CHAPTER SIX

Medical Outbreaks on Campus

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In the fall of 2014, an 18-year-old student at San Diego State University died unexpectedly after contracting bacterial meningitis. In the days after her death, university officials scrambled to contact approximately 400 people with whom she was thought to have had direct or indirect contact, urging them to seek preventative treatment. While the community was able to avoid additional infections, university leadership was forced to take a hard look at the circumstances that could contribute to an even more devastating event.

Campus-based medical outbreaks like this one are possible and, because of the nature of college life, even probable (Moe *et al.* 2001; Butler 2006; Iuliano *et al.* 2009; Whelan *et al.* 2010; Dustin 2013). Many individuals living in congregate housing, frequenting community areas such as bathrooms and student centers, and eating in dining halls can increase the likelihood and spread of a bacterial or viral infection (Moe *et al.* 2001; Butler 2996; Iuliano *et al.* 2009; Whelan *et al*. 2010). Administrators' response to these outbreaks can be the key to preventing student displacement, defined as a lag in academic progress because of missed classes or an inability to perform. Furthermore, some diseases can have lasting effects, which have the potential to impact students' lives in a more drastic way. The four infectious diseases discussed in this chapter are common diseases that spread easily and have impacted colleges and universities in a significant way—measles/mumps, meningococcal meningitis, noroviruses, and colds and influenzas. Administrators should work with campus-based, local,

and state health departments to prepare for the possibility of outbreaks on their campuses and effectively educate student populations.

Measles and Mumps

Measles and mumps are both acute viral diseases that can be prevented by the Measles/Mumps/Rubella (MMR) vaccine (Markowitz *et al.* 1989). Until the 1960s, children pervasively developed measles and mumps at a rate almost as high as the birth rate (Dales *et al.* 1993; CDC 2014b). With the development of the vaccine in the 1960s, they have largely been eradicated (Goodson *et al.* 2012). In 1971, the MMR vaccine was became a requirement for admission to preschool and school (Frank *et al*. 1985; McLean *et al*. 2013). However, the importation of the diseases from countries which are still experiencing the diseases, unvaccinated individuals, and occasional failure of the MMR vaccine have led to frequent resurgences in the United States, as well as a change in the typical age group that contracts the diseases. Whereas it was once limited to preschool and school-aged children, individuals aged 20 and older now contract the diseases more frequently (Gastañaduy *et al.* 2014).

Individuals who have been vaccinated with the MMR vaccine multiple times can still develop either disease. Many outbreaks over the years have prompted research teams to investigate the pattern of the outbreak from its origin point. In each of the studied cases, researchers found that immunity was not guaranteed even after two or three vaccinations (Marin *et al.* 2008; Barskey, Glasser and LeBaron 2009; Whelan *et al*. 2010).

Measles

Measles presents itself through the following symptoms (CDC 2014a):

- Rash
- Fever
- Cough
- Runny nose
- Conjunctivitis (red, watery eyes)
- Fatigue
- Aches
- White spots inside the mouth

The general presentation of measles symptoms begins like a cold or flu with a fever, followed by a cough, runny nose, sore throat, and possibly conjunctivitis

(CDC 2014a). After the first couple of days, white spots begin to form inside the mouth. Around the third to fifth day, a rash begins to form, usually around the face. At this point, the fever may spike to dangerous levels (104 degrees or higher) (CDC 2014a). Individuals who contract measles usually do so because they are either unvaccinated or have been exposed to unvaccinated individuals (Dales *et al.* 1993; Vitek *et al.* 1997).

In 2000, indigenous measles was considered eliminated in the U.S. However, the importation of measles from foreign countries continues (Hinman *et al.* 2011; Gastañaduy 2014). In 2008, there were three large outbreaks and several smaller cases, amounting to a total of 131 cases of the virus (CDC 2008). Seventy-six percent of the individuals affected by the outbreak were less than 20 years old (CDC 2008). In 2011, 222 measles cases were reported, the majority of which were due to importation of the disease from France. In this case, those affected were primarily aged 20 years or older (CDC 2011a; CDC 2012a). In 2013, a large outbreak affected 159 individuals (CDC 2014c).

Perhaps the worst outbreak was in 2014 when over 600 individuals contracted measles (CDC 2014c). The majority of those affected by more recent outbreaks of measles are college-aged or older (Gastañaduy 2014). Though the past and recent measles outbreaks have not occurred primarily on university campuses, the potential for future outbreaks to occur on college campuses has become greater, especially if individuals are unvaccinated or have not received follow-up vaccinations.

Mumps

The mumps virus presents itself through the following symptoms (CDC 2010a):

- Fever
- Fatigue
- Headache
- Appetite loss
- Muscle aches
- Swelling of salivary glands (this looks like the cheeks and jaws are swollen)

The mumps virus typically begins with a fever for the first couple days of infection, often accompanied by headache, muscle ache, fatigue, and loss of appetite. Following the presentation of these symptoms, swelling of the salivary glands will occur (CDC 2010a). In some cases, complications could occur that can be potentially fatal or cause permanent damage (CDC 2010a). It is important to

note that the aforementioned symptoms are also typical of less serious influenza-type illnesses, which can lead health centers on higher education campuses to misdiagnose individuals who have contracted mumps (Whelan *et al*. 2010). Unlike measles, indigenous mumps has not been eliminated in the U.S.

