

# Pertussis Infection in a Baccalaureate Nursing Program: Clinical Implications, Emerging Issues, and Recommendations

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## abstract

Pertussis is a significant public health problem with a dramatic rise in reported cases. Academic and clinical nursing educators are challenged to develop policies based on evolving national immunization guidelines. Of relevance to clinical educators, several outbreaks involving health care facilities and universities have been reported in the past few decades because of failure to adequately recognize pertussis infection and treat disease spread among adults and lack of control measures. The purpose of this article is to present information about pertussis transmission in a baccalaureate nursing program, outline actions taken, and explore emerging issues and recommendations.

*J Contin Educ Nurs* 2008;39(9):419-426.

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Despite widespread immunization of children in the United States, pertussis is a significant public health problem with a dramatic rise in reported cases since the 1990s. A considerable number of pertussis infections occur among immunized adolescents and adults due to declining levels of protective antibodies (Dworkin, Spitters, & Kobayashi, 1998; Ward et al., 2005). Clinician recognition of pertussis in adolescents and adults is crucial. Educators and administrators in both hospitals and nursing schools are challenged to develop policies based on rapidly evolving national recommendations. Adolescents and adults may infect infants, who are much more likely to become severely ill and die. The medical and nonmedical (e.g., missed work) costs of adult pertussis are significant.

Standardization of vaccination requirements for prelicensure nursing students is an arena of ongoing assessment and emerging recommendations. Community standards regarding mandatory influenza vaccinations and meningitis vaccinations for nursing students vary nation-

ally (Goetz, Yu, & Muder, 1992; Hussain, 2005). The importance of adult pertussis vaccination surfaced from necessity at a school of nursing in Colorado. Many insights and recommendations resulted from this experience of pertussis infection in an academic setting. The purpose of this article is to present information about pertussis transmission in a baccalaureate nursing program in a Colorado school of nursing, outline actions taken, and explore emerging issues and recommendations.

## CASE STUDY OF PERTUSSIS INFECTION

Large classes are emerging as the norm in many prelicensure nursing programs in the United States, in response to the national nursing shortage and an influx of applications to nursing programs. Thus, it was not unusual in the fall of 2005 to find 160 students filling a lecture hall for a nursing fundamentals class at a school of nursing in Colorado. The class included a weekly laboratory in which small groups of 16 students and two laboratory instructors practiced fundamental nursing skills.

During the initial weeks of this 6 hours per week lecture, students and faculty noted a student whose coughing became persistent. This student's laboratory group and instructors were particularly concerned about the transmission of an infection because of the duration of the cough over weeks, the small classroom and laboratory spaces, and shared laboratory equipment. Course faculty strongly advised this student to seek diagnostic-based care from a primary care provider. This student did indeed pursue care from a primary care provider, but

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SIDEBAR 1  
**PERTUSSIS NOTIFICATION**

Pertussis Disease Alert  
Important Notice

A person at the \_\_\_\_\_ School of Nursing has been diagnosed with and treated for pertussis, also known as whooping cough. Pertussis is a contagious illness that is spread when an infected person sneezes or coughs and another individual breathes in the bacteria. Symptoms of pertussis usually develop 7 to 10 days after exposure but can develop from 4 to 21 days after exposure.

Students and staff with a cough should inform their physician of the possible exposure to pertussis and be examined. If your physician suspects pertussis, you should be tested (PCR is the preferred test) and receive an appropriate antibiotic for pertussis. Students or staff diagnosed with pertussis cannot return to school until completing 5 days of an appropriate antibiotic. Nursing students should be particularly cautious about early pertussis symptoms if assigned to patient care areas.

Pertussis begins with a cough that progressively becomes more severe until the person develops coughing fits. In between coughing fits, the individual may look and feel fine. Vomiting, breathlessness, a change in facial color, and/or a whooping sound may follow the coughing fits.

Pertussis is more severe in young children, the elderly, and immunocompromised individuals.

In summary, we recommend the following:

- Contact your health care provider if you have a cough.
- If diagnosed with pertussis, complete a course of an appropriate antibiotic for pertussis.
- Individuals diagnosed with pertussis will be excluded from work or school until they have completed 5 days of an appropriate antibiotic.

