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INSIDE

RELIAS MEDIA

New Coronavirus Exploding Out of China Poses Threat to Healthcare Workers

Cases expected to increase in United States

By Gary Evans, Medical Writer

Given the deadly precedents of severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) coronaviruses, a rapidly emerging similar virus out of Wuhan, China, could pose a grave threat to healthcare workers in the United States. As of Jan. 21, the World Health Organization (WHO) reported that 16 healthcare workers had been infected by the 2019 novel coronavirus (2019- nCoV), and none have died. However, those numbers were considered conservative amid a dramatically accelerating situation as this report was filed.

> AS OF JAN. 21, THE WORLD HEALTH ORGANIZATION REPORTED THAT 16 HEALTHCARE WORKERS HAD BEEN INFECTED BY THE 2019 NOVEL CORONAVIRUS, AND NONE HAVE DIED.

"I am sure it is more than that," says **Daniel Lucey,** MD, MPH, FIDSA, FACP, an infectious diseases physician at Georgetown University Medical Center, who is closely following the 2019-nCoV epidemic in China for the Infectious Diseases Society of America. "I don't know about the numbers. There are rumors of a lot more healthcare workers infected in the incredibly overstretched hospitals throughout Wuhan and other cities in Hubei province."

As this story was filed, no U.S. healthcare workers had been infected. There were six infected American patients, five of whom had returned from Wuhan to

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Illinois, Washington, California, and Arizona, the CDC reported. The case in Illinois transmitted the virus to her husband, bringing the total to six. *(See related story, page 31.)* The patients were hospitalized in these respective states, and no transmission had been reported to any other contacts. In addition to the six cases, 68 possible U.S. cases have tested negative, and 92 people are still under investigation in 36 states.

"We expect to find more cases of 2019-nCoV in the U.S.," **Nancy Messonnier**, MD, director of CDC's National Center for Immunization and Respiratory Diseases, said at a January press conference. "We have had multiple states and clinicians reach out to us to establish potential cases, with their labs following up and sending samples if warranted."

In a widely anticipated move, the WHO declared the coronavirus outbreak a Public Health Emergency of International Concern on Jan. 30. *(See related story, page 29.)*

The rapidly emerging 2019-nCoV follows the SARS coronavirus outbreak in 2002-2003, which also emerged from China, resulting in 8,098 infections globally, and 774 deaths. Some of the SARS infections and deaths, particularly in hospitals in Toronto, were in healthcare workers. The ongoing MERS outbreak centered in Saudi Arabia has been deadly to healthcare workers but has not shown the ability to sustain spread to other countries. A recently published analysis of reported MERS cases between December 2016 and January 2019 revealed that 26% of 403 cases in the region were healthcare workers. The case fatality rate was 16% among healthcare workers, compared to 34% among patients.[1] The threat of 2019-nCoV to healthcare workers was a point of emphasis at a recent CDC press conference.

"This is a hugely important issue, and the health of our healthcare workers is very important to all of us," Messonnier said. "We are being proactive at all levels to make sure that as much as possible the people taking care of [these patients] are careful and cautious."

In a snapshot of rapidly changing numbers, as of Jan. 30, China reported 9,692 cases, including 1,527 people in serious condition, and 213 deaths. Although Wuhan remains ground zero, cases were reported from many other cities in China, including 139 in Beijing, the second most populous city in the world. Including the United States, there were at least 129 cases scattered among many other countries, with at least one case in Taiwan, Japan, Korea, Thailand, Singapore, Vietnam, Nepal, Malaysia, Australia, France, Canada, Germany, Cambodia, United Arab Emirates, Finland, Philippines, India, and Italy.[2]

In a particularly concerning development, several media outlets reported that a Chinese health minister said the 2019-nCoV may be transmissible before symptoms are present, which would considerably complicate infection control efforts. SARS and MERS primarily spread through respiratory droplets dispersed when an infected person coughs or sneezes. However, both coronaviruses could contaminate hospital surfaces, linger in the environment, and spread via aerosols produced by medical procedures.

"We also have seen reports coming out of China regarding spread of disease. We at CDC do not have any clear evidence of patients being infectious before symptom onset," Messonnier said. "We are actively investigating that possibility.

That is part of the reason we are working with our state health partners to aggressively evaluate close contacts. We certainly would want to pick up a close contact who got ill, and it might even change our guidance."

Another ominous sign is in the emerging research on the epidemiologic measure of viral reproductive ratio, called r-naught. The conventional wisdom is that an r-naught of less than 1 means viral spread will fade out.

"R-naught is how many infected people come from a single infected person," Messonnier explained. "Most of the research [on 2019-nCoV] has the r-naught between 1.5 and 3. In general, you want to see an r-naught below 1, and that's how you get the disease controlled."