Though less frequent than the measles, outbreaks of mumps have continued to occur over the past ten years in spite of an increase in immunization policies for school admissions. In 2006, just under 6,600 cases of mumps were reported across multiple states, primarily in the Midwest (CDC 2014b; Hinman *et al.* 2011). This not only affected primary school children, but also a large population of college students; in fact, the rate was highest for college-aged individuals (Barskey *et al.* 2009). This outbreak was largely due to a failure of two-dose vaccinations (Marin *et al.* 2008; Barskey *et al*. 2009).

Between 2009 and 2010, there were two large outbreaks. The first affected about 3,000 individuals in New York, and the second about 500 people in Guam (CDC 2014b). The CDC reported that 965 people had contracted mumps since the beginning of 2014 (CDC 2014b). The ongoing resurgence in the mumps virus has prompted investigation on how higher education campuses can combat the virus and ensuing student displacement.

Impact on Higher Education Institutions

Measles and mumps on college campuses are problematic because of the interpersonal propinquity inherent to the campus environment. Many higher education institutions are closed communities, with a close-knit community style of living that can facilitate a more rapid spread of illness. Nearly every study of measles and mumps on college campuses reports close quarters as the primary reason for their swift and extensive propagation (Hersh *et al.* 1991; Marin *et al.* 2008; Huang *et al.* 2009; Whelan *et al.* 2010; CDC 2012b).

Institutional health centers may experience difficulty diagnosing more serious illnesses for various reasons. There may be a lack of collective experience among the staff, or they may have adopted a heedless approach to diagnosis attributable to addressing large numbers of common cases. Institutional health centers commonly employ students who are on track to get their medical doctorate as a cost-savings measure, but these interns may lack the experience to differentiate the potent infections from the prosaic. Furthermore, institutional

health centers see a huge numbers of individuals that contract illnesses such as a common cold, influenza, strep throat, or mononucleosis, all of which can spread as quickly and as easily as mumps or measles.

A mumps outbreak occurred at a California institution in 2011. On his first visit to the campus health center, the initial patient was misdiagnosed with cellulitis (CDC 2012b). Whether the misdiagnosis was due to inexperience or carelessness is unclear. However, the student was discharged without proper treatment, leading to the infection of other students and faculty. Furthermore, public health authorities were not alerted of the case of mumps until the second generation of transmission (CDC 2012b). In another investigation of a large Kansas university, researchers determined that although public health authorities were alerted as soon as mumps was first diagnosed on campus, the virus had spread because campus health faculty had not acted to contain it (Huang *et al.* 2009).

In a 1991 study, researchers found that even if a campus warns students of a circulating illness, students often avoid the health center due to apathy or lack of funds (Hersh *et al.* 1991). This in turn can facilitate the circulation of measles or mumps.

Though measles has been eliminated in the U.S., it is still very prevalent in other countries, including Western European, Asian, and African countries (CDC 2012b). When individuals travel to and from these countries, the diseases have a higher transmission potential. Higher education institutions that are heavily involved in study abroad and foreign exchange with these countries increase the risk of outbreaks occurring at their institution. Administrators should be aware of the higher risk that study abroad and foreign exchange bring to their institution and make sure that students are vaccinated before traveling to or from the university.

Combating Mumps and Measles on Campus

The most important step toward combating measles and mumps resurgences on institutional campuses is to require immunization records for admission into the institution. These requirements can help the administration admit only those students who have had at least two doses of the MMR vaccine (CDC 2012b). This preventative measure has already been put into effect by most U.S. institutions in hopes that the likelihood of an outbreak will decrease. Ohio State University, Fordham University, and the University of Illinois at Urbana–

Champaign have established vaccination requirements for admission, as well as requirements or recommendations for vaccinations if students present symptoms of the viruses (NYC Health 2014; McKinley Health Center 2014; Rodriguez and Kline 2014). Many past cases of both measles and mumps began with unvaccinated individuals who contracted the disease and spread it to vaccinated individuals (Hersh *et al.* 1991; Huang *et al.* 2011). In addition to requiring vaccinations before admission into their institution, administrators should develop plans for rapid-response vaccine clinics if their campus incurs an outbreak of either disease.

Education about symptoms, the prevalence of measles and mumps in the area, and the prevention of the aforementioned diseases constitute additional preventative measures. Universities have typically informed students of measles and mumps outbreaks through announcements, articles in school newspapers, school websites, and advertisements around campus. The CDC recommends that outbreak locations define the at-risk population, promote cough etiquette and respiratory and hand hygiene, isolate patients, alert students of how to recognize symptoms, and encourage students to go to student health services for testing (CDC 2014d). Furthermore, they recommend promptly alerting public health authorities of outbreaks so that control measures can be implemented quickly (CDC 2014d). In these situations, it is important for students to recognize the illness if they present symptoms, to realize the seriousness of the illness, and to take the necessary steps to seek out a medical professional.

Once measles or mumps are diagnosed, isolation is the first step toward keeping diseases from spreading on a college campus. Though this step is needed in order to combat the spread of the disease, affected students may begin to flounder in their classes or extracurricular activities, or even experience disaffection from their social circles. In response to multiple cases of mumps on their campuses, Fordham University and the University of Illinois at Urbana-Champaign developed a protocol for isolating those students who present symptoms for at least five to seven days (corresponding with the contagious period). These students are sent home or otherwise prevented from attending classes, social events, or athletic practices and games (NYC Health 2014; McKinley Health Center 2014). However, it was found that many students forgo reporting their symptoms so as not to miss too many classes or campus events (Huang *et al.* 2009; Whelan *et al.* 2010).

