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Research

# Travel-associated illness in children in pre-pandemic Western Sydney, 2018–2020

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## Article history

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## Key points

- Returned child travellers in Western Sydney, New South Wales (NSW), mostly had common paediatric conditions coincidentally acquired during travel, particularly respiratory infections
- Approximately 10% had exotic infections, mostly those visiting friends and relatives (VFR); approximately half of these were enteric fever
- Improved delivery of pretravel health advice and vaccination could reduce illness in child travellers in NSW
- Universal screening for overseas travel in emergency departments would improve the monitoring of imported diseases

## Abstract

**Objectives and importance of study:** Australian children frequently travel overseas, but little is known about their travel-related morbidity. We aimed to describe the spectrum of illness and injury in returned travellers presenting to the largest paediatric referral centre in NSW, the Children's Hospital at Westmead (CHW).

**Study type:** Observational cohort study.

**Methods:** In the 18 months immediately before the COVID-19 pandemic (2018–2020), we prospectively collected demographic, travel and clinical data from children with travel-acquired illness or injury identified by active surveillance of CHW Emergency Department attendees and referrals to the infectious diseases service.

**Results:** We identified 587 returned child travellers with an illness or injury associated with overseas travel. Most were aged younger than 5 (62.8%) and had travelled within the Asia-Pacific region (84.6%). The main reason for travel, where recorded (50.3%), was visiting friends and relatives (VFR) (65.4%). Most travellers (90.1%) had a common childhood infection, illness or injury coincidentally acquired during travel, including respiratory infection (37.5%), acute diarrhoea (15.7%) and nonspecific febrile illness (13.1%). Exotic/nonendemic infections were uncommon (9.9%, including potential rabies exposure) but were associated with much higher admission rates than 'cosmopolitan' (globally distributed) diseases (74.2% vs 21.9%). Most of these occurred in VFR travellers (86.3%); enteric fever, largely acquired in South Asia, predominated (51.7%). One in five admitted patients had a disease for which specific pretravel vaccination is available. Receipt of pretravel vaccines was infrequently recorded.

## Abstract (continued)

**Conclusions**: Returned child travellers in Western Sydney frequently presented with respiratory infections and may be a key population for surveillance of imported respiratory viruses. The burden of exotic disease was small and borne by VFR travellers. Travel-related illness in Western Sydney could be reduced by health education of travellers and targeted pretravel vaccination, especially typhoid vaccination for VFR travellers to South Asia. Universal, systematic screening of emergency department attendees for recent overseas travel would improve surveillance of travel-related illness.

# Introduction

Australians are avid overseas travellers who frequently travel with their children. In 2019, the year before the COVID-19 pandemic, there were a record 11.3 million re-entries into Australia by residents who had taken a short-term (less than one year) overseas trip[1]; 1.3 million of these were by children aged 14 years or younger.

Children are mostly obligate, passive travellers to destinations chosen by their parents or carers. Young children, in particular, are often visiting friends and relatives (VFR), commonly visiting a migrant parent's country of birth.[2,3] VFR travellers have a greater tendency to travel without seeking health advice, have close contact with local populations, visit nonurban areas, eat riskier foods and stay for longer: all factors that can increase their risk of illness during travel.[4] However, relatively little is known about travel-related morbidity in Australian children; to date, there is only one published Australian study describing the spectrum of illness seen in children after international travel, a small 2015 retrospective review from the Children's Hospital at Westmead (CHW) in Sydney, New South Wales (NSW).[5]

In November 2018, CHW began prospective surveillance for travel-related illness in children after becoming a reporting site for GeoSentinel, a global traveller surveillance and research network. Traveller data were collected until April 2020, when Australian borders closed because of the COVID-19 pandemic. Here, we report on all-cause morbidity, including injury, in returned travellers presenting to CHW during this 18-month period.

# Methods

## Study population

The study population was children attending the CHW Emergency Department (ED) or reviewed by the infectious diseases (ID) service from November 2018 to April 2020. CHW, the largest children's hospital in NSW, provides services to children aged 0-16 years (up to 18 years with a known chronic condition) and is located in Western Sydney, where 41% of residents are born overseas: India is the top migrant country of birth (5.4%), followed by China (3.6%).[6] The ED services the direct catchment area and averages 5000 presentations per month. CHW also provides tertiary and quaternary services to broader metropolitan Sydney and regional NSW.

