Competing interests

The authors have declared that no competing interests exist.

Financial disclosure

The authors received no specific funding for this work.

Acknowledgments

The authors acknowledge the support of the "IHU Mediterranean Infection, Aix Marseille University and AP-HM", medical staff and patients who agreed to participate at this study.

References

1. Sun Guanghao, Akanuma Masahiko, Matsui Takemi. Clinical evaluation of the newly developed infectious disease/fever screening radar system using the neural network and fuzzy grouping method for travellers with suspected infectious diseases at Narita International Airport Clinic. *J Infect* 2016;**72**(1):121—3. http://dx.doi.org/10.1016/j.jinf.2015.09.017.
2. Sun Guanghao, Matsui Takemi, Hakozaki Yukiya, Abe Shigeto. An infectious disease/fever screening radar system which stratifies higher-risk patients within ten seconds using a neural network and the fuzzy grouping method. *J Infect* 2015;**70**(3):230—6. http://dx.doi.org/10.1016/j.jinf.2014.12.007.
3. Ng Eddie YK, Kawb GJL, Chang WM. Analysis of IR thermal imager for mass blind fever screening. *Microvasc Res* 2004;**68**(2):104—9. http://dx.doi.org/10.1016/j.mvr.2004.05.003.
4. Chiu WT, Lin PW, Chiou HY, Lee WS, Lee CN, Yang YY, et al. Infrared Thermography to mass-screen suspected SARS patients with fever. *Asia Pac J Public Health* 2005;**17**(1):26—8. http://dx.doi.org/10.1177/101053950501700107.
5. Selent Monica U, Molinari Noelleangelique M, Baxter Amy, Nguyen An V, Siegelson Henry, Brown Clive M, et al. Mass screening for fever in children: a comparison of 3 infrared thermal detection systems. *Pediatr Emerg Care* 2013;**29**(3):305—13. http://dx.doi.org/10.1097/PEC.0b013e3182854465.
6. Nguyen An V, Cohen Nicole J, Lipman Harvey, Brown Clive M, Molinari Noelle-Angelique, Jackson William L, et al. Comparison of 3 infrared thermal detection systems and self-report for mass fever screening. *Emerg Infect Dis* 2010;**16**(11):1710—7. http://dx.doi.org/10.3201/eid1611.100703.
7. Priest Patricia C, Duncan Alasdair R, Jennings Lance C, Baker Michael G. Thermal image scanning for influenza border screening: results of an Airport Screening Study. *PLoS One* 2011;**6**(1). http://dx.doi.org/10.1371/journal.pone.0014490.
8. Chan LS, Lo Jessica LF, Kumana Cyrus R, Cheung Bernard MY. Utility of infrared thermography for screening febrile subjects. *Hong Kong Med J* 2013;**19**(2):109—15.
9. Bitar D, Goubar A, Desenclos JC. International travels and fever screening during epidemics: a literature review on the effectiveness and potential use of non-contact infrared thermometers. *Euro Surveill* 2009;**14**(6).
10. Chiang Ming-Fu, Lin Po-Wei, Lin Li-Fong, Chiou Hung-Yi, Chien Ching-Wen, Chu Shu-Fen, et al. Mass screening of suspected febrile patients with remote-sensing infrared thermography: alarm temperature and optimal distance. *J Formos Med Assoc* 2008;**107**(12):937—44. http://dx.doi.org/10.1016/S0929-6646(09)60017-6.

Matthieu Bardou[a]
Piseth Seng*[a]
Service des Maladies Infectieuses, Hôpital de la Conception, Assistance Publique — Hôpitaux de Marseille, 147, boulevard Baille, Marseille, France

Aix Marseille Univ, INSERM 1095, CNRS 7278, IRD 198, URMITE, Marseille, France

Line Meddeb
Service des Maladies Infectieuses, Hôpital de la Conception, Assistance Publique — Hôpitaux de Marseille, 147, boulevard Baille, Marseille, France

Jean Gaudart
Service BioSTIC, Hôpital Timone, UF Biostatistique et Modélisation, 264 Rue saint Pierre, 13385 Marseille, France

Estelle Honnorat
Andreas Stein
Service des Maladies Infectieuses, Hôpital de la Conception, Assistance Publique — Hôpitaux de Marseille, 147, boulevard Baille, Marseille, France

Aix Marseille Univ, INSERM 1095, CNRS 7278, IRD 198, URMITE, Marseille, France

*Corresponding author. Fax: +33 04 91 38 20 41.
E-mail address: sengpiseth@yahoo.fr (P. Seng)

[a] These authors contributed equally to this work.