Supporting students through academic delays is an important step towards combating displacement. Some administrators have offered support by notifying students of the progress of the outbreak and details concerning their response. Students may also be offered alternative assignments that can be completed individually, allowing them to continue their studies while they recover (D'Onfrio 2014; McKinley Health Center 2014; NYC Health 2014; Thomas 2014).

Ohio State University Outbreak

Ohio State University (OSU) experienced a historically devastating outbreak of mumps in 2014. In the central Ohio community, 484 people were infected (Columbus Public Health 2014). Of those cases, a total of 255 were linked with OSU; 163 were OSU students, 34 were OSU staff, 3 were family of OSU students or personnel, and 55 were community members who were linked with OSU (Columbus Public Health 2014). Of the 255 cases that were linked with OSU, 155 were female and the majority were college-aged (Columbus Public Health 2014). The majority of those affected had been vaccinated (Merriman 2014a). The first case on the OSU campus appeared in January of 2014.

In February, the university alerted the Columbus Public Health authorities of the few early cases that had been reported on campus (Thomas 2014). This allowed university administrators and public health personnel to work together to determine if they were merely isolated cases or the onset of an outbreak. The general public was not notified until increasing numbers of confirmed cases emerged (Thomas 2014; Merriman 2014b). At this point, administrators, campus health services, and Columbus Public Health collaborated to notify students, faculty, and the Ohio community of the outbreak. Their messaging included a description of symptoms, prevention strategies, and steps to take if symptoms emerged (Thomas 2014; Merriman 2014b).

The scope and impact of the outbreak increased over the following months, and by April, 150 people in surrounding counties and 99 people on the OSU campus were infected with mumps (Prax 2014). OSU and Columbus Public Health personnel sent out warnings via email and issued press releases to potential visitors (Prax 2014).

Throughout the outbreak, Columbus Public Health authorities and OSU administrators urged those in the institutional community to get vaccinated

if they had not already received two doses of the MMR vaccine (Young 2014a). Thomas (2014) indicated that this was a key strategy contributing to the containment of the outbreak.

When the number of confirmed mumps cases on OSU's campus reached 32, academic administrators instructed professors to accommodate students isolated with mumps who could not attend class so as to prevent displacement (Young and Bendtsen 2014). The Provost Joseph Steinmetz and other administrators collaborated on a message to faculty and staff:

> *The recent outbreak of mumps on the Columbus campus has all of us concerned. While relatively few students have been affected, any number is too large, and the university is taking precautions to ensure that the outbreak is controlled as rapidly as possible... Those precautions include Student Health Services and Columbus Public Health's urging students who have fallen ill with mumps to stay home and avoid school, work and other public settings for five days after their symptoms appear. This request means that affected students will be unable to attend school, perhaps for several days...If you have such students in your classes, I ask that you offer them all reasonable accommodation to make up any quizzes or exams, labs, class activities, or other work they've missed while sparing their classmates from possible infection.* (Young 2014)

Messages like these were vital in preventing student displacement and enabling continued participation on campus throughout the outbreak (Thomas 2014). OSU officials also created a committee to analyze the university's comprehensive response to the outbreak, identify areas of improvement, and develop a plan for future outbreaks of infectious diseases (Young 2014b).

Meningococcal Meningitis

Meningitis is characterized by inflammation of the membranes surrounding the brain and spinal cord, caused by infection of the fluid in the aforementioned areas (CDC 2014d). The symptoms for meningitis are similar to measles and mumps; in fact, meningitis can develop in an individual who has contracted mumps (Marin *et al.* 2008). There are five specific types of meningitis: bacterial,

viral, fungal, non-infectious, and parasitic (CDC 2014d). Meningococcal meningitis is a bacterial form of meningitis and also the most common form of meningococcal disease (WHO 2012; Kaneshiro, Vyas, and Zieve 2012). Though children are more physically susceptible to meningococcal meningitis, research indicates that college-aged students are at a higher risk of contracting the disease (Butler 2006).

The most common symptoms for meningococcal meningitis are (WHO 2012):

- Stiff neck
- High fever
- Sensitivity to light
- Confusion
- Headaches
- Vomiting

According to Kaneshiro (2012) and colleagues from the U.S. National Library of Medicine, the symptoms of meningococcal meningitis can also include chills; purple, bruise-like areas called purpura; and a rash that can have pinpoint red spots (caused by subdermal bleeding). Other, less frequent symptoms include agitation, an outward curving of the soft spot of the head in infants, a loss of consciousness, irritability, diminished appetite in children, rapid breathing, and unusual posture with the head and neck arched backwards.

About 5 to 10 percent of patients with meningococcal meningitis die within 24 to 48 hours of presentation of symptoms (WHO 2012). The disease can be transmitted through droplets of mucus from the throat; therefore, kissing, sneezing, coughing, or even close living quarters can spread the disease once someone is infected (WHO 2012).

Impact on Higher Education Institutions

There is limited research on meningococcal meningitis on college campuses. However, many studies agree that outbreaks on college campuses have the potential to increase. The CDC notes that rates of meningococcal disease have increased in recent years, citing approximately 2,000–3,000 cases diagnosed each year in the United States. The disease is most common in infants and individuals with certain medical conditions. The proportion of cases in adolescents and young adults has increased in recent years, with rates of invasive disease among people age 17 to 20 years about twice that of the general U.S. population.

In 1991–1992, the rate of meningococcal disease in college students was low. However, in the few observed cases, students residing in congregate living such

as dormitories and Greek Life houses were 9 to 23 times more likely to contract the disease than those off campus (CDC 2000). This trend continued until 1999, when 97 percent of the 90 cases of meningococcal disease reported to the CDC from 1998 to 1999 were undergraduate students living in dorms (CDC 2000). Not surprisingly, the majority of college students affected are first-year students living on campus and interacting in close proximity (Butler 2006; CDC 2000).

