study results. All laboratory samples were not processed by the study team, but by routine pathology laboratory staff as per protocol subsequently listed and by the enteric virus laboratory at the Murdoch Children's Research Institute for the enteric virus polymerase chain reaction (PCR) assays.

#### Respiratory viral testing

HCW ID samples were tested for respiratory viruses using viral PCR technique after an automated DNA-RNA extraction procedure, an identical process to routine clinical samples collected from pediatric patients. The Respiratory Pathogen 12 Assay (AusDiagnostics, Beaconsfield, NSW, Australia) was used to detect RNA or DNA from 9 common respiratory viruses (Table 1). Picornavirus results did not differentiate between enteroviruses and rhinoviruses; therefore, they were left as a group.<sup>9</sup>

#### Gastrointestinal viral testing

HCW ID badges were tested for rotavirus and norovirus using reverse transcription- polymerase chain reaction (RT-PCR) assays. Viral RNA was extracted from the samples using the QIAamp viral RNA Mini Kit (Qiagen, Limburg, The Netherlands). Norovirus RNA was screened using a nested RT-PCR assay targeting a 266-bp region of the capsid gene.<sup>10</sup> Rotavirus double-stranded RNA was screened using a VP6-targeted RT-PCR assay.<sup>11</sup> Positive RT-PCR products were confirmed by sequence analysis. Pediatric clinical fecal samples were tested for rotavirus using the RIDAQUICK Rotavirus/Adenovirus Combi N1003 (R-Biopharm, Darmstadt, Germany).

#### Data analysis

Results were summarized as number (%) for categorical variables and analyzed using Fisher *t* test. Statistical significance was defined as  $P < .05$ . Data were analyzed using Stata 12.0 (StataCorp, College Station, TX). The study was approved as a quality assurance study by the Monash Health Human Research Ethics Committee.

**Table 1**  
Respiratory pathogen assay panel

Respiratory pathogen
Influenza A virus
H1N1 (swine) influenza virus
Influenza B virus
Respiratory syncytial virus
Picornavirus*
Parainfluenza 1 virus
Parainfluenza 2 virus
Parainfluenza 3 virus
Human metapneumovirus

\*Picornavirus results did not differentiate between enteroviruses and rhinoviruses; therefore they were left as a group.

**Table 2**  
Demographics and results of respiratory and fecal swabs

Group	Surveillance samples (HCW)	Positive, n (%), 95% CI	Clinical samples (patients)	Positive, n (%)
Total RPCR, October 2012	49	1 (2, 0.05-10.9)	117	77 (66)
Total RPCR, August 2013	50	0	157	104 (66)
Total SPCR, October 2012	49	0	45	2 (4)
Total SPCR, August 2013	50	0	50	3 (6)

CI, confidence interval; HCW, health care worker; RPCR, respiratory virus polymerase chain reaction; SPCR, stool polymerase chain reaction.

## RESULTS

Ninety-nine pediatric HCWs were recruited in this study. Forty-nine HCWs were recruited in October 2012 and 50 in August 2013.

In our study, across both periods, the rate of positive respiratory ID badge-lanyard samples was 1.0% (95% confidence interval, 0-5.5) (Table 2). This compares with an overall 56.4% positive rate in tests ordered on pediatric patients across the study period for respiratory viruses. One ID badge-lanyard swab over the study period was positive for parainfluenza virus type 3. This is in the context of 11 positive parainfluenza virus type 3 results out of 286 pediatric samples in the preceding 60 days prior to the positive HCW ID result, with no parainfluenza outbreak during that time.

There were no positive HCWs samples for gastrointestinal viruses (Table 2). During the overall study period, 4.9% of pediatric fecal samples tested positive for norovirus and rotavirus.

## DISCUSSION

In the pediatric population, respiratory tract infections and gastroenteritis are the most common infectious presentations. These viruses are easily transmitted from person to person, and fomites can potentially act as vehicles for transmission. Nosocomial viral infections are common, with the frequency of respiratory syncytial virus infections between 30% and 70% in neonatal wards and 20% and 40% in pediatric wards.<sup>12</sup>

Viruses are estimated to have a variable life span on dry inanimate objects, with viability ranging between 6 hours to 60 days.<sup>13</sup> Many respiratory viruses, such as respiratory syncytial virus, human parainfluenza viruses, influenza virus, rhinovirus, and coronavirus, are enveloped and have been shown to survive on surfaces of fomites from several hours to several days. Enteric viruses on the other hand are usually nonenveloped and therefore can remain viable for weeks to months.<sup>2</sup> However, our results are based on PCR detection rather than viral culture; hence, viability and infectivity of the aforementioned viruses are difficult to infer. Therefore, whether this translates to an increased risk of transmission and hence increased nosocomial infection rate remains to be seen.

To our knowledge, this is the first study looking specifically at potential viral contamination of ID badges and lanyards in a pediatric population. Our results demonstrate that they are not likely to be significant vectors in the nosocomial transmission of common respiratory and gastrointestinal viruses. This low contamination rate is despite the study coinciding with the peak season for respiratory viruses in both years and also the tail end of the peak of gastrointestinal viruses, where a higher rate of background infection would imply higher risk of transmission and hence colonization on fomites.

These results are not congruent with previous studies showing colonization of bacteria in ID badges and lanyards<sup>3-5</sup>; however, there are certain factors that could explain the difference.

First, studies investigating viral survival on environmental surfaces are conducted in artificially created experimental conditions. Bean et al demonstrated that influenza viruses isolated from throat swabs could be transferred from nonporous or cloth surfaces to hands for up to 24 hours or 15 minutes, respectively, after contamination. However, this is only feasible with viral titers that exceed physiologic levels of viral shedding.<sup>14</sup> Nonetheless, PCR methods used in this study are likely to detect viral loads below the transmission threshold, even assuming that detected RNA-DNA represents viable viruses.

Viral titers have also been shown to decline exponentially with time on inanimate surfaces. Therefore, unless swabs were taken immediately or close to initial contamination of the ID or lanyard, the viral titer could have been too low even for detection by PCR. The implication of this may be similar to the way viruses can become inactivated on human skin and can only survive on hands for a few minutes.<sup>15</sup>

Furthermore, respiratory pathogens may be spread via airborne or droplet transmission, but fecal pathogens are predominantly spread via contact transmission. Therefore, unless there is clear surface contact with the lanyard, it is difficult to establish successful transmission, thereby possibly accounting for the lack of any detected fecal nosocomial infections in this study.

Our study was limited by a number of factors. Although the pediatric wards sampled are in close proximity and have a centralized humidity and temperature control systems, the sampling methods do not account for factors such as ultraviolet light exposure, which may affect viral survival. Furthermore, inter-sample variability caused by time differences between contact and sampling and disinfection of individual lanyards prior to sampling could not be accounted for because of the study method.

The relatively small sample size of our study limits the applicability to the general population of pediatric HCWs, and confirmation in another setting is warranted. The use of artificially

contaminated ID badges and lanyards as positive controls could also be included to further evaluate the validity of the methodology. Nonetheless, our findings in the peak respiratory season suggest that ID badges and lanyards are not significantly contaminated with common respiratory and gastrointestinal viruses and are unlikely to represent major vectors of transmission in pediatric health care settings.

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