If you have any questions, please contact \_\_\_\_\_ at Denver Public Health or \_\_\_\_\_, School of Nursing Administrator.

was never tested for pertussis. She was provided an inhaler for relief of presenting symptoms. After approximately 4 weeks, one of the student's laboratory instructors presented with a runny nose and a persistent cough. The laboratory instructor sought immediate care from a primary care provider. The results of a nasal swab confirmed the presence of pertussis.

### **PERTUSSIS TRANSMISSION RISK AND INSTITUTIONAL RESPONSIBILITY**

Ascertaining the precise epidemiology of the transmission of pertussis among this large group of students

was difficult because of the irregular unfolding of cases over time. Some students presented with symptoms and went to their primary care provider for a nasal swab. Other students chose not to seek health care. Reports of confirmed cases were directed to different course faculty throughout the semester. The first confirmed case was the laboratory instructor. The next confirmed case, 3 weeks later, was a student who was present in the large lecture hall, but was not in the laboratory group with the original confirmed case. Later in the semester, another laboratory instructor was classically symptomatic (cold-like symptoms and cough). The course faculty waited for the results of this laboratory instructor's nasal swab before eliminating her laboratory students as close contacts. The variable intervals between confirmed cases contributed to the difficulty determining the most prudent course of action.

### **Student and Clinical Facility Notification**

The presence of a communicable disease is particularly important in the context of clinical nursing education because of how closely nursing students interact with immunologically vulnerable populations in the course of providing care. This nursing fundamentals class culminated in a 16-hour clinical rotation in local long-term care centers. The 160 students were divided among 15 clinical sites. With the presence of two confirmed cases of pertussis, the faculty's immediate concerns were twofold: how to best manage and advise students who could be considered close contacts in the didactic and skills laboratory settings, and how to avoid exposing residents of the long-term care centers in the approaching clinical rotation. These urgent matters guided the faculty in the many levels of their response.

### **Information Gathering and Resource Development**

Once notification of a confirmed case of pertussis was received, the faculty contacted the local Department of Health (DOH). The DOH provided well-defined Centers for Disease Control and Prevention (CDC) guidelines for treatment and prophylaxis of confirmed and highly suspicious presentations of pertussis symptoms (CDC, 2000). However, at the time the case was reported, the current pertussis vaccination had only recently been approved for use by the Food and Drug Administration (FDA) (Walsh, 2005). In addition, no policy existed at the school of nursing regarding protocol for students or faculty with a confirmed case of pertussis.

### **COMMUNICATING DECISIONS**

The absence of conclusive national and institutional guidelines resulted in confusion regarding what steps

to follow to ensure the safety of the students, faculty, and staff and a susceptible patient population. There was a high level of urgency to communicate the information because of the necessity to begin prophylactic treatment immediately to protect the health of those exposed and reduce further transmission. Based on the information given by the local DOH, the decision was made to inform the students, faculty, and staff that a confirmed case of pertussis had been reported. Information was disseminated through verbal announcements in class, via e-mail, and in a written letter distributed to students (Sidebar 1). The long-term care facilities were notified of students' exposure to pertussis, and were informed that further information would be provided. Ultimately, the decision was made to cancel the first week of a 2-week clinical rotation. This decision was based on a pending nasal swab result from a symptomatic laboratory instructor. The faculty felt strongly that the potential risk of pertussis exposure in a highly susceptible population far outweighed student learning in an 8-hour shift at the long-term care facilities. Faculty provided a written assignment to replace the cancelled clinical hours.

### Student Reaction

Student reactions to the announcement of the case of pertussis were mixed. Because the students were in close contact with the symptomatic student and instructor in the laboratory as well as the lecture hall, many were not surprised by the announcement and were readily compliant with the CDC guidelines for prophylaxis. Other students expressed dismay about insurance co-pays, medication costs, and the inconvenience of having to contact their primary care provider. Students were also concerned that the school of nursing did not have a policy in place for the emerging situation. Special cases involved extra attention: a pregnant student who could not take the antibiotic, a student with religious constraints regarding travel required to procure the medication, and students and instructors who had philosophical issues related to antibiotic treatment as well as immunization protocols.