According to the National Meningitis Association (2014), cases of meningococcal meningitis in adolescents and young adults have increased by nearly 60 percent since the early 1990s. In the last seven years, Princeton University, Monmouth University, University of California, Santa Barbara, and Georgia Institute of Technology have had cases of meningococcal meningitis on their campuses. The overall increase in cases, the potential for devastating outbreaks on college campuses, and the threat of lasting effects of meningococcal meningitis make administrative preparations for even sporadic cases extremely important for colleges and universities.

Combating Meningococcal Meningitis on Campus

The most important step to combating meningococcal meningitis in higher education institutions is to require routine vaccination for all students following admission to college (Pediatrics 2000; Harrison 2000; Butler 2006). Meningococcal vaccination can prevent up to 80 percent of meningococcal meningitis cases in adolescents and young adults, it is safe and effective against almost all of the strains of meningococcal meningitis, and protection afforded by the vaccine lasts for three to five years (National Meningitis Association 2014). Many administrators have found vaccination to be the best protection against meningococcal disease (CDC 2014e).

Another important step in combating meningococcal meningitis, especially in the event of an outbreak, is to distribute targeted information to students, faculty, and staff as quickly as possible. The campus community should be made aware of specific symptoms, risk factors for the disease, behaviors that could increase their likelihood of developing the disease, and what to do if symptoms present themselves. In response to the outbreak at the University of California, Santa Barbara, institutional administrators contacted public health authorities and together compiled a list of symptoms, risk factors, and other important in-

formation to raise awareness and improve understanding of the disease, because vaccination was not an immediately accessible option (CDC 2014e). Administrators encouraged students to avoid large social gatherings and cancelled many student organization events (CDC 2014e).

The right information at the right time can help minimize the spread of an outbreak. If left untreated, the disease can spread unchecked and potentially result in fatality. Notwithstanding the serious medical concerns, a containment period can disrupt normal academic activities. Students that miss class, whether they become ill or are simply following instructions from administrators, will suffer a decrease in contact time and may feel disconnected from the campus community. Administrators should proactively educate the campus community of the seriousness of meningococcal meningitis and encourage faculty to develop contingency plans for continuing to interact with students throughout outbreaks to prevent displacement.

Princeton University

The meningococcal meningitis outbreak on Princeton University's campus began in May 2013 (New Jersey Department of Health 2014). Over a period of one year, a total of nine cases of meningococcal meningitis were reported on the university's campus (New Jersey Department of Health 2014). The first eight cases of meningococcal disease were spread out over the course of March through November (New Jersey Department of Health 2014). The final patient was diagnosed in March 2014, a year later than the first case, and died the day after developing symptoms (New Jersey Department of Health 2014).

After the first case of confirmed meningococcal meningitis on campus, Princeton University administrators sent an email to students, parents, and faculty, notifying them of the case and informing them about the disease (Princeton University 2014). Follow-up emails were sent throughout the course of the outbreak with each new development (Princeton University 2014). Fact sheets, videos, websites, and campus posters were utilized by Princeton University to distribute information about the situation, taking advantage of all media available (Princeton University 2014). The posters were hung in prominent areas throughout the campus to maintain awareness and provide reminders about preventative actions (Olin 2014). After the first four cases occurred on Princ-

eton University campus, the New Jersey Department of Health was invited to work with Princeton University officials in monitoring and treating the outbreak. An important outcome of this collaboration was the approval of the use of the meningococcal vaccination on campus. It was immediately distributed to those associated with the university, and offered to all members of the upcoming freshman class (New Jersey Department of Health 2014).

Michael Olin, Associate Dean of Undergraduate Students at Princeton University, discusses the impact that the outbreak had on Princeton students:

> *The effect on students who contracted meningitis has varied greatly. Some have been able to return to class after recovering and feeling strong enough to do so. Others have taken time away from campus to recover, and have returned to engage as a full-time student again. In all occasions, the decision has been up to the student and their family. I'm sure most of the students who became ill with meningitis missed some class and schoolwork; however, the faculty, Office of the Dean of the College, and residential college staff have worked with each individual student as needed to assist in managing missed work, deadlines, etc.* (Olin 2014)

The university's special consideration for students' needs helped those who were infected make progress in their studies and maintain their academic and social connections to the institution. Olin (2014) further described the institution's attempts to combat any displacement those affected might have experienced:

> *The best thing we can do whenever a student has a serious illness is to support them in their recovery, and be a resource for them and their family. We do strongly encourage students to follow the recommendations of their treatment providers, but work individually with each student to assist with missed schoolwork, deadline management, and strategies for catching up, if need be.*

Olin offered recommendations for other institutions that face outbreaks of meningitis on campus. He emphasized adherence to the recommendations of the CDC and other public health authorities on preventative measures and pre-matriculation immunization (2014). He also noted the importance of working with local and state authorities:

While my main responsibility as part of the meningitis response team was serving as a representative from the Office of the Dean of Undergraduate Students, I have been able to observe the rest of the team in action as they have responded to this crisis. It seems to me that any campus that would unfortunately have to deal with a meningitis outbreak would be well served to coordinate efforts with the local and state Department of Health, consult with other campuses that have experienced such outbreaks, and explore any and all opportunities with health professionals, government, etc. to effectively combat the outbreak.

