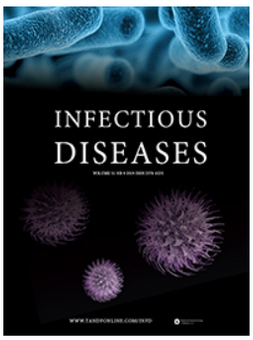

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LETTER TO THE EDITOR

Epidemiology of pertussis in Marrakech and contribution of molecular diagnosis

Sir,

Aming to delineate preventive policies, pertussis hospitalizaton in Portugal was recently analyzed and reported in this journal [1]. Of 2281 hospitalizations, 94% occurred in infants <1 year-old. Main complicatations were acute respiratory failure and pneumonia and the case fatality rate was 0.7%. The authors emphasized the need to adopt preventive strategies. We here contribute with a surveillance of pertussis at the University of Marrakech, Morocco, to determine the prevalence of the infection and to highlight the usefulness of rapid molecular diagnosis in the care of these children.

Currently, in Morocco, the vaccination strategy includes a primary vaccination at 2, 3 and 4 months of age, completed by booster doses at 18 months and 5 years of age. The vaccine is provided through UNICEF.

This is a prospective study including all patients younger than 14 years of age admitted to the Paediatric pole of the university hospital centre in Marrakech, Morocco, from January 2018 to March 2019 and met the case definition in accordance with the criteria defined by the WHO [2].

Bordetella pertussis was also diagnosed in mothers of children with confirmed pertussis.

Nasopharyngeal samples were obtained by insertion of a swab into each nostril parallel to the palate and submerged into transport solution (phosphate buffered saline).

A total of 300 µl from each sample were applied to the BioFire FilmArry Respiratory panel in a multiplex PCR assay that detects 20 respiratory pathogens, including RSV, influenza A virus H1, influenza A virus H1 2009, influenza A virus H3, influenza B virus, adenovirus, parainfluenza virus types 1–4. Human rhinovirus (HRV)/human enterovirus (HEV), human metapneumovirus, human bocavirus, human coronavirus types OC43, 229E, NL63 and HKU1, *Bordetella pertussis, Chlamydia pneumoniae and Mycoplasma pneumoniae*.

Table 1. Demographics of patients with *Bordetella pertussis*.

Characteristics	Patients positive $n = 24$ (%)
Age	
<28 days	2 (8.3)
29 days–<2 months	12 (50)
2–<3 months	8 (33.3)
3–5 months	1 (4.2)
5 months–12 years	0 (0)
>12–<14 years	1 (4.2)
Gender	
Male	13 (55)
Female	11 (45)

Sample extraction and multiplex-nested PCR was performed in an enclosed pouch on the FilmArray instrument. For each pathogen, the results were generated using endpoint melting curve analysis.

Quantitative variables were described as frequencies and percentages for each group using Microsoft Excel.

A total of 81 children hospitalized as probable cases of pertussis were prospectively studied from January 2018 to March 2019.

Ages of *B. pertussis*-positive children appear in Table 1.

The confection was found in 37.5% (9/24) of the cases. Human rhinovirus was demonstrated in seven cases and coronavirus NL63 in two.

The monthly distribution of pertussis cases was not homogeneous. The majority of cases were reported in September 25% (6/24) of cases (Figure 1).

The majority of patients 54.1% (13/24) were admitted in Paediatric Respiratory Diseases service and 8 of them were hospitalized in emergency, and three infants were hospitalized in an intensive care unit.

The common symptoms observed among the 24 confirmed patients were fever 100% (24/24), paroxysmal cough 91.6% (22/24) and cyanosis 54.2%(13/24), whereas apnoea 33.3% (8/24) or post-tussive vomiting 20.8% (5/24) presented less frequently.