### Legal Implications

An ad hoc committee of faculty members addressing the pertussis infection sought legal counsel regarding issues of liability and privacy. Following CDC protocol, the local DOH requested the names of all exposed students so that follow-up calls could be made. To protect the privacy of the students under the Family Educational Rights and Privacy Act (FERPA), the school of nursing was unsure if names could be released. Because the uni-

SIDEBAR 2  
**RECORD OF PRE-ROTATION MEDICAL CARE**

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Confirmation of Antibiotic Therapy

I have received information that I have been in close contact with a person who has a confirmed case of pertussis.

I understand that the recommended treatment in this situation, as prescribed by the Colorado Department of Public Health, is a course of antibiotic therapy.

I understand that in order to participate in the long-term health care facility clinical I must complete the recommended antibiotic therapy.

I have been in contact with a health care provider and received the appropriate antibiotic therapy.

I will have **completed** the prescribed course of antibiotic therapy by the following date: \_\_\_\_\_.

Date: \_\_\_\_\_

Student signature: \_\_\_\_\_

Please print name: \_\_\_\_\_

versity had little experience with protocol in this situation, legal counsel researched the precedence in similar cases. Ultimately, it was determined student and instructor names could be released because pertussis was a public health threat.

Legal counsel assisted in drafting a "Confirmation of Antibiotic Therapy" document for the students. The document, which required a student signature, stated the student had been informed of the exposure to pertussis and had taken the appropriate medication according to the CDC guidelines. This document clearly assigns student responsibility for obtaining appropriate, pre-rotation medical care and provides a written record for the school of nursing (Sidebar 2).

### LESSONS LEARNED ABOUT PERTUSSIS AND COMMUNICABLE DISEASE

There has been a significant rise in adult and adolescent pertussis cases in recent years and pertussis has become more common in the past two decades than previously acknowledged (Cherry, 1999; Cherry, Grimprel, Guiso, Heininger, & Mertsola, 2005; Dworkin et al., 1998; Edwards & Freeman, 2006; Josephs, 2000; LaPorte, 2002; Mitchell, Liddell, & Criggie, 2000; Schabas, 2000; Tan, Trindade, & Skowronski, 2005).

Diagnosis is challenging in adult cases because symptoms mimic the common cold and frequently occur without the distinctive whooping cough (Cherry, 2005; Deville et al., 1995; Dworkin et al., 1998; Edwards & Freeman, 2006; Josephs, 2000; Mitchell et al., 2000). Mink et al. (1992) examined possible pertussis infection in university students with persistent cough lasting 6 days or more. Thirty-four (26%) of 130 students studied during a 30-month period had evidence of recent infections with pertussis. Significantly, disease presentations of the students with pertussis were similar to the illnesses of students without pertussis. Findings from this study suggest that adult populations, such as large student groups, are challenging to diagnose and may be reservoirs for pertussis outbreaks; therefore, booster vaccines are indicated to reduce transmission from undetected adolescent and adult pertussis infection (Mink et al.). Additionally, adult pertussis can lead to severe complications such as pneumonia and cracked ribs from coughing, particularly in susceptible populations.

### **Pertussis Outbreaks in Health Care Facilities**

Several outbreaks involving health care facilities have been reported in the past few decades, which is relevant to clinical health care education settings (Broome et al., 1981; Christie et al., 2001; Haiduven, Hench, Simpkins, & Stevens, 1998; Kurt, Yeager, Guenette, & Dunlop, 1972; Linnemann, Ramundo, Perlstein, Minton, & Englander, 1975; Swinker, 1997; Weber & Rutala, 1994; Wright, Edwards, Decker, & Lamberth, 1994). These outbreaks occurred for three main reasons: (1) failure to adequately recognize and isolate infants and children with pertussis infection; (2) failure to recognize and treat disease spread in adults, particularly health care providers; and (3) lack of control measures in place. Pertussis control measures typically involve clear standards regarding health care provider work restriction, isolation measures, and standard prophylaxis to decrease institutional outbreaks (Weber & Rutala).

