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Incidence of pertussis in the province of Pesaro-Urbino (Italy)

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SUMMARY

Pertussis vaccination coverage in the Marche region is one of the lowest in Italy, with the province of Pesaro-Urbino remaining stable below 95% coverage since at least 2013. In this paper, we retrospectively analyzed all whooping cough notification cards arriving at the prevention department of the Area Vasta 1 Health Office in the Marche region and relating to the Pesaro-Urbino province (Italy). Between 2012 and 2017, there were 28 reported cases of pertussis with a peak in 2016 (11 cases, of which seven were in Urbino). The 28 patients were mostly male (65%), and had a mean age of 9 years. Three of these were not Italian. Between 2012 and 2017, the district of Pesaro reported the highest number of cases (almost 46.5% of the total), followed by Urbino (28.5%) and Fano (25%). The average incidence in the province in the period in question, still under 2 cases/100,000 inhabitants, arrived in 2016 at 4 cases/100,000 inhabitants. In particular, in Urbino there was an unforeseen incidence >8 cases/100,000 inhabitants. There were no deaths, although two children (both under 12 months of age) were hospitalized. Our data confirm that in 2016 there was a pertussis epidemic in Urbino (Italy).

Keywords: whooping cough, pertussis vaccine, Central Italy.

INTRODUCTION

Pertussis is a contagious, infectious disease that mainly affects children and it is caused by *Bordetella pertussis*. The pertussis vaccine has changed the epidemiology of the disease so much so that it has almost vanished, with a minimum number of cases recorded in Italy (2008), when vaccination coverage was at 97% [1]. Despite the presence of universal immunization programs and high vaccination coverage, pertussis remains a major public health concern. Pertussis epidemics occur every 3-4 years because infections and vaccines do not induce lifelong immunity to the disease [2, 3]. The reduction of the vaccinated pediatric population and the loss of acquired immunity could be the cause of the re-emergence of a disease which is a major cause of death among children under one year of age: case-fatality rates range from 0.2% in developed countries to 4% in developing countries [4].

According to The European Centre for Disease Prevention and Control data in 2016, 30 EU/EEA countries reported more than 48,000 cases of pertussis. Four countries (Germany, the Netherlands, Poland and the UK) accounted for 68% of all notified cases. Cases of whooping cough in 2016 increased in 20 of the 30 countries studied (Italy included) and decreased in 7. The EU/EEA notification rate of 10.8 for a population of 100,000 is much higher than that of Italy which however has doubled when comparing the incidences in 2015 with that of 2016 (0.8 and 1.6/100,000 cases respectively) [5]. In Italy, the disease generally peaks between March and August [6]. In Italy, the

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acellular vaccine is administered via the hexavalent combined vaccine during the first year of life with a primary 3-dose schedule (3rd, 5th and 11th month). Booster doses at 5-6 years and 11-12 years of age are recommended to avoid infections due to the waning of immunity [7, 8].
Pertussis vaccination coverage in the Marche region is one of the lowest in Italy and the province of Pesaro-Urbino has remained stable below 95% of coverage since at least 2013 [9]. In a previous paper we described three cases of whooping cough occurring in 2016 within a few months of each other in the municipality of Urbino [10].
In this paper we have retrospectively analyzed the prevalence of pertussis in the Province of Pesaro-Urbino between 2012-2017 (Area Vasta 1, Health Office of the Marche region, Italy).
In 2016, the annual report ofArea Vasta 1 reported vaccination coverage in the Pesaro district of less than 90% even for mandatory vaccinations (87% for tetanus, polio, diphtheria and hepatitis B). Even though the district Urbino had better percentages, it did not reach 95% of the vaccination coverage considered to be essential for the stemming of communicable diseases. For non-compulsory vaccinations, Pesaro had a vaccination coverage of <73% (for measles, parotitis and rubella). The vaccine coverage of Fano and Urbino was also very low for some diseases where vaccination is not compulsory (85 and 89% respectively). As for the same report, it reported an average coverage in the Province of 91.47%, distributed as follows: Pesaro 87.58%, Fano 93.86%,-and Urbino 93.4%.
As regards pertussis (for which vaccination is not mandatory in Italy), since the vaccination for this disease is carried out simultaneously with that of tetanus (mandatory) the percentages of coverage in the province were equal to those of mandatory vaccinations [9, 11].

