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Parental attitude towards mass antimicrobial prophylaxis during a school-associated pertussis outbreak

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SUMMARY

We describe parental attitude towards mass antimicrobial prophylaxis and adolescent booster vaccination to prevent pertussis. A survey was distributed to parents at a large suburban high school where an outbreak of pertussis was occurring. A total of 314 surveys were received among 450 distributed. If antimicrobial prophylaxis was recommended for all students and faculty as a method of controlling a pertussis outbreak in their child's school (i.e. mass antimicrobial prophylaxis), 40% of parents would have their child take the medication and 49% might have their child take the antibiotic but would first consult their child's physician. Having $\geqslant 2$ children attend the high school (OR 2·2, 95% CI 1·10–4·59) and generally favouring immunizations (OR 1·7, 95% CI 0·99–2·87) were predictors of likely compliance with mass antimicrobial prophylaxis. These findings underscore the importance of communicating the rationale of public health intervention efforts to physicians in order to help ensure their success.

INTRODUCTION

Mass antimicrobial prophylaxis is an important area of study for diseases such as pertussis, invasive meningococcal disease, bioterrorism agents such as anthrax and plague, and several other infectious diseases. Information that contributes to the successful use of mass antimicrobial prophylaxis may expedite outbreak resolution in a population.

Several pertussis outbreaks in schools have been reported [1–4] and mass antimicrobial prophylaxis has been used to successfully control a school-associated pertussis outbreak [1]. Control of a pertussis outbreak requires case identification and treatment, and prophylaxis of close contacts of the cases. School-associated pertussis outbreaks are difficult to contain, especially because pertussis vaccines have only recently been approved for use in the United States on or after the seventh birthday, leaving many adolescents at risk for pertussis due to waning immunity. Provision of antimicrobial prophylaxis to an entire school (i.e. mass antimicrobial prophylaxis) is generally not recommended, however, it may be considered if there are many laboratory-confirmed cases in multiple classes and a high degree of student interaction across classes and grades.

Diagnosis and treatment of cases is largely dependent upon physicians in the community in which the outbreak is occurring. Prophylaxis of close contacts is often undertaken as a cooperative effort between physicians and the local health department. Physicians may lack clinical experience with pertussis or may not maintain a high index of suspicion for disease, particularly in vaccinated adolescents and adults [5]. Moreover, physicians may be reluctant to prescribe antimicrobial prophylaxis for contacts of

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cases because of concerns about inappropriate use of antimicrobials. Because we rely upon physicians in the community for a significant proportion of outbreak control, it is important that public health officials and school administrators gain physician support of recommendations for antimicrobial prophylaxis in order to successfully curtail a pertussis outbreak. We describe a survey of parental attitudes towards antimicrobial prophylaxis administered during a school-associated pertussis outbreak.

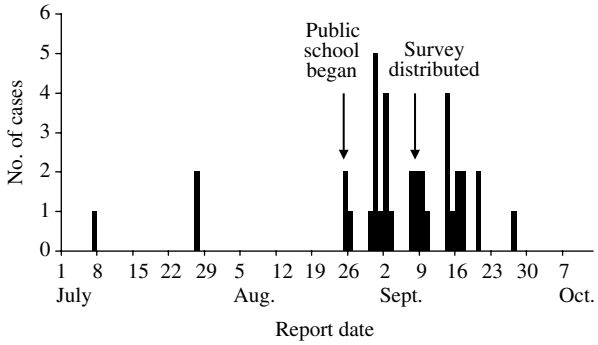

Fig. Epidemic curve of reported dates of adolescent cases of pertussis ($n = 37$).

METHODS

Outbreak

On 7 July 2004, the Village of Oak Park Department of Public Health (VOPDPH) was notified of a suspect case of pertussis. The patient was a 13-year-old girl with cough onset on 29 June and her family physician suspected pertussis based on the girl's clinical presentation. A nasopharyngeal specimen was positive by PCR testing on 9 July. The girl was treated with a 14-day course of clarithromycin, and her family and close contacts were recommended to obtain prophylaxis. VOPDPH sent letters to area health-care providers on 9 and 13 July, informing them of the pertussis case.

Almost 3 weeks later, on 27 July, a 46-year-old man was reported to VOPDPH as a pertussis case, based on cough duration and a positive PCR test. The case investigation by VOPDPH revealed that the two teenaged sons of the patient were symptomatic with cough, with onset dates before their father's. Both boys were treated for pertussis.