### **Mandating Prophylaxis and Immunizations**

Many questions emerge in schools of nursing and in other health care settings because of the absence of clear standards related to mandatory prophylaxis, necessary isolation, and immunization requirements. For example, costs incurred by students associated with primary care provider visits and treatments must be balanced with the need to protect susceptible populations in health care agencies where nursing students are placed for their clinical education.

The risk and spread of vaccine-preventable diseases

among nursing students and health care providers who have philosophical and religious exemptions from immunization must be considered. Although state vaccine exemption regulations vary and state academic centers may reflect state laws, clinical agencies hosting nursing students may not accept students with inadequate communicable disease titers. Colorado is one of the few states that allows both religious and philosophical exemptions by parent or guardian signature on a statement that declares adherence to religious or personal opposition to immunization. As a result, the percentage of personal exemptions in Colorado was more than twice the national average in the mid-1990s (Feikin et al., 2000).

Clinicians, educators, and administration in health care facilities must be knowledgeable about regional prevalence rates and public health risk when developing policies. In a population-based, retrospective cohort study of measles and pertussis cases among children aged 3 to 18 years in Colorado from 1987 to 1998, Feikin et al. (2000) examined the risk of pertussis among exemptors (children without pertussis immunization) compared with vaccinated children. Exemptors were six times more likely to acquire pertussis than vaccinated children. Schools with pertussis outbreaks had more exemptors (mean, 4.3% of students) than schools without outbreaks (1.5% of students;  $p = .001$ ). This study suggests the risk of pertussis is increased in personal exemptors; therefore, legislators and public health policymakers should recognize the potential impact of exemptors in pertussis outbreaks (Feikin et al.). Nursing educators play a critical role in raising public awareness of the risks involved in exemptions to vaccinations.

### **Seeking Balance With Diverse Perspectives**

Although perspectives might differ when developing immunization and prophylactic treatment policies, it is imperative that nursing students, staff, educators, and policymakers be knowledgeable about the latest CDC recommendations and weigh competing perceptions of risks and benefits. The prevalence and effect of the disease are often weighed against the perceived likelihood of an adverse reaction to vaccination or treatment. Over time, the success of immunization against vaccine-preventable diseases has shifted the perception of risk from the diseases to the vaccines themselves. Despite concerns regarding the safety of vaccines against pertussis, studies have proven that serious adverse events are rare (Cherry, 2005; Ward et al., 2005).

The decision to forgo vaccination or prophylactic antibiotics must balance individual rights with social responsibility and health care provider obligations to cli-

ent health and safety. Pertussis, rapidly spread in close contact, is frequently underdiagnosed in adults, and the health of any individual in a school, community, or health care facility is dependent on the health of the rest of that population. As a result of exposure and capacity to spread pertussis to vulnerable populations, health care providers, including nursing students and clinical and academic educators, are obligated to understand the risks and benefits of vaccination and prophylactic antibiotics. Until vaccines are completely effective or eradicate the disease, vaccine exemptors have the potential to precipitate community-wide outbreaks of vaccine-preventable diseases such as pertussis.

### **NEW VACCINES, RECOMMENDATIONS, AND FUTURE DIRECTIONS**

The FDA licensed two new formulations of acellular pertussis vaccines in the United States for adolescent and adult use in May and June 2005, respectively. In the spring of 2005, Boostrix (GlaxoSmithKline Biologicals, Philadelphia, PA) was licensed for adolescents and Adacel (Sanofi Pasteur, Swiftwater, PA) was licensed for adults younger than 65 years. With the advent of new adult and adolescent pertussis vaccines, it is important to note that the Advisory Committee on Immunization Practices (ACIP) of the CDC continues to recommend that children be vaccinated against diphtheria, tetanus, and pertussis at 2, 4, 6, and 15 to 18 months of age and at 4 to 6 years of age. DTaP is the vaccine used for children younger than 7 and Tdap is the newly licensed adolescent and adult booster against tetanus, diphtheria, and pertussis (Kretsinger et al., 2006).