## Data collection

PM (ED hospitalist) screened the ED database (FirstNet) weekly to identify patients reporting overseas travel and then reviewed their medical records to determine whether their presentations were travel-related. PB (ID physician) provided consensus where required. Deidentified demographic, travel and clinical data were stored in a returned traveller database. In the absence of an embedded travel screen in FirstNet, travellers were detected by manual review of paper 'rapid triage assessment' forms (on-entry nursing assessment of ambulant ED attendees with an optional probe for overseas travel within the past 3 weeks). A keyword search of the database was conducted using mixed travel and disease terms, e.g. 'travel', 'return', 'holiday', 'dengue', and 'typhoid'. PM also screened blood culture reports for the growth of nonendemic organisms, and PB identified cases of travel-related disease consulted by the ID service; these were crosschecked against ED attendees.

## Inclusion criteria and definitions

We included Australian residents returning from an outbound trip and recently arrived migrants/refugees. An illness or injury qualified as travel-associated if symptoms began abroad, if the disease-specific incubation period suggested overseas exposure, or if the disease was not endemic to Australia. Influenza and upper respiratory tract infections were included if symptom onset was within 4 days of return and acute diarrhoea within 3 days of return (where no pathogen was identified). Injuries were those sustained abroad and not in transit. Multiple presentations for the same illness were counted as one case, and a single main aetiological or syndromic diagnosis was assigned. We used World Bank global subregions to report regions of travel[7] and further delineated Southeast Asian countries from East Asia according to Association of Southeast Asian Nations (ASEAN) membership. For multi-country trips, we recorded the most likely country of acquisition.

Immunisation status was determined solely from the hospital record.

### Analysis

We performed a descriptive analysis of the returned traveller database using Microsoft Excel.

### Ethics

Data collection for this study was approved by the Royal Melbourne Hospital Human Ethics Committee (HREC/17/MH/207) with subsequent CHW site-specific approval.