Importantly, Olin noted that an unlicensed vaccine was approved for use on the Princeton Campus because of the severity of the outbreak. He expressed confidence that other universities would benefit from learning from the experience that Princeton University had with addressing the outbreak by committing to the use of the vaccine.

Norovirus

The most common symptoms of norovirus include (CDC 2013b; California Department of Public Health 2014):

- Acute onset of vomiting
- Nausea
- Watery, non-bloody diarrhea
- Abdominal cramping

Other symptoms that can occur, albeit infrequently, include (CDC 2013b):

- Low-grade fever
- Body aches
- Headaches

Norovirus is the most common cause of acute gastroenteritis in the United States (Roberts *et al.* 2009; CDC 2013a). Norovirus infections were previously labeled Norwalk or Norwalk-like viruses, as the first outbreak of this type occurred at an elementary school in Norwalk, Ohio in 1968 (Hall *et al.* 2011). Norovirus illnesses are not 'stomach flus,' as commonly believed; in fact, they are not related to influenza at all (CDC 2013a). This virus is highly contagious and can occur multiple times throughout an individual's life (CDC 2013a). Nor-

ovirus causes 19 to 21 million illnesses and contributes to 56,000–71,000 hospitalizations and 570–800 deaths per year in the U.S. (CDC 2013a).

Before 1968, cases of vomiting and diarrhea were labelled "winter vomiting disease" after the typical season that the illnesses would occur (Patel *et al.* 2008). The late development of the technology to detect and analyze noroviruses has caused the identification of sporadic cases of norovirus illnesses to be relatively poor (Patel *et al.* 2008). Since the 1990s, more than 90 percent of the previously unknown causes of outbreaks in the U.S. have been attributed to noroviruses (Patel *et al.* 2008; Glass, Parashar, and Estes 2009). From September 2012 to October 2014, there were a total of 2,431 reported outbreaks of norovirus in the U.S. submitted to CalciNet, the national outbreak surveillance network launched by the CDC.

There is currently no vaccine for norovirus (Patel, Hall, Vinjé, and Parashar 2008). Symptoms typically present themselves about 12–48 hours after being exposed to the norovirus and can last between 24–72 hours (CDC 2013b). Norovirus illnesses are relatively mild in nature, but young children and older or sick adults can develop complications, such as severe dehydration, which can lead to hospitalization or death (CDC 2013b). Norovirus can spread through contact with an infected person or through contaminated food or water (CDC 2013b). Even before an infected individual develops symptoms, they can be contagious (CDC 2013b).

Norovirus can be transmitted by food, water, contaminated environmental surfaces, and from person to person (Hall *et al.* 2011). There is no immunity to norovirus and it can affect members of any age group (Hall *et al.* 2011). Historically, norovirus outbreaks are predominantly food-borne, originating in restaurants and at catered events (Frankhauser *et al.* 2002; Hall *et al.* 2011). These food-borne outbreaks are largely associated with produce (Patel *et al.* 2008). Infected individuals with stool or vomit particles on their hands touch the food or place it on infected surfaces before preparing or sharing it. Food can also be contaminated by washing with infected water (Hall *et al.* 2011).

Impact on Higher Education Institutions

Contained institutional settings are a breeding ground for norovirus outbreaks (Hall *et al.* 2011). Long-term residential and other healthcare facilities are their

most frequently reported settings, with restaurants and catered events second, and schools and colleges in third (Hall *et al.* 2011). The CDC (2014f) reported that 214 of the 3,494 outbreaks of norovirus from 2009 through 2012 occurred at a school or daycare facility, without specifying how many were in a university setting (CDC 2014f).

In 2008, there was a large norovirus outbreak that affected college campuses in California, Michigan, and Wisconsin (Roberts *et al.* 2009). The three universities had a combined total of 1,000 cases, ten hospitalizations, and one of the campuses had to be closed because of the outbreak (Roberts *et al.* 2009). Rider University and Princeton University both suffered norovirus outbreaks in early 2012, with 511 total cases of illness (Foodborne Illness Outbreak Database). Emory University developed an outbreak of norovirus among students on their campus starting November 12, 2012. Officials believed that the outbreak was contained by their initial efforts, but days later more cases emerged, and a total of 101 students were eventually affected (Clark 2014). In all of these cases, the outbreak started because of infected food in a dining hall or restaurant (Moe *et al.* 2001; Roberts *et al.* 2009; Foodborne Illness Outbreak Database; Clark 2014).

Many norovirus illnesses result from food contamination, and the college and university setting can increase the likelihood of person-to-person transmission. The nature of living on campus facilitates close contact and exposure, including through sport, students working as food handlers in dining halls, and the shared use of bathrooms and common areas in residence halls (Moe *et al.* 2001). Even though the illness is mild and has a short life cycle, students may end up missing class or work (Moe *et al.* 2001). There is no vaccine for norovirus, so students who become infected must simply let the virus run its course.

Combating Norovirus on Campus

Many institutions have followed CDC recommendations to identify the initial cause of the outbreak in order to contain and remove the original contaminant (Kilgore *et al.* 1996; Moe *et al.* 2001; Clark 2014). Unfortunately, foodborne norovirus outbreaks often begin to transmit by person-to-person contact, especially on campuses, which makes it difficult to identify the initial cause of the outbreak (CDC 2001). However, speaking to infected students to determine

commonalities can be helpful. One way to combat the issues that arise from multi-cause outbreaks is to educate students, staff, and faculty on personal hygiene and fecal-oral viral transmission (CDC 2001; Moe *et al*. 2001). Education about symptoms, preventative measures, and steps that should be taken if symptoms arise can stop the spread of the norovirus on institutional campuses (Kilgore *et al.* 1996; CDC 2001; Roberts *et al.* 2009).