In a recent large randomized, controlled, double-blind study with adult subjects between the ages of 15 and 65 years, Ward et al. (2005) concluded that the acellular pertussis vaccine is safe, immunogenic, and protective among adolescents and adults. Therefore, its routine use may reduce the overall disease burden and transmission to children (Ward et al.). Contraindications to Tdap include anaphylaxis to vaccine components and a history of encephalopathy within 7 days of administration of a pertussis vaccine. Contraindications include individuals diagnosed with Guillain-Barré syndrome within 6 weeks after a previous dose of a tetanus toxoid-containing vaccine. Precautions are needed for adults with unstable neurological conditions and those who have a moderate-to-severe acute illness. Although considered to be ultimately cost-effective by preventing pertussis infections, adding a pertussis component to the tetanus and diphtheria vaccine is expected to increase the vaccine cost by \$15 to \$20. The recent availability of affordable and safe

pertussis vaccines, medical costs of a prolonged pertussis infection, and protection of infants and the elderly from the disease support the immunization of adults and adolescents against pertussis (Dworkin et al., 1998; Lee et al., 2005; Ward et al.).

### **IMPLICATIONS FOR CONTINUING EDUCATION**

Knowledge gained in the academic setting is wide ranging and applicable to continuing nursing education in general. The case study in this article describes the nature of pertussis outbreaks, corresponding issues, and recommendations for nursing educators in a variety of health care settings. This information, delivered in varying levels of complexity, is appropriate for infection control departments, occupational health staff, nursing educators, and administrators.

Further discussion is needed to ensure that academic and clinical policy decisions regarding mandatory immunizations and prophylaxis are made on the basis of current, accurate national recommendations, in-depth understanding, and sensitivity to individual beliefs. Given the recent increased rates of vaccine-preventable diseases across the United States, nursing educators can anticipate upcoming changes in lifespan immunization recommendations. For instance, in June 2005, ACIP reviewed national pertussis cases and available vaccinations for adolescents in the United States, and made provisional recommendations to replace the adolescent immunization of tetanus and diphtheria with the Tdap vaccine. As a result of high incidences of pertussis reported in several states, measures to increase active surveillance of adolescent pertussis were instituted.

On October 26, 2005, ACIP decisively recommended routine use of a single dose of Tdap for adults 19 to 64 years old to replace the next booster dose of tetanus and diphtheria toxoids vaccine (Td) (Broder et al., 2006; CDC, 2005). Tdap is recommended for adults prior to the usual 10-year tetanus and diphtheria vaccine interval to protect them against pertussis and for adults who have close contact with infants younger than 12 months. Ideally, Tdap ought to be given at least 1 month before beginning close contact with infants. Pregnancy is not a contraindication to Tdap or Td. If a woman is pregnant and received the last Td vaccination 10 or more years previously, the CDC currently recommends administration of Td during the second or third trimester. If the woman received the Td vaccination less than 10 years previously, Tdap should be administered during the immediate postpartum period (Murphy et al., 2008).

Health care providers are at high risk for pertussis due to close patient contact and may be a mode of transmis-

TABLE  
SUMMARY OF RECOMMENDATIONS FOR PERTUSSIS IMMUNIZATION

Dose	Customary Age for Routine Administration	Comments
Primary 1 (DTaP)	2 months	Minimum age or interval during outbreaks: 6 weeks old
Primary 2 (DTaP)	4 months	Minimum age or interval during outbreaks: 4 weeks after first dose
Primary 3 (DTaP)	6 months	Minimum age or interval during outbreaks: 4 weeks after second dose
First booster (DTaP)	15 to 18 months	Minimum age or interval during outbreaks: 6 months after third dose but not before 12 months old
Second booster (DTaP)	4 to 6 years	The final dose of the DTaP series
Adolescent dose/booster (Tdap)	Minimum age for Boostrix (GlaxoSmithKline) is 10 years Minimum age for Adacel (Sanofi Pasteur) is 11 years	Adolescents aged 11 to 18 years should receive a single dose of Tdap instead of Td for booster immunization if they have completed the recommended childhood DTP/DTaP vaccination series; the preferred age for Tdap vaccination is 11 to 12 years Adolescents aged 13 to 18 years who received Td but not Tdap are encouraged to receive a single dose of Tdap with an interval of at least 5 years between Td and Tdap to reduce risks of local or systemic reactions; however, the benefit of Tdap at a shorter interval to protect against pertussis generally outweighs the risk of complications
Adult dose/booster (Tdap)	Adacel is licensed for use in adults younger than 65 years	A one-time dose of Tdap should replace tetanus and diphtheria vaccine (Td) for any adult younger than 65 years either as part of a primary series or as a booster A one-time administration of one dose of Tdap with an interval as short as 2 years from a previous Td vaccination is recommended for postpartum women, close contacts of infants younger than 12 months, and all health care workers with direct patient contact For persons 65 years or older, neither Tdap product (Boostrix or Adacel) is licensed, so Td should be used in this age group whenever needed every 10 years