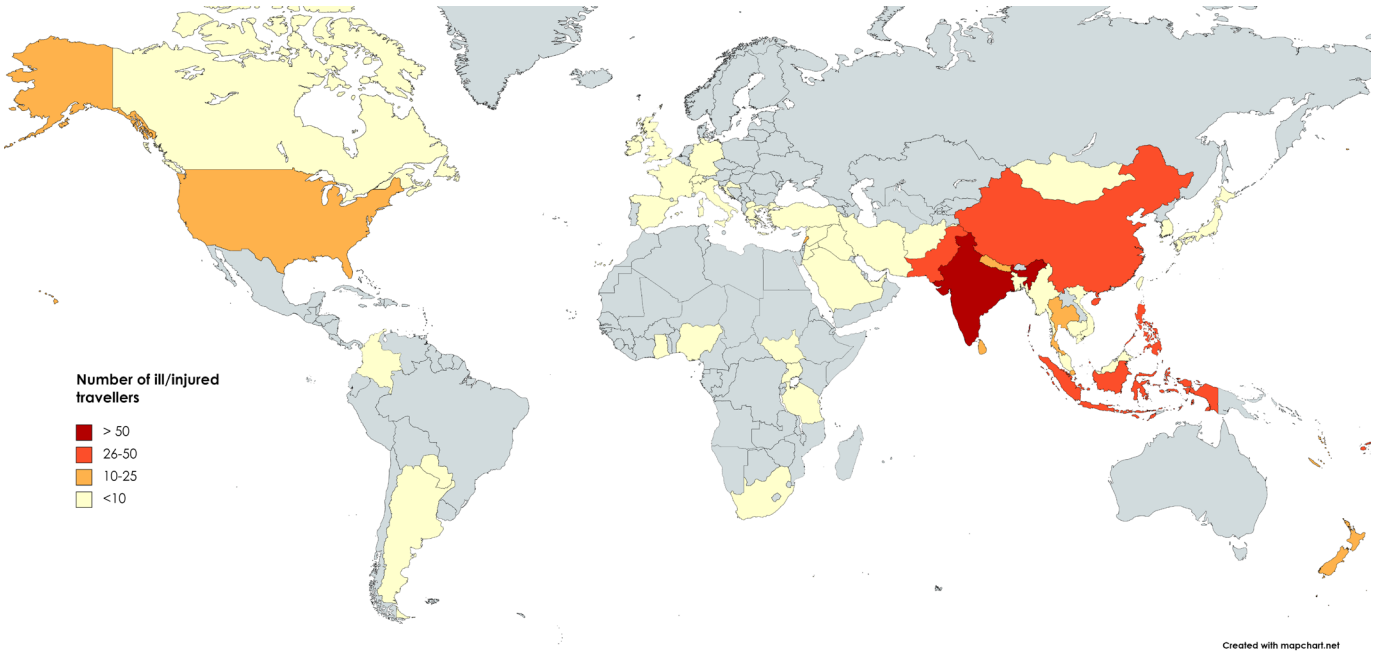
## Results

### Traveller characteristics

From November 2018 to April 2020, we identified 1314 recently returned travellers presenting to CHW ED; 582 had a travel-associated complaint (< 1% of total attendances; *N* = 89 192); 5 more were identified from direct ID service referrals, bringing the total to 587 cases. Traveller presentations peaked in February 2019 and February 2020, following the Australian summer school holidays.

The demographic and travel characteristics of ill child travellers are shown in Table 1. Most (62.8%) were aged younger than 5 (median age 3 years). Where the reason for travel was recorded (50.3%), VFR travel was more than twice as common as tourism (65.4% vs 28.1%). Most (84.5%) ill travellers had visited the Asia-Pacific regions, with 31.2% acquiring their illness in India and 32.7% in one of the following six countries: Pakistan, Fiji, China, Indonesia (mostly Bali), the Philippines and Thailand (shown schematically in Figure 1). Fiji and Bali were the most frequent tourist destinations. Most travellers were discharged home to follow up with their general practitioner as required (69.3%) or in the outpatient review clinic within 1–3 days (3.6%); 27.1% were admitted.

**Figure 1.** Cases of illness or injury in child travellers: country of acquisition[a]




[a] Case numbers, not rates (destination-specific risks cannot be calculated as there are no denominator data).

**Table 1.** Characteristics of ill or injured returned child travellers

| Traveller characteristics | All travellers *N*=587 | | Discharged *n*=428 (72.9%) | | Admitted *n*=159 (27.1%) | | |
|---|---|---|---|---|---|---|---|
| Sex | *n* | (%) | *n* | (%) | *n* | (%) | Admission rate, % |
| Male | 336 | (57.2) | 240 | (56.1) | 96 | (60.4) | |
| Age | | | | | | | |
| <12 months | 87 | (14.8) | 66 | (15.4) | 21 | (13.2) | 24.1 |
| 1–4 years | 282 | (48.0) | 212 | (49.5) | 70 | (44.0) | 24.8 |
| 5–9 years | 141 | (24.0) | 95 | (22.2) | 46 | (28.9) | 32.6 |
| 10–18 years | 77 | (13.1) | 55 | (12.9) | 22 | (13.8) | 28.6 |
| Region of travel[a] | | | | | | | |
| South Asia | 256 | (43.6) | 172 | (40.2) | 84 | (52.8) | 32.8 |
| Southeast Asia[b] | 109 | (18.6) | 84 | (19.6) | 25 | (15.7) | 22.9 |
| Pacific[c] | 73 | (12.4) | 52 | (12.1) | 21 | (13.2) | 28.8 |
| East Asia | 58 | (9.9) | 51 | (11.9) | 7 | (4.4) | 12.1 |
| Middle East and North Africa | 34 | (5.8) | 26 | (6.1) | 8 | (5.0) | 23.5 |
| Europe and Central Asia | 23 | (3.9) | 18 | (4.2) | 5 | (3.1) | 21.7 |
| North America | 21 | (3.6) | 17 | (4.0) | 4 | (2.5) | 19.0 |
| Sub-Saharan Africa | 10 | (1.7) | 6 | (1.4) | 4 | (2.5) | 40.0 |
| Latin America and Caribbean | 3 | (0.5) | 2 | (0.5) | 1 | (0.6) | 33.3 |
| Reason for travel, where recorded | (*n*=295) | | (*n*=175) | | (*n*=120) | | |
| Visiting friends and relatives | 193 | (65.4) | 102 | (58.3) | 91 | (75.8) | 47.2 |
| Tourism | 83 | (28.1) | 63 | (36.0) | 20 | (16.7) | 24.1 |
| Migration to Australia | 13 | (4.4) | 6 | (3.4) | 7 | (5.8) | 53.8 |
| Other[d] | 6 | (2.0) | 4 | (2.3) | 2 | (1.7) | 33.3 |
| End-encounter diagnosis category | | | | | | | |
| Common illness/injury[e] | 529 | (90.1) | 413 | (96.5) | 116 | (73.0) | 21.9 |
| Exotic/nonendemic disease[f] | 58 | (9.9) | 15 | (3.5) | 43 | (27.0) | 74.1 |