Rider University

On February 9, 2012, a norovirus outbreak began at Rider University. On the first night that the disease emerged, a total of 40 students became infected and were hospitalized (Jaslow 2012). The outbreak appeared to be the same as the one happening on the nearby Princeton University campus, as about 100 cases of the norovirus had occurred on their campus since January 29 (Stengel and Zeck 2012). The day following the initial outbreak at Rider University, another 11 Rider students and another 7 Princeton students fell ill. These ensuing infections brought the total affected population between the two schools to about 160 students (Khavkine 2012).

A month later, it was reported that the norovirus had affected more than 400 students at colleges and universities throughout Mercer County, New Jersey, the area in which both Rider and Princeton are located (Costa 2012). School officials noted that there was no realistic way to get an exact count of students infected with the virus, because of the sheer amount of students presenting symptoms in a short amount of time; furthermore, students commonly chose to treat their symptoms on their own rather than seeking medical attention (Costa 2012). After a month-long investigation, authorities in the area pinpointed the origin of the virus to a local Panera Bread, a public eatery that about 15 of the original Princeton University students had visited (Chapman 2012). In April 2012, Rider University and Princeton University reported that the norovirus outbreak on their campuses seemed to have subsided (Ranka 2012). The Foodborne Illness Online Database reported a total of 511 ill as a result of the outbreak in the Mercer County norovirus outbreak; with 261 confirmed cases at Princeton University and 250 cases at Rider University.

Administrators at Rider University were reluctant to discuss their experience with norovirus on their campus. However, via news articles and the Rider Uni-

versity webpage, the outbreak was fairly well-documented. At the beginning of the outbreak, Rider students hesitated to attend classes and many reported skipping classes altogether for fear that they would come into contact with the infected (Stengel and Zeck 2012). Some students interviewed by the university newspaper argued that continuing with classes was a poor decision (Stengel and Zeck 2012). For example, one student stated:

> *Classes should have been cancelled...Not only is the virus still transmittable, but the school was late in notifying students, putting the entire student body at risk. Out of the safety of their students, the administration should have cancelled class.* (Stengel and Zeck 2012)

The CDC recommends isolation of ill and non-ill people involved in the outbreak area (Hall *et al*. 2011). Isolation can minimize the risk of spreading the disease, especially for 48 to 72 hours following abatement of symptoms (Hall *et al*. 2011). Closing classes for a day or two could have benefitted ill students and prevented the extent of the spread of the norovirus. Students were further frustrated due to the university's lack of communication about the outbreak. Students felt that the university did not notify them quickly enough and put the student body at risk. The CDC (2001) recommends educating the public about symptoms and alerting the affected population that an outbreak has occurred. Furthermore, past research has determined that these two components are key to controlling the outbreak (Kilgore *et al*. 1996; Roberts *et al*. 2009).

While there is limited information on how the Rider University administration notified students of the outbreak, there was an update by the health officer appointed to assist the institution a day after the initial outbreak was reported. The spokesman for Princeton University, Martin Mbugua, noted that: "As soon the university noticed an increase in the number of cases being seen at McCosh Health Center, we took a number of measures to try to contain the spread of illness" (Costa 2012). The measures that the university took included a number of CDC-recommended actions, including issuing campus alerts, sterilizing the campus, closing the on-campus diner as a precautionary measure, cleaning bathroom facilities, consulting with dining hall staff, reviewing good hygiene practices, implementing hygiene precautions, and investigating the outbreak to find initial cases (Costa 2012).

Cold and Influenza

The CDC (2013c) describes common cold symptoms as:

- Sneezing
- Stuffy or runny nose
- Sore throat
- Coughing
- Watery eyes
- Mild headache
- Mild body aches

Flu symptoms include (CDC 2014h):

- Fever or feeling feverish/chills
- Cough
- Sore throat
- Runny or stuffy nose
- Muscle or body aches
- Headaches
- Fatigue (tiredness)
- Vomiting and diarrhea (more common in children)

The common cold and influenza (flu) are ordinary illnesses, especially in school settings. While it can be difficult to differentiate the two, certain medical tests administered at the onset of symptoms can accurately identify them (CDC 2011b). The flu is a respiratory illness that is caused by influenza viruses, which are constantly evolving. The illness is generally accompanied by more intense symptoms than the common cold, which can cause complications in some patients (CDC 2001b; CDC 2014h). Children, pregnant women, and people over 65 years old are more susceptible to the common cold and flu; however, the flu can cause even generally healthy people to develop complications (CDC 2013c; CDC 2014h).

Both the flu and common colds can last up to two weeks. However, individuals who contract influenza can suffer another infection just a few days after recovery, even with antibiotics (CDC 2013c; CDC 2014h). Flu viruses and the common cold can spread by droplets that leave infected individuals when they cough, sneeze, or talk; in some cases, the flu can spread by infected individuals touching an infected surface and then their eyes, nose, or mouth (CDC 2014h). Complications that can arise from common colds are sinus infections, middle ear infections, and/or asthma (NIAD 2014). Flu complications are much more severe and include bronchitis, pneumonia, worsening of preexisting or chronic

conditions, and death (NIAD 2014). While common colds are mild, the flu can be unpredictable and volatile, varying from person to person and from one season to the next (CDC 2014h). Preparedness for the flu can decrease the severity of an outbreak, especially on a college campus.