MATERIALS AND METHODS

The Province of Pesaro and Urbino is located in the Marche region of Italy and has 359,411 inhabitants. The two provincial capitals are Pesaro and Urbino; the administrative headquarters are situated in Pesaro, as are all administrative and provincial offices. The geographical area of the province of Pesaro-Urbino is divided into three health districts: Pesaro, Fano and Urbino, which in 2017 had 139,065, 137,038 and 84,608 inhabitants respectively. We have retrospectively analyzed all the pertussis notification cards received by the Department of Prevention of Area 1 of the Single Regional Health Authority (ASUR) Marche concerning the territory of the province of Pesaro-Urbino. The data sheets show the personal data (gender, age, nationality, residence) and clinical data (date of onset, symptoms, possible hospitalization).
Based on these data, the distribution of pertussis cases in the province over the last 5 years is reported and the average incidence of the disease are calculated for each year from 2012 to 2017 in the Province and in the three districts separately.

RESULTS

Between 2012 and 2017 there were 28 reported cases of pertussis (14 confirmed/14 possible) with a peak in 2016 (11 cases of which seven were in Urbino).
The Centers for Diseases control and Prevention (CDC) classification was used to define a case as confirmed (acute cough illness of any duration, with isolation of *B. pertussis* from a clinical specimen or cough illness lasting ≥2 weeks, with at least one of the following signs or symptoms: paroxysms of coughing; or inspiratory "whoop"; or post-tussive vomiting; or apnea with or without cyanosis and polymerase chain reaction positive for pertussis or contact with a laboratory-confirmed case of pertussis) or probable (suggestive clinical signs or symptoms in absence of laboratory or epidemiological confirm) [12].
The average age was 9.1 years (range 1 month-53 years), the median age of 4.11. Almost two thirds of cases (64.3%) were male. Twenty-five of the 28 patients were of Italian nationality, three were children born to immigrant parents (10%).
Almost all cases occurred in the age group 0-14 years (85.7%); only one case was reported in a 16-year-old boy, three cases occurred in adults.
In the first age group, infants were 9/24 (37.5%). In the same group 28.5% (8/24) were aged between 7 and 14 years. The personal and clinical characteristics of the 28 patients with whooping cough are summarized in Table 1. Figure 1 shows the distribution of cases by month and year. Two thirds of cases (67.8% occurred between April and September, and only 32.1% in the colder months).

The distribution by district was as follows: most of the cases had been reported in the district of Pesaro (46.4% of cases out of 28), followed by Urbino with 28.5% of reported cases and finally Fano with 25%. As for the average incidence of the Province in the studied periods, this has never exceeded the threshold of 2 cases per 100,000 inhabitants except for 2016 when it reached 4 (Figure 2). However, the number of cases in the districts of Fano has always remained below the 1 case/100,000 but an unexpected peak was recorded in the District of Urbino in 2016 with 8.2 cases/100,000 which also raised the average incidence of the entire province for that year (3.94 cases/100,000).

Regarding the district of Pesaro, we report an average incidence which is much higher than the national average in the years 2015 and 2016 (3.6

Table 1 - Clinical and epidemiological characteristics of patients.