[a] See Figure 1 for countries visited
[b] Defined as the Association of Southeast Asian Nations (ASEAN) member states
[c] Includes 10 Pacific Island cruises
[d] School trip (3), visiting Australian parent working overseas (2), Umrah (1)
[e] Includes nonspecific (presumed viral) illness
[f] Enteric fever (30), dengue (7), hepatitis A (all likely travel-acquired, 7), potential rabies exposure (6), malaria (4), neurocysticercosis (2), brucellosis (1), cutaneous tuberculosis (1).

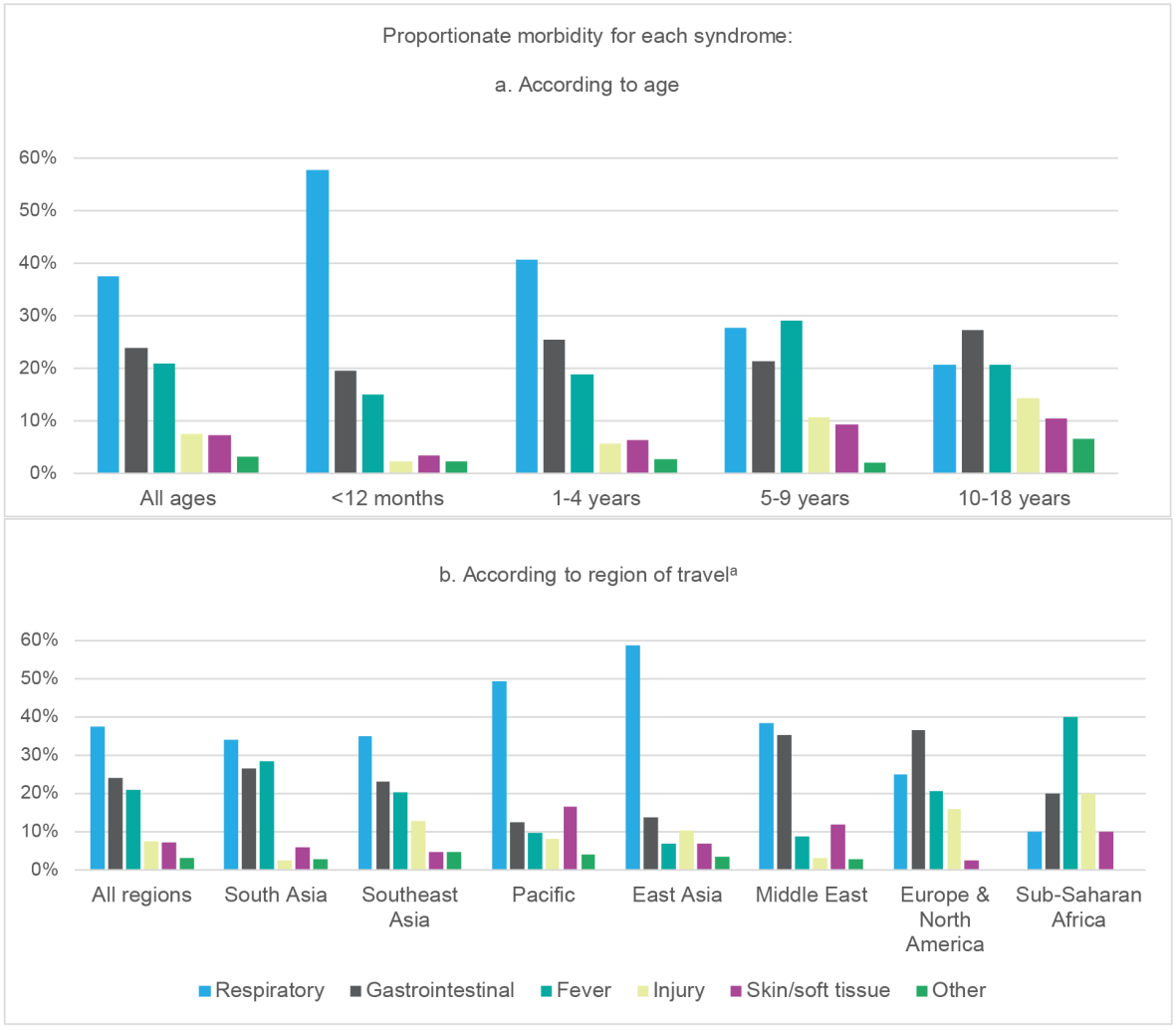
## Diagnoses in returned travellers

Overall, 90.1% of travellers were considered to have a common illness or injury, and 9.9% had an exotic or nonendemic disease (Table 1). VFR travellers accounted for 86.3% of exotic and 61.1% of cosmopolitan (globally distributed) illnesses, where the reason for travel was recorded (in 87.9% and 46.1% of cases, respectively). Traveller illness was categorised into six major presenting syndromes: Table 2 details the diagnoses within each syndrome; Figure 2 shows the proportionate morbidity for each syndrome according to age and region.

### Acute Respiratory Illness (ARI)

Respiratory tract infection (RTI) was the most frequent illness in returned travellers (37.5%), travellers aged younger than 5 years, and those returning from East Asia (79.4% acquired in China) and the Pacific. Most (80%) children who reported return from a Pacific cruise had an RTI. Most (60.9%) ARI was viral upper RTI with or without wheeze. Respiratory polymerase chain reaction (PCR) testing was performed for 53.6% of travellers with ARI: the two most frequent pathogens were influenza and respiratory syncytial virus (RSV), identified in 40.7% and 10.2% of swabs, respectively. Travel-related influenza cases peaked in January and February, i.e. the Australian summer/northern hemisphere winter, and so mostly presented interseasonally: there were two to three times more cases between November and April 2018/19 and 2019/20, respectively than during the expected Australian transmission season (May to October 2019). No COVID-19 cases were detected between February 2020 (the start of surveillance) and the end of the study period.