There have been four major influenza pandemics in the world over the past century. The most recent pandemic occurred from 2009 to 2010. This H1N1—or swine flu—pandemic affected a total of 74 countries (DOHHS 2014). Between 43 and 89 million people contracted the swine flu, and of those, between 8,870 and 18,300 died (DOHHS 2014). The swine flu pandemic was declared over in 2010; however, the H1N1 flu still affects people as a seasonal influenza virus (CDC 2010b).

Molinari and colleagues analyzed the annual cost of seasonal influenza epidemics in the United States and found that about 24.7 million cases of influenza occur per year, resulting in 334,185 hospitalizations, 44 million days of productivity lost, and 41,008 deaths annually (2007).

Impact of Influenza on Higher Education Institutions

Seasonal influenza can spread easily through schools and commonly results in high levels of school absenteeism and loss of productivity (WHO 2014). In 2005, around 91 percent of 3,200 students surveyed at University of Minnesota reported having at least one upper respiratory infection (URI), 83 percent reported having at least one cold, and 36.7 percent reported having at least one influenza-like illness (Nichol, D'Heilly, and Ehlinger 2005).

During the 2009–2010 H1N1 flu pandemic, one university in Delaware was estimated to have had 1,887 students (9 percent) and 300 faculty/staff (27 percent) affected by flu-like and acute respiratory symptoms (Iuliano *et al*. 2009). The CDC (2010c) reported that the highest number of cases of 2009 H1N1 flu were confirmed among those ages five to 24—making university students at high risk. While the pandemic is over, cases of H1N1 still emerge periodically, and seasonal influenza affects higher education campuses on a continual basis.

Students can be significantly impacted by contracting a cold or flu. In 2014, the American College Health Association (ACHA) surveyed 80,000 college and university students and determined that 15.1 percent of students felt their academic performance was significantly disrupted by a cold/flu/sore throat, a fac-

tor that was only surpassed by anxiety, stress, and sleep difficulties. Among 3,249 student surveyed at a Minnesota university (2014) from November through April, URIs were responsible for a cumulative 17,444 days of significantly decreased ability to perform daily activities, 6,023 days in bed, 4,263 days of missed class, and 3,175 days of missed work (Nichol *et al*. 2005). Of those students with colds, 14.5 to 17.3 percent did poorly on a test and 33.6 to 38 percent reported doing poorly on a class assignment (Nichol *et al*. 2005). Of those who had influenza-like illnesses, 29.4 to 40 percent reported doing poorly on a test and 54.4 to 57.7 percent reported doing poorly on a class assignment (Nichol *et al*. 2005).

At a university that was affected by H1N1, 361 of the 604 students who reported having influenza-like illnesses said that they missed more than one day of class or work and 266 of the 941 students who reported respiratory illnesses reported missing more than one day of class or work (Iuliano *et al*. 2009). Students performing poorly or not being able to attend class because of a cold or flu can put them behind in their studies and impact their academic success.

Combatting Influenza on Campus

While vaccination against influenza is not required for admission into universities and colleges, the CDC recommends vaccination, as it can significantly decrease the number of influenza cases that occur on college campuses (CDC 2010c; CDC 2014h). Nichol and colleagues (2008) found that among 12,075 participants, vaccination was associated with a reduction of students reporting influenza, the likelihood of doing poorly in class or on an assignment, and number of days away from school or work because of illness. Of 80,000 university students surveyed in 2014, only 45.1 percent reported receiving vaccination against influenza (ACHA 2014).

While the best prevention or reduction of influenza on a college campus is vaccination prior to an outbreak, Nichol and colleagues (2010) found that vaccination after an outbreak on a college campus can also be effective in controlling an influenza outbreak. The vaccine and strain of influenza that is circulating do not need to match to reduce the number of influenza-like illnesses (Nichol *et al*. 2008).

Education about and updates on influenza outbreaks can be helpful to students as well. The CDC recommends educating students about hand hygiene

and cough etiquette through posters, flyers, emails, and text messages (CDC 2010c). University students who are knowledgeable about and use hand hygiene and face masks can reduce infection rates about 35 to 51 percent (Nichol *et al*. 2010). The CDC further recommends that institutions educate students on flu symptoms (CDC 2010c). Some schools, like Western Oregon University, have utilized the CDC's recommendations during and following outbreaks and experienced positive results (Western Oregon University 2009).

Institutions should also consider suspending classes and permitting high-risk students, faculty, and staff to stay home when influenza is spreading in the community. Many courses can be shifted to online environments, at least temporarily, and registrars should be prepared to make adjustments to the academic calendar if classes are cancelled. The CDC (2010c) also recommends that institutions separate people who are sick from those who are well as soon as possible during an outbreak. It also advises that those who are sick stay home for at least 24 hours after symptoms subside, and encourages faculty and staff to support students who miss classes or have done poorly because of colds or influenza illnesses. Isolation and support are vital steps for helping students through the physical and academic difficulties resulting from influenza or common cold outbreaks.