*Note.* The recommended immunization schedules are approved by the Advisory Committee on Immunization Practices (ACIP) ([www.cdc.gov/vaccines/recs/acip](http://www.cdc.gov/vaccines/recs/acip)), the American Academy of Pediatrics ([www.aap.org](http://www.aap.org)), and the American Academy of Family Physicians ([www.aafp.org](http://www.aafp.org)). This schedule indicates immunization recommendations at the time of publication. The authors recommend that providers regularly consult the ACIP for detailed, updated recommendations. Additional information about the vaccines in this schedule and extent of available data is also available at [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines) or from the CDC-INFO Contact Center at 800-CDC-INFO (800-232-4336) in English and Spanish, 24 hours a day, 7 days a week.

sion. It is not surprising that ACIP extended the recommendations in February 2006, advocating that health care providers in direct patient contact receive a single dose of Tdap as soon as possible, if not administered previously. Moreover, ACIP recommended that hospitals and ambulatory care settings provide Tdap for health care personnel and employ approaches that maximize vaccination rates, such as education about the benefits of vaccination, convenient access, and provision of Tdap at no charge (CDC, 2006). A summary of CDC and ACIP recommendations for lifespan pertussis immunization is presented in the Table.

Nursing staff should be able to identify pertussis, particularly in adult patients and coworkers. It is recommended that policy development and provider education be a collaborative activity among infection control, occupational health, and continuing nursing education departments. Pertussis policies and education can serve

as the template for many other communicable diseases in the future. The staff educator, who is often an advanced practice nurse, is well positioned to coach nursing staff, model early identification of cases, proactively develop policies relating to vaccine-preventable illness, and influence health care policy related to reimbursement for vaccines in health care. Informed and updated decisions about mandatory immunization have economic and ethical implications and fall in the purview of nursing educators. Academic settings and continuing education departments in facilities that host students are obligated to work in partnership to ensure consistent and safe immunization schedules are in place to protect students, staff, and patients.

It is hoped that the experiences described in this article serve as a stimulus to bring educators and appropriate stakeholders together for far-reaching discussions about pertussis and other communicable disease issues.

## key points

### Pertussis Infection

Matthews, E., Armstrong, G., Spencer, T. (2008). **Pertussis Infection in a Baccalaureate Nursing Program: Clinical Implications, Emerging Issues, and Recommendations.** *The Journal of Continuing Education in Nursing*, 39(9), 419-426.

- 1 Pertussis is a significant public health problem affecting all segments of the population. It has important ramifications in academic health care programs and clinical settings.
- 2 Knowledge of transmission risk and current immunization guidelines and recognition of symptoms are the responsibility of health care facilities and schools of nursing.
- 3 The Centers for Disease Control and Prevention (CDC) recently recommended routine use of a single dose of Tdap for adults younger than 65 years to replace the next booster dose of tetanus and diphtheria toxoids vaccine (Td). The CDC recommended Tdap for parents or caregivers of infants younger than 1 year, health care workers having direct patient contact, and individuals at risk for pertussis due to increased pertussis activity or during outbreaks.
- 4 Nursing school and continuing nursing education faculty are called upon to develop policies regarding mandatory immunizations and prophylaxis on the basis of current information, in-depth understanding, and sensitivity to individual beliefs.

The most up-to-date knowledge about emerging communicable diseases is vital to support continued career competence in a wide range of nursing situations.

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