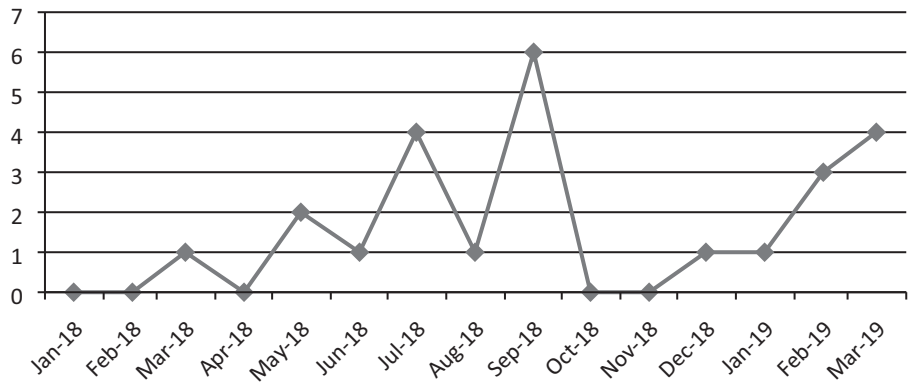

Figure 1. Distribution of *B. pertussis* cases by months.

We observed that both leukocytosis and lymphocytosis were present in six cases with *B. pertussis*.

The analysis of vaccination status of patients with a positive result for *B pertussis* showed that 90% of infants under 3 months had not yet received their first dose of pertussis vaccine. Two patients aged less than 3 months received the first dose, the only four-month-old infant received 2 doses and only a 13-year-old girl received all the doses of pertussis vaccine.

It is noteworthy that 100% (24/24) of the confirmed cases had received antibiotic treatment prior to completion of sampling. The administration of macrolide antibiotics (clarithromycin or azithromycin) was noted in 90% of them whereas 10% received other antibiotics.

Clinical improvement occurred in 23 of 24 cases. A 40-day-old infant developed cardiorespiratory arrest before admission and died due to severe pertussis.

The family survey was conducted in 14 mothers of infants with a positive PCR. Of these, 8 mothers were infected and all had a chronic cough. Their average age was 24 years.

In this study, a total of 24 cases (29.6%) had positive samples for *B. pertussis*, being 91.6% of them infants under 3 months old. This proportion of positive samples is slightly lower than a previous study conducted in Casablanca in 2015 [2], where 61% of probable cases for pertussis were positive. However, these variations are expected as the clinical features have shown to be insufficient to establish a diagnosis and it is estimated that without PCR testing, the overall percentage of missed cases would range from 9 to 26% per year in infants under 6-months-old [3].

It has been demonstrated that a whooping cough alone is not enough to start antibiotics immediately, especially in infants younger than 4 months [4,5]. However, in Morocco in areas where laboratory resources are limited physician usually, give macrolides when there is high suspicious of pertussis.

For *B. pertussis* seasonality, a pattern corresponding to the summer and spring months have been reported in the southern hemisphere [5]. Comparably, a previous study in infants under 6-month of age from 2003 to 2008 in Lima, registered more hospitalizations due to whooping cough during the months of February and September. Another study in Peru in 2015 showed an increase of *B. pertussis* cases from February to March and from October to November [6], In our study, an increase of *B. pertussis* cases in September was founded, this difference can be explained by the nature of climate in Morocco.

Bordetella pertussis is a highly contagious disease acquired through direct contact or inhalation. The mother has been identified as the most common source in up to 63% of cases, followed by fathers, siblings and other family members [7,8]. In our study, among children with *B. pertussis,* we found that 8 mothers were carriers of *B. pertussis*.

In the present study, analysis of the immunization status of children with *B. pertussis* showed that 81% of infants had not yet received their first dose of pertussis vaccine. We should seek to achieve an early and timely vaccination. WHO proposes vaccination to initiate at 6 weeks and no later than 8 weeks of age, and to maintain high coverage ($\geq$90%) with at least 3 doses [9,10].

This study emphasizes the frequency of whooping cough in unvaccinated young children under three months of age, who often have an emetic cough, but who may also have severe apnoeas leading to serious complications. The incidence of whooping cough in mothers of infected infants indicates that infection of unvaccinated infants may be more associated with young parents or close relatives. The availability of PCR

in the laboratory allowed a quick diagnosis. Broad vaccination of parents before or at the time of birth can be a solution to reduce the number of whooping coughs in young children.

Disclosure statement

No potential conflict of interest was reported by the authors.

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