The University of Delaware

During the 2009–2010 H1N1 pandemic, many universities and schools were affected by influenza. One of the first universities affected by the pandemic was the University of Delaware. On April 27, 2009, four students were confirmed to have contracted the H1N1 strain of influenza (Iuliano *et al*. 2009; University of Delaware 2009). The initial cases at the university seemed to have stemmed from a trip to Mexico over spring break (Iuliano *et al*. 2009; University of Delaware 2009). Following an alert put out by the university about the H1N1 virus, 1,080 students visited clinics complaining of respiratory illnesses between April 26 and May 5, 24 of which tested positive for H1N1 (Iuliano *et al.* 2009; University of Delaware 2009). After multiple cases of H1N1 on the university's campus were confirmed, medical staff no longer tested each student with symptoms for H1N1, but instead treated over 500 people with oseltamivir (Tamiflu), if they presented any respiratory illness symptoms (Iuliano *et al*. 2009). Because of the discontinuation of testing, there was no final data on the exact amount of students who were involved

in the outbreak. However, Iuliano and colleagues (2009) determined that during the period of April 2009 and May 2009, 1,545 students met the criteria for acute febrile respiratory illnesses; of those, 604 met the influenza-like illness criteria. Furthermore, 61 percent of students presenting with flu symptoms indicated that they had to miss work or school because of their illness.

Because of the vast amount of students presenting symptoms, the school opted not to provide medical waivers for students to miss classes without being penalized (University of Delaware 2009). Instead they followed CDC recommendations by instructing ill students to isolate themselves until 24 hours after their fever subsided, facilitating absences via other methods. Deputy Provost Havidán Rodriquez described this by stating: "We will continue to monitor this situation closely...and we are evaluating alternative methods we might be able to employ if classes are disrupted for an extended period of time (University of Delaware 2009)."

The university was prompt in notifying students of an outbreak on their campus, but chose not to provide details until confirming the nature of the illness. The first notice was sent out on April 28, a day following the first four cases were reported but not yet confirmed to be H1N1 (University of Delaware 2009). The university also cancelled many events at the time of this notice, including practices, trips, and organization meetings (University of Delaware 2009). Because the university provided limited information about the severity of H1N1, many students developed concern about contracting H1N1 (University of Delaware 2009; Iuliano 2009). Students swarmed the medical centers and clinics provided by the university campus because they did not know what symptoms to look for. In September, following the initial outbreak of cases, the university sent out a message to faculty urging them to be flexible with students infected with H1N1:

> *In case of a major H1N1 outbreak at UD, regular communication with your students and your department/unit is essential. Also, being flexible with your students in terms of class participation and makeup of assignments and exams is critical, especially if students suspect that they might be ill with H1N1. Please make sure that you review, as soon as possible, these issues and potential alternatives with your students and provide information on the strategies that you will implement to deal with these issues.* (University of Delaware 2009)

These notes to faculty along with efforts by the university to plan online instruction or distance learning helped support the university community and allowed students options to make up missed classes.

At the time, H1N1 was relatively new to the public and, as a pandemic, was much more widespread than other strains of influenza. Higher education institutions can learn from the University of Delaware campus and other campuses that had to deal with H1N1 outbreaks. Iuliano and colleagues (2009) noted that the sheer influx of students to the health care facilities on the University of Delaware campus caused confusion and over-testing for the virus. They recommend that universities develop a response plan should an outbreak like H1N1 occur on their campuses, including expanding access to health care facilities and establishing quarantine zones. Furthermore, they recommend that administrators focus on providing detailed information about outbreaks to their campus community as quickly as possible, and take preventative measures should an outbreak of influenza occur on their campuses.

Conclusion

The diseases and illnesses mentioned in this chapter are not alone in those that commonly infect college students. Other illnesses include infectious mononucleosis (mono), caused by the Epstein-Barr virus, and conjunctivitis (pink eye). Limited research has been done on mono, while conjunctivitis outbreaks on college campuses can be addressed quickly with antibiotics and pose limited interruption to a student's life (Turco *et al.* 2002; McKesson Health Solutions 2003). Sleep deprivation, anxiety, and stress are also common in college students and can lead to poor academic performance and even cause students to drop out of their university or college (ACHA 2014).

Administrators can learn from the experiences of other institutions that have dealt with medical outbreaks on their campus. Some campuses were more prepared for outbreaks than others. For example, Princeton University handled the outbreak of meningococcal meningitis very well. Atypical admittances to the campus health center were taken seriously and a communication plan for all community stakeholders was developed after only a few identified cases. The communication plan was segmented into a series of continuous updates and

involved leveraging all forms of media to which the institution had access. They closely followed the CDC's guidelines by sharing information with the local health department, which in turn provided additional resources to the campus. Perhaps most importantly, Princeton equipped its students with timely and accurate information, and offered alternative academic arrangements for those affected by the outbreak.

Recent fears of a possible Ebola outbreak in the U.S. should encourage campus leaders to carefully and intentionally develop plans for handling a medical situation on their campus. Fortunately, the CDC has published preparedness plans for a variety of outbreaks that can be followed by campuses large and small, urban and rural. The plans include tips and guidelines for preparing students to travel abroad, preparing for visitors or foreign exchange students, and responding to an outbreak (CDC 2014j). Periodically revised preparation is of the utmost importance for the prevention of medical outbreaks.

Even with the best-laid plans, however, medical anomalies may still occur. Institutions should be ready to coordinate with local and state health authorities to help disseminate information and request support in the form of additional medical supplies and expertise. In the event of an outbreak, institutions should prioritize containing the spread of the virus, but of equal importance are the efforts required to sustain the continuation of academic and extracurricular activities. It is essential that all members of the campus community be alerted to an outbreak as soon as possible and supplied with additional information as it becomes available so as to prevent distress and panic. Additionally, faculty, staff, and students should all be equipped with attendance contingency plans, alternative participation arrangements, and options for the continuation of campus activities should the spread of illness render normal operations unmanageable. Regardless of the severity of the situation, detailed plans for all campus constituents will minimize the disruptive effects of physical illness and emotional discord, allowing the campus community to return to normal more quickly and smoothly.