Pts	*Reporting date*	*Age*	*Sex*	*Municipality*	*District*	*Nationality*	*Symptoms*
1	28/04/2012	16	M	Serrungarina	Fano	Italian	Cough >two weeks
2	20/06/2012	0	M	Fano	Fano	Not-Italian	Paroxysmal cough >two weeks
3	09/08/2013	6	F	Pesaro	Pesaro	Italian	Inspiratory hiss, paroxysmal cough
4	30/12/2013	0	M	Fano	Fano	Italian	Paroxysmal cough
5	03/01/2014	63	F	Fano	Fano	Italian	Cough >two weeks
6	12/02/2014	31	M	Fano	Fano	Italian	Cough >two weeks
7	23/05/2014	13	M	Fano	Fano	Italian	Cough >two weeks
8	30/05/2014	0	M	Pesaro	Pesaro	Italian	Paroxysmal cough >two weeks
9	11/08/2014	0	M	Pesaro	Pesaro	Italian	Paroxysmal cough
10	22/06/2015	0	F	Pesaro	Pesaro	Italian	Apnea, inspiratory hiss, Paroxysmal cough >two weeks
11	25/06/2015	2	M	Pesaro	Pesaro	Italian	Apnea, inspiratory hiss, Paroxysmal cough >two weeks
12	11/07/2015	42	F	Pesaro	Pesaro	Italian	Paroxysmal cough >two weeks
13	25/08/2015	4	M	Pesaro	Pesaro	Italian	Paroxysmal cough
14	25/08/2015	0	F	Pesaro	Pesaro	Italian	Paroxysmal cough
15	12/12/2015	4	F	Urbania	Urbino	Italian	Cough >two weeks
16	18/03/2016	0	M	Pesaro	Pesaro	Italian	Apnea, Paroxysmal cough
17	12/05/2016	0	M	Pesaro	Pesaro	Italian	Paroxysmal cough
18	06/06/2016	7	M	Pesaro	Pesaro	Italian	Paroxysmal cough >two weeks, Inspiratory hiss
19	04/07/2016	1	F	Sant'Ippolito	Fano	Italian	Cough >two weeks
20	12/07/2016	0	M	Fermignano	Urbino	Italian	Apnea
21	05/08/2016	8	M	Frontino	Urbino	Not-Italian	Paroxysmal cough
22	05/08/2016	8	M	Acqualagna	Urbino	Not-Italian	Paroxysmal cough
23	05/08/2016	14	M	Acqualagna	Urbino	Italian	Paroxysmal cough
24	22/08/2016	11	F	Acqualagna	Urbino	Italian	Paroxysmal cough
25	01/10/2016	8	M	Fermignano	Urbino	Italian	Cough >two weeks
26	23/11/2016	4	F	Urbino	Urbino	Italian	Paroxysmal cough >two weeks, vomiting
27	21/01/2017	5	F	Montelabbate	Pesaro	Italian	Paroxysmal cough >two weeks
28	30/06/2017	1	M	Pesaro	Pesaro	Italian	Paroxysmal cough >two weeks

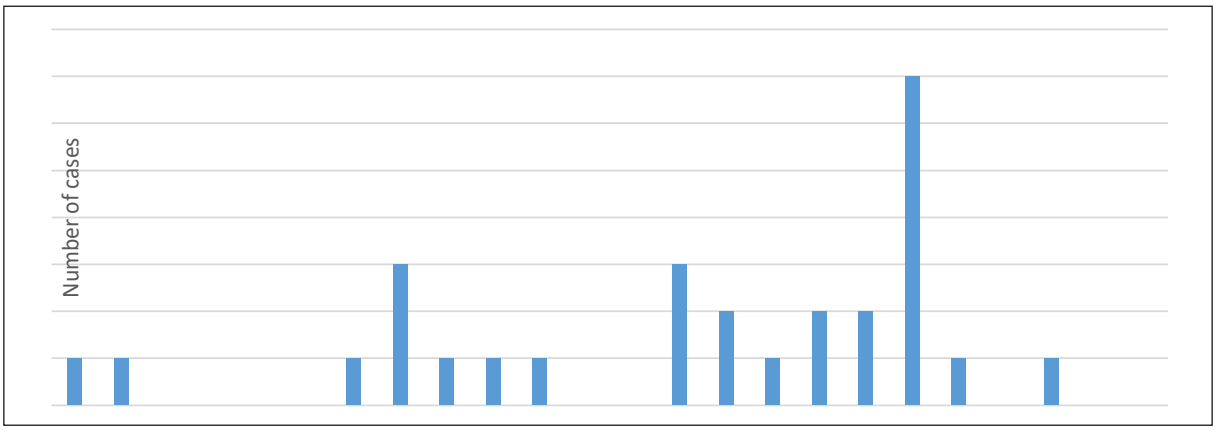

Figure 1 - Distribution of pertussis cases by date of symptoms onset.