No further pertussis cases were reported until 1 month later. Between 25 August and 3 September, 18 cases were reported to VOPDPH, with 14 of these cases aged 10–19 years and half reporting attendance at the local public high school (Fig.). On 2 and 3 September, VOPDPH, in cooperation with the high school, sent letters to the homes of all students to alert parents of the presence of the pertussis outbreak and to inform them of how and when to seek medical attention for their children. Two additional letters were sent to area health-care providers in September. VOPDPH staff continued interviewing cases, verifying laboratory reports, and determining close contacts for each case. A case of pertussis was defined as a cough illness lasting $\geqslant$14 days. Close contacts were then contacted by phone or by letter. Eighty-eight percent (29/33) of adolescent cases (aged 10–19 years) with known vaccination status had received the full series of five doses of pertussis-containing vaccine. A total of 100% (33/33) had received at least the primary series of three doses of pertussis-containing vaccine. Four adolescent cases had unknown vaccination history. Ongoing communications between VOPDPH and the Illinois Department of Public Health (IDPH) during this time addressed prophylaxis, including the possibility of providing mass antimicrobial prophylaxis to all students, faculty, and staff at the high school. On 9 September members of the Rapid Response Team (RRT) – an outbreak investigation team – from IDPH, in cooperation with VOPDPH, arrived at the high school to survey parents.

Survey

The purpose of the survey was to estimate the prevalence of students with a cough illness compatible with pertussis, assess the degree of parental support for mass antimicrobial prophylaxis should it become necessary during the course of the outbreak, determine what proportion of medical expenses related to the control of a pertussis outbreak would be covered by insurance among the student population, and assess the degree of parental support for an adolescent pertussis booster vaccine [Boostrix® (GlaxoSmith-Kline Biologicals, Rixensart, Belgium) and Adacel™ (Sanofi Pasteur, Toronto, Ontario, Canada) had not been approved at the time of our survey]. In order to assess parental attitude about an adolescent booster vaccine, should one become available, compared to prophylaxis to control a pertussis outbreak parents were asked, 'If your child was exposed to a person with pertussis and you could have your child take antibiotics as preventive treatment (providing a few weeks of protection) or a pertussis booster vaccine

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(possibly providing years of protection), which would you choose?'

Members of the RRT distributed 450 pertussis surveys to a convenient sample of parents during an evening curriculum activity at a large suburban community high school where an outbreak of pertussis was occurring. Surveys were randomly distributed to one parent or guardian per household as they arrived at the high school and collected their schedule for the evening, were self-administered, and returned during the curriculum activity. The student population was estimated to be 3087. Mass antimicrobial prophylaxis of the high school had been considered as a possible way of controlling the outbreak because of how disruptive and tedious contact tracing and prophylaxis of close contacts had become [1]. One week prior to distributing the survey, a general letter had been sent by VOPDPH to parents of all high-school students to inform them of the current pertussis outbreak. A more detailed letter was sent to parents of students that were identified as close contacts of pertussis cases, recommending that their child receive antimicrobial prophylaxis to prevent pertussis. Students may have received multiple letters if they shared a classroom with several cases with variable dates of diagnosis. At this time, all classroom contacts were considered potential close contacts (a more conservative approach was later adopted). The survey case definition, a cough illness lasting $\geqslant$14 days since 1 June 2004, was based on the CDC outbreak case definition [6].

Statistical analyses

We used bivariate and multivariate analysis to identify the predictors of a parent having their child comply with recommendations for mass antimicrobial prophylaxis during a pertussis outbreak. SAS version 8e for Windows (SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses.

RESULTS

A total of 314 surveys were received (70% response rate). With the exception of ethnicity, no more than 7% of responses were missing for any variable. Most survey respondents were white (75%, 231/307), non-Hispanic (97%, 263/272), aged 40–59 years (92%, 267/291), and had at least a college degree (90%, 276/308). Twenty-one percent (64/307) of survey respondents were black, 4% (12/307) Asian, and 2% (5/307) other race; 3% (8/272) were Hispanic.

Eighty-three percent (262/314) of survey respondents had one child in their household that attended the high school, 16% (50/314) had two children, and 1% (2/314) had three children. Ninety-four percent (293/312) of parents had received at least one letter from VOPDPH notifying them of the current outbreak and 32% (98/309) of parents noted that their child was identified as a close contact of a pertussis case. Seven parents had a child that was diagnosed with pertussis since 1 June 2004. Eighteen additional parents had a child with a cough illness lasting $\geqslant$14 days since 1 June 2004; 16 out of 18 (89%) had already visited a physician regarding their illness. Based on the proportion of cases identified by the survey, among all surveys completed (18 children of the 314 surveys completed) and the total student population ($n=3087$), an estimated 177 high-school students may have met the pertussis outbreak case definition. Health insurance would not cover the cost of their child's physician visits according to 10% of parents surveyed and antibiotics according to 11% of parents surveyed.