Accepted 30 August 2016

http://dx.doi.org/10.1016/j.jinf.2016.08.017

Morbidity and mortality risk factors of pertussis in pediatrics

KEYWORDS
Pertussis;
Infant;
Pediatric intensive care unit;
Risk factors

We have read with great interest the study of Clarke et al. on the relationship between *Bordetella pertussis*

Table 1 Demographic and clinical characteristics of 176 children hospitalized with pertussis according to PICU admittance (128 children in hospital, 48 in PICU).

	Hospital N = 128	PICU N = 48	p value
Demographic characteristics			
Sex, male (%)	65 (50.8)	18 (37.5)	0.116
Age categories (%)			0.001
0 month	17 (13.3)	13 (27.1)	
1 month	44 (34.4)	25 (52.1)	
2 months	33 (25.8)	7 (14.6)	
>2 months	34 (26.5)	3 (6.2)	
Age, days median (IQR)	64 (42—96)	45 (27—60)	<0.001[a]
Prematurity (%)	15 (11.7)	9 (18.7)	0.259
Vaccination doses			<0.001
0	78 (60.9)	42 (87.5)	
1	38 (29.7)	6 (12.5)	
2	5 (3.9)	—	
3	5 (3.9)	—	
4	2 (1.6)	—	
Deaths	—	7 (14.6)	
Clinical characteristics			
Hospital stay, days median (IQR)	6.5 (3—10)	14 (8—20)	<0.001[a]
PICU stay, days median (IQR)	—	4 (3—8)	—
Time of evolution, days median (IQR)	7 (4—10)	7 (3—10)	0.085[a]
Paroxysmal cough (%)	127 (99.2)	47 (97.9)	0.472
Post-tussive vomiting (%)	51 (39.8)	12 (25)	0.067
Inspiratory whoop (%)	39 (30.5)	6 (12.5)	0.019
Respiratory distress (%)	14 (10.9)	22 (45.8)	<0.001
Primary apnea (%)	8 (6.2)	15 (31.2)	<0.001
Post-crisis apnea (%)	43 (33.6)	21 (43.7)	0.212
Fever > 38 °C (%)	8 (6.2)	4 (9.1)	0.737
Cyanosis (%)	86 (67.2)	40 (83.3)	0.034
Cardiac symptoms (%)	4 (3.1)	8 (16.7)	0.004
Altered X-rays at admittance (%)	14 (31.8)	20 (45.4)	0.189
Bacterial over-infection (%)	2 (1.6)	12 (25)	<0.001
Pneumonia (%)	1 (0.8)	4 (9.1)	0.020

IQR25-75 interquartile range; p values are Chi-square or Fisher exact test probabilities except for: [a]Mann—Whitney U test for non-parametric variables.

genotype and clinical severity in Australian children with pertussis.[1] Developed countries have changed from whole cell pertussis vaccines (WCV) to acellular vaccines (ACVs) along the past decades; this may have influenced the characteristics of worldwide *B. pertussis* strains, increasing the presence of variants deficient in the pertactin (Prn) protein. These Prn deficient variants may persist longer in the epithelia and their clinical consequences are still to be determined.[2] Clarke et al. have found no differences in disease severity between Prn deficient/Prn positive strains in their pediatric patients. The factors most significantly associated to disease severity in their sample are young age and absence of prior vaccination. Also concerned by the spread and severity of pertussis in Spain we have analyzed 176 children that required admission to the Hospitalization Unit (HU) and/or the pediatric intensive care unit (PICU) of Sant Joan de Déu Hospital (Barcelona, Spain). Unfortunately, we do not have information about the Prn status of *B. pertussis* strains in our sample but a survey conducted on several European countries (EU), Spain included, revealed that. *B. pertussis* isolates in Spain do not differ from other EU countries using comparable ACVs.[3]

Of our 176 patients, 128 were hospitalized (72.7%) and 48 (27.3%) were admitted in the PICU, these numbers leaved room for a consistent analysis of data, especially for the identification of factors of worse prognosis and mortality. Patients have not been uniformly distributed during the 12 years considered (2001—2013). Cases fluctuated from 5 to 18 until 2010 when the number increased to 20, to 28 in 2011, and to 23 in 2012. The observed peaks of incidence, every 3—6 years, matched the epidemic cycles of the disease described in the literature. Our seasonal distribution of cases also matched the distribution already described, with higher cases in spring—summer, especially in HU patients.[4,5]

We examined through univariate and multivariate methods a set of demographic and clinical characteristics