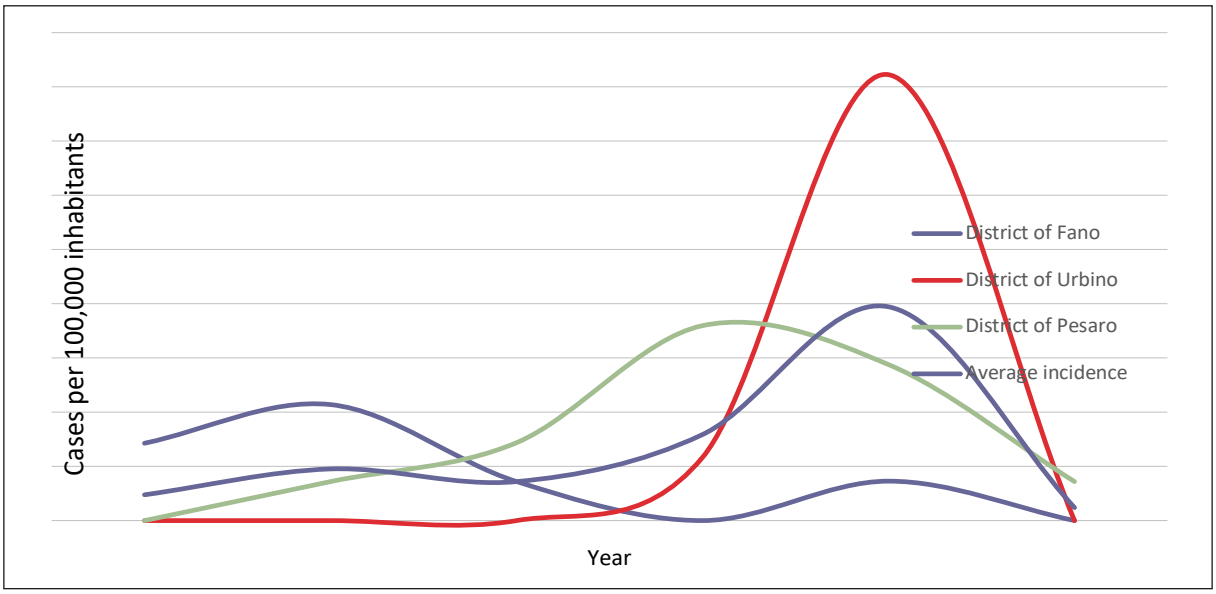

Figure 2 - Incidence of pertussis per 100,000 inhabitants in Pesaro-Urbino province, years 2012-2017.

and 2.9 cases/100,000 inhabitants respectively versus the Italian average of 0.8 and 1.6 for the same years).

Cough was present in 30 of the 31 patients (96.7%); in about half (51.6%) it had been present for more than 15 days; it had paroxysmal characters in 20 of 31 (64.5%); in 4 children it was associated with apnea and in one with vomiting. The complete symptoms are summarized in Table 1.

There were no deaths among the cases of pertussis described, although two infants both under the age of 3 months were hospitalized.

DISCUSSION

Despite the universal spread and great progress made in the field of vaccination, many serious infectious diseases, preventable through passive immunization, continue to be a major public health problem, even in high-income countries. Italy is going through a period where there is great suspicion of pediatric vaccination, despite the presence of scientific evidence that should dispel such doubts. This distrust can be easily understood by analyzing the trend of vaccine coverage data over

the last 10-15 years and the frequent and recent reports concerning the reappearance of preventable diseases through vaccinations such as measles and whooping cough.
The great reduction of vaccination coverage in the general population throughout the country in certain regions and provinces, such as in Pesaro-Urbino, is particularly serious and often linked to local conditions (known local people or mass-media influencing the population, the creation of pseudo-cultural movements against vaccination, and sometimes also the influence of doctors opposed to vaccination).
In this work we document an epidemic of pertussis occurring in a small town like Urbino, confirming the suspicion which has already been reported in a previous paper. An incidence of 9 cases/100,000 inhabitants in 2016 is certainly a noteworthy figure for a district that has around 85,000 inhabitants and a relatively low population density and a high old-age index (179 towards 154 of Italy).
Although there were not the striking peaks seen in Urbino, in Pesaro too, the district with the worst vaccine coverage, there were note a remarkable number of cases of pertussis both in 2015 and in 2016. The percentage of cases reported in foreign citizens of 10% is not significant and reflects the presence of immigrants in the Province. Our data confirm that there is no increased risk of infectious diseases among immigrants who often show higher vaccination coverage than natives both on arrival and for those born in Italy [13, 14].
Finally, the importance of older children (>6 years) is confirmed as a source of infection for newborns, due to the decay of immunity acquired with the vaccine and probably also to a less effective system of control of the population in which to perform vaccination calls. On 7 June 2017, law 119/2017 on vaccinations which made ten vaccinations compulsory including the vaccination against pertussis was published (15). Larger studies are needed to verify the effectiveness of this new Italian law, even if several positive reports have already been published (16-18).

Conflicts of interest
None

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