**Figure 2.** Proportionate morbidity of the major presenting syndromes in returned child travellers according to age and region of travel




a Data from Europe and North America (socioeconomically similar northern hemisphere regions) are combined, and Latin America is excluded as there were only 3 travellers to this region.

**Table 2.** Presenting syndromes and diagnoses in returned child travellers

| Presenting syndromes and top 3 diagnoses for each[a] | Proportion of illness in all travellers *N*=587 | | Proportion of illness in admitted travellers *n*=159 | | Admission rate |
|---|---|---|---|---|---|
| | *n* | % | *n* | % | % |
| **Acute Respiratory Illness (ARI)** | **220** | **37.5** | **46** | **28.9** | **20.9** |
| Viral upper RTI[b] +/- wheeze | 134 (60.9%) | 22.8 | 18 | 11.3 | 13.4 |
| Influenza (laboratory-confirmed) | 48 (21.8%) | 8.2 | 15 | 9.4 | 31.3 |
| Lower RTI[b,c] | 28 (12.7%) | 4.8 | 13 | 8.2 | 46.4 |
| **Gastrointestinal (GI)** | **140** | **23.9** | **35** | **22.0** | **25.0** |
| Acute diarrhoea (<2 weeks) | 92 (65.7%) | 15.7 | 19 | 11.9 | 20.7 |
| Vomiting and/or nonspecific abdominal pain | 28 (20.0%) | 4.8 | 3 | 1.9 | 10.7 |
| Hepatitis A | 7 (5.0%) | 1.2 | 6 | 3.8 | 85.7 |
| **Fever** | **123** | **21.0** | **58** | **36.5** | **47.2** |
| Fever, unspecified/ presumed viral illness[d] | 77 (62.6%) | 13.1 | 21 | 13.2 | 27.3 |
| Enteric fever | 30 (24.4%) | 5.1 | 27 | 17.0 | 90.0 |
| Mosquito-borne (dengue + malaria) | 11 (8.9%) | 1.9 | 6 | 3.8 | 54.5 |
| **Injury** | **44** | **7.5** | **1** | **0.6** | **2.3** |
| Fracture/joint injury | 28 (63.6%) | 4.8 | 0 | 0 | 0 |
| Bite/scratch requiring rabies prophylaxis | 6 (13.6%) | 1.0 | 0 | 0 | 0 |
| Burn | 4 (9.1%) | 0.7 | 1 | 0.6 | 25.0 |
| **Skin/soft tissue** | **42** | **7.2** | **13** | **8.2** | **31.0** |
| Bacterial infection skin/ deep tissues | 18 (42.9%) | 3.1 | 10 | 6.3 | 55.6 |
| Mycobacterial infection, including BCG reaction | 6 (14.3%) | 1.0 | 1 | 0.6 | 16.7 |
| Urticaria | 5 (11.9%) | 0.9 | 0 | 0 | 0 |
| **Other** | **18** | **3.1** | **6** | **3.8** | **33.3** |
| Neurological symptom, temporal association with travel[e] | 10 (55.5%) | 1.7 | 5 | 3.1 | 50.0 |
| Limp/leg pain | 4 (22.2%) | 0.7 | 1 | 0.6 | 25 |
| Well child, review after medical episode abroad | 2 (11.1%) | 0.3 | 0 | 0 | 0 |