Although 64% (192/302) of parents generally favoured the use of immunizations, such as vaccines against pertussis, a substantial minority (33%, 99/302) opposed such immunizations. Four percent (11/302) of parents neither favoured or opposed immunizations, but expressed concerns about the safety and efficacy of the DTaP pertussis vaccine. If local public health authorities recommended antimicrobial prophylaxis for all students in their child's classroom following exposure to a pertussis case, 60% (183/306) of parents would have their child take the prophylactic treatment, 34% (104/306) might have their child take the antibiotic but would first consult their child's physician, 3% (8/306) would have their child take it if the antibiotic was provided free of charge, 3% (8/306) chose an option other than the available responses, and 1% (3/306) would not have their child take it. Given a similar situation wherein antimicrobial prophylaxis was recommended for the entire student body and faculty as a method of controlling a pertussis outbreak in their child's school (i.e. mass antimicrobial prophylaxis), 40% (121/299) of parents would have their child take the prophylactic or therapeutic treatment, 49% (147/299) might have their child take the antibiotic but would first consult their child's physician, 4% (11/299) would have their child take it if the antibiotic was provided

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Table. *Descriptive statistics summarizing two parental responses* (n=268) to the question: If preventive antibiotic treatment was recommended for every high-school student and faculty member, regardless of whether they were ill or well as a method of controlling a pertussis outbreak at the school, how would you respond?*

Characteristic	I would have my child take it *n* (%)	I would first consult my child's physician *n* (%)	OR (95% CI)
Mean age (overall, 51 years)	52	51	—
Number of children			
1	96 (42)	130 (58)	1·0 (—)
⩾2	25 (60)	17 (40)	2·0 (1·02–3·89)
Race†			
White	82 (42)	115 (58)	0·52 (0·29–0·92)
Black	32 (59)	22 (41)	2·0 (1·09–3·69)
Asian	2 (25)	6 (75)	0·38 (0·08–1·96)
Insurance covers antibiotics			
Yes	106 (46)	125 (54)	1·0 (—)
No	12 (48)	13 (52)	1·1 (0·48–2·49)
Insurance covers physician visits			
Yes	104 (44)	132 (56)	1·0 (—)
No	14 (56)	11 (44)	1·6 (0·70–3·71)
Education			
Some high school or High-school graduate	17 (57)	13 (43)	1·0 (—)
College, graduate school, or professional school graduate	102 (44)	130 (56)	0·60 (0·28–1·29)
Attitude			
Oppose immunizations	34 (39)	53 (61)	1·0 (—)
Favour immunizations	87 (52)	81 (48)	1·7 (0·99–2·83)

OR, Odds ratio; CI, confidence interval.

* Other possible responses included having their child take prophylaxis if it were free or not having their child take prophylaxis; however, the majority of responses resided in one of the two categories listed.

† Each is compared to all other races combined.

free of charge, 4% (11/299) chose an option other than the available responses, and 3% (8/299) would not have their child take it. If their child was exposed to pertussis and an adolescent booster vaccine was available, the majority of parents would choose to have their child receive a booster vaccine (57%, 174/303) rather than have their child take antimicrobial prophylaxis (17%, 51/303). Twenty-six percent (78/303) were unsure.

In a bivariate analysis, having ⩾2 children attend the high school [odds ratio (OR) 2·0, 95% confidence interval (CI) 1·02–3·89] and parental black race (OR 2·0, 95% CI 1·09–3·69) were the strongest predictors of having their child comply with mass antimicrobial prophylaxis rather than perhaps having their child comply with mass antimicrobial prophylaxis but first consulting their child's physician. Higher education (OR 0·60, 95% CI 0·28–1·29) and parental white race (OR 0·52, 95% CI 0·29–0·92) were negatively associated with a parent having their child comply with mass antimicrobial prophylaxis, although only parental white race was statistically significant. We did not find a significant association between parental education level and attitude towards immunization. Lack of health insurance that covers antibiotics or physician visits and generally favouring immunizations were associated with a parent having their child comply with mass antimicrobial prophylaxis, although neither was statistically significant (Table).