BCG = Bacillus Calmette-Guerin vaccine;

[a] Remaining diagnoses: ARI – otitis media (6), tonsillitis (4), flu-like illness (contact, no swab, 2); GI – chronic diarrhoea (5), mesenteric adenitis (2), ruptured appendix (2), undiagnosed jaundice (1), pancreatitis (1), nontyphoidal salmonella infection (splenic abscess, abdominal pain/bacteraemia, 1 each); Fever – urinary tract infection (4), brucellosis (1), Injury – traumatic wound (3), facial injury (2), marine sting (1); Skin/soft tissue – nonspecific rash (3), eczema (2), scarlet fever (2), varicella (2), superficial eye infection (2), herpes simplex virus whitlow (1), surgical wound check (1); Other – behavioural disturbance (1), insomnia (1)

[b] RTI = respiratory tract infection

[c] Lower RTI = lobar pneumonia (10), bronchiolitis (9), viral pneumonitis (9)

[d] Aetiology specified for 8 'viral illnesses' only: enterovirus (3), adenovirus (2), roseola (1), Epstein-Barr virus (1), parvovirus (1)

[e] Seizure (6, including 2 caused by neurocysticercosis), migraine (2), encephalopathy (1), postinfectious cerebellar ataxia (1).

### Gastrointestinal (GI)

GI complaints (23.9%) were the second most common presentation. They were most frequent among travellers aged 10–18 and those returning from Europe, North America, and the Middle East. Most (65.7%) travellers with GI symptoms had acute diarrhoea, and most (80%) with symptom onset overseas or within 24 hours of return. Stool PCR and culture were performed for 46.7% (43/92) cases, with 75% of tests identifying a likely pathogen: 50% bacterial (*Campylobacter* spp., nontyphoidal *Salmonella* spp., *Shigella* spp., *Aeromonas* spp.), 37.5% viral (rotavirus, norovirus, adenovirus, astrovirus) and 12.5% parasitic (*Giardia duodenales, Cryptosporidium parvum*). Seven children, all VFR travellers, had hepatitis A infection.

### Fever

Travellers with acute undifferentiated fever accounted for 21% of presentations and were most likely to be admitted (47.2%). Fever was the most frequent presentation for travellers aged 5–9 returning from Sub-Saharan Africa (40% had malaria). Most (62.6%) febrile travellers had no specific diagnosis made during their encounter or were ascribed the diagnosis of 'viral illness'. Enteric fever was the most common specific aetiological diagnosis and the most common cause of admission in all travellers. Children with enteric fever were mostly aged 5 or older (80%) and returned VFR travellers from South Asia (93.3%). There were 18 culture-proven *S.* Typhi infections, including an extensively drug-resistant strain[8], and 12 *S.* Paratyphi infections; 27 patients were admitted for intravenous antibiotics (mean length of stay 6.6 days), and three received outpatient treatment with oral azithromycin. One child presented with life-threatening sepsis requiring intensive care support, but more than half of the admitted patients (16/27) had an initial outpatient workup for posttravel fever and were subsequently recalled from the community after laboratory notification of bacteraemia. Three children relapsed, requiring readmission.

The next most common specific diagnoses for returned travellers with undifferentiated fever were dengue fever (two of seven cases admitted for minor bleeding) and *P. falciparum* malaria (four cases, all acquired in Africa and admitted: one VFR traveller who had not taken prophylaxis and three recently arrived refugees with no record of premigration malaria screening).