We fit a logistic regression model including predictors found to be significant in the bivariate analysis and other variables that were associated with a parent's decision to have their child comply with

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mass antimicrobial prophylaxis. After adjustment, having ⩾2 children attend the high school (OR 2·2, 95% CI 1·10–4·59) remained a significant predictors of a parent having their child comply with mass antimicrobial prophylaxis rather than perhaps having their child comply with mass antimicrobial prophylaxis but first consulting their child's physician. Generally favouring immunizations (OR 1·7, 95% CI 0·99–2·87) was marginally significant and was retained in our final model.

DISCUSSION

These results indicate that a substantial number of high-school students were experiencing a cough illness compatible with pertussis at the time of this survey. Most of these students had already visited a physician regarding their illness. If mass antimicrobial prophylaxis was needed to control the high-school pertussis outbreak and the physician community supported this recommendation, these survey results suggest that 90% of the parents would comply. However, if physicians in the community opposed this recommendation, fewer than half of the students would be likely to receive prophylaxis, which may threaten the success of the mass antimicrobial prophylaxis effort. Multivariate analysis revealed that parents with ⩾2 children attending the high school were more likely to have their child take antimicrobial prophylaxis, as were parents who generally favoured immunizations. Perhaps having ⩾2 children potentially exposed to pertussis leads to greater concern among these parents, thereby increasing their likelihood of complying with prophylaxis. Similarly, parents that generally favour immunizations may be more trusting of public health interventions.

Approximately 11% of parents reported that most of their children's antibiotics were not covered by health insurance. This type of information may be helpful in predicting the amount of antibiotic that would need to be purchased to ensure complete coverage of the student population. Prophylaxis for all students and faculty with azithromycin and erythromycin would have cost approximately $151 481 and $64 976 respectively [7]. The anticipated cost of antibiotics for the uninsured parents would, therefore, be approximately $15 629 and $6704 respectively based on a 5-day regimen of azithromycin and a 14-day regimen of erythromycin as recommended [8]. Although these and the other results from our survey are not generalizable to other schools, such information is important to gather or estimate before launching a mass vaccination or mass antimicrobial prophylaxis effort. This study was limited in that we used a convenient sample and survey questions asked about hypothetical scenarios. Ideally, the faculty should also be surveyed because they would also need to partake in mass antimicrobial prophylaxis.

It is also of importance that the survey results may change depending on the stage of the outbreak. For example, early in a recognized outbreak parental concern regarding pertussis may be higher, therefore prophylaxis could be met with less resistance. Later, after some parents have received multiple notifications that their child has been exposed to pertussis and requires prophylaxis (>4 for some parent households), enthusiasm for mass antimicrobial prophylaxis may wane and confidence in the local health authority may also be undermined. Furthermore, the estimated number of students meeting the outbreak case definition derived from the high-school survey may overestimate the true number of pertussis cases because the case definition specifies that the illness should not be attributable to other causes; information needed to make that determination was not included in the survey. However, the number may underestimate the true number of pertussis cases because the survey did not ask about symptoms characteristic of the catarrhal phase of illness.

This survey demonstrated the potential impact that local physician support may have on a mass antimicrobial prophylaxis effort. These findings underscore the importance of communicating the rationale of public health intervention efforts to physicians in order to help ensure their success. Physician knowledge of pertussis disease and public health protocols may be poor [9] and therefore it cannot be assumed that they will support local health department efforts to control pertussis. Health departments should keep local physicians current on methods to prevent pertussis and the rationale for using these methods. The survey also demonstrated that more than half of the parents surveyed had a favourable opinion regarding the prospect of a novel pertussis vaccine, which is important given that an adolescent booster vaccine (Boostrix; GlaxoSmithKline Biologicals) and a booster vaccine for use in adults (Adacel; Sanofi Pasteur) have been licensed by the FDA. Use of such a vaccine for pertussis outbreak control has yet to be established. Mass prophylaxis in a school setting has unproven efficacy and, therefore,

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its use to control an outbreak should be circumspect. However, with rising rates of reported cases of pertussis, especially in the adolescent population it is likely that this issue will continue to arise. More than 40% of parents surveyed during this outbreak were either unsure about accepting a pertussis booster vaccine or were against it. It is likely that they would consult with their physician if a local health jurisdiction recommended its use. Further data on the acceptability and efficacy of the vaccine as part of outbreak control are needed.

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DECLARATION OF INTEREST

None.

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