### Injuries and skin/soft tissue problems

Travellers presenting for review of an overseas injury (7.5%) mainly had fractures, bites and burns. Injuries were more common in school-aged travellers. Six children (aged 4–15) required rabies postexposure prophylaxis after a transdermal mammalian bite or scratch in Asia. Two had been referred by the local public health unit for infiltration of rabies immunoglobulin into the wound under sedation. None had received pretravel rabies vaccination.

Travellers with skin or soft tissue problems (7.2%) mostly had bacterial skin or deep soft tissue infections (42.9%) or rashes. Skin complaints were more common in school-aged travellers and those returning from the Pacific. Six visitors to South Asia had cutaneous mycobacterial infections: one *M. tuberculosis*, one *M. fortuitum* complex and four bacillus calmette-guerin (BCG) site abscesses following overseas vaccination. Two children had uncomplicated varicella infection after exposure to an infected family contact abroad.

### Other

The remaining presentations (3.1%) were mostly travellers with new neurological symptoms, including two children with seizures who were subsequently diagnosed with neurocysticercosis[9], both acquired in India (one migrant, one VFR traveller).

## Vaccine-preventable diseases (VPDs)

A sizeable minority of presentations (11.8%) and admissions (21.4%) were for children whose illness might have been prevented or ameliorated specifically by pretravel vaccination (influenza, typhoid, hepatitis A) and who were age-eligible for these vaccinations at the time of travel.

Information about receipt of pretravel vaccination was recorded for only 135 (23%) travellers: of these, 28.9% had received a vaccine specifically for travel, mostly hepatitis A and typhoid. Two infants received accelerated MMR immunisation (before travel to Bangladesh and the Philippines), and seven children (aged 0–3 years) received BCG vaccination before travel to South Asia or shortly after arrival. No traveller was recorded as having received a pretravel influenza vaccine.

None of the travellers with typhoid infection for whom immunisation status was recorded (70.6%) had been vaccinated. Typhoid immunisation was further explored for all travellers returning from South Asia, the highest-prevalence region for typhoid infection[10]: status was recorded for 69 of 181 vaccine-eligible children (aged 2 or older at the time of travel) and only 16 (23.2%) had been vaccinated.

# Discussion

This updated review of all-cause morbidity in returned child travellers presenting to a major paediatric ED in NSW, based on 18 months of prospective surveillance, validates the findings of the earlier study.[5] Children with travel-associated illness comprised just less than 1% of overall ED presentations, were mostly aged younger than 5 and had travelled primarily to visit friends and relatives (VFR), mostly in the Asia-Pacific region. India was the most frequent country of exposure, likely reflecting its endemic burden of disease and the fact that Indian-born residents are the largest migrant group in Western Sydney.

Our returned travellers presented with a wide range of illnesses and injuries; however, more than 90% were common paediatric conditions coincidentally acquired abroad, particularly respiratory infections. The high prevalence of ARI in our travellers (37.5%) suggests that recently returned child travellers in Western Sydney may be an important source of imported respiratory pathogens, particularly influenza. Even with limited respiratory testing, around one in every 12 ill travellers presenting to our ED had laboratory-confirmed influenza. Children can be efficient influenza transmitters, likely because of higher nasopharyngeal viral loads, longer viral shedding, and more frequent and physical interactions with contacts.[11-13] Our study demonstrates a potential role for child travellers in seeding influenza into Australia following travel during the Australian summer holidays coinciding with the Northern hemisphere winter and causing out-of-season clusters. We note that the 2018–2019 summer influenza epidemic in NSW was considered to be driven by traveller-imported influenza.[14]

Despite the recommendation to consider the influenza vaccine for all travellers[15], acknowledging limited data, there was no evidence of uptake in our study. This is unsurprising given the low rates of seasonal influenza vaccination in NSW children (less than 42% annually since the introduction of funded vaccines for children 6–59 months in 2018).[16] Poor access to vaccination services and the absence of a specific healthcare provider recommendation have previously been identified as two major barriers to influenza vaccination in children[17] and may apply in the travel context.

Another implication of the frequency of ARI in our cohort is that ill child travellers are likely to be suitable sentinels for detecting emerging respiratory viruses in NSW. Real-time respiratory surveillance systems already operate in NSW, including Paediatric Active Enhanced Disease Surveillance-The Influenza Complications Alert Network (PAEDS-FluCAN, seasonal surveillance) and the Public Health Rapid, Emergency, Disease and Syndromic Surveillance System (PHREDSS, continuous surveillance). Both use routinely collected data from hospital information systems to identify severe or unusual patterns of respiratory illness. However, recording patient traveller status is currently discretionary in NSW hospitals, and early detection of less severe or low-volume imported respiratory infections requires a travel signal. Designating recent travel as a mandatory, reportable patient variable for ED data collection and integrating it into existing or expanded surveillance systems could facilitate early detection of imported respiratory viruses and other travel-associated disease clusters.

Imported exotic infections were uncommon in our returned travellers but associated with high hospitalisation rates and often resource-intensive treatment, particularly for enteric fever. Children undertaking VFR travel to South Asia have been repeatedly recognised as having high risk for typhoid infection[18-20] and Australian guidelines specifically recommend typhoid vaccination for all VFR travellers to the Indian subcontinent.[15] Yet our data suggest that, in Western Sydney, the typhoid vaccine remains underutilised: less than a quarter of eligible returned travellers from South Asia whose immunisation status was recorded had been vaccinated.

Vaccination is increasingly important for typhoid prevention in South Asia where evolving antimicrobial resistance is narrowing treatment options[21], with extensively drug-resistant *S.* Typhi established in Pakistan[22] and azithromycin resistance emerging in India.[23] Conjugate typhoid vaccines, now used in this region, are not yet available in Australia but would be a welcome alternative to existing vaccines for young VFR travellers because a single dose given in infancy provides effective and durable cover throughout childhood.[24]

The reasons for typhoid nonvaccination in VFR travellers are likely complex and multiple but are likely to include[25-27]: parental unawareness of risk; trust that safe eating habits will prevent disease; false belief in existing immunity because of past infection or vaccination; false belief that Australian childhood vaccines confer protection; failure of the health provider to recommend the vaccine; and forgoing the recommended vaccine because of cost or time constraints. Pharmacy-initiated typhoid vaccination for children aged 5 or older, introduced in NSW in 2022, may improve access; however, increasing uptake for high-risk children is likely to require strategies that involve parents (e.g. using social and community media in target migrant groups to share parents' experiences of typhoid[28]) and immunisation providers (e.g. creating software prompts to ask about future travel during routine childhood vaccine visits, and preemptively discussing relevant travel vaccines). Ultimately, given a decades-long discussion about preventable typhoid infection in child VFR travellers, higher-incentive systems-based interventions may need to be considered, such as a partial government subsidy for typhoid vaccine for children younger than 15 or applying the Medicare Vaccine Information Payment to travel vaccines given to children and recorded on the Australian Immunisation Register.

Finally, it is important to recognise that the primary means of prevention for much of the illness and injury in our returned travellers is reducing exposure through safe travel behaviours: respiratory hygiene, eating and drinking safely, mosquito precautions, simple wound care, not interacting with animals, and being alert to child safety hazards. These are simple messages that parents can access from government websites such as Smartraveller without having to visit a health service. However, there is currently little material in languages other than English which should be addressed.

## Limitations

Travel screening in ED was not mandatory, and detection of travellers relied on nurse/physician reports, so our study may have underestimated the proportion of recent

travellers among ED attendees and underreported cases of travel-related illness. We are also unable to estimate disease or destination-specific risks as there are no comparative denominator data for healthy returned child travellers during the study period. Additionally, the variable degree of traveller work-up resulted in a mix of syndromic/clinical and aetiological/microbiological diagnoses; some children with a 'viral illness' may have received a more specific diagnosis on subsequent community follow-up, which our study will not have captured. Lastly, our study is based in a tertiary paediatric hospital, so higher acuity travel-related illnesses may be overrepresented.

## Conclusion

This study presents an Australian perspective on the spectrum of illness seen in children after overseas travel. Although based in Western Sydney, our findings are likely to be informative to similar ethnically diverse urban settings nationally and in other high-income countries. The high prevalence of respiratory infections suggests that child travellers may contribute more to the spread of imported respiratory disease than previously appreciated and are likely to be valuable sentinels for its detection. However, effective surveillance requires the implementation of mandatory recording of patient traveller status in health information systems. Enteric fever remains a particular risk for child VFR travellers to South Asia, and innovative ways of improving uptake of typhoid vaccine in this migrant community need to be found.

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## Peer review and provenance

Externally peer reviewed, not commissioned.

## Competing interests

None declared.

## Author contributions

PM was responsible for data curation and analysis, and manuscript drafting. KL and LD reviewed and revised the manuscript. PB contributed conceptualisation, supervision, review and revision of the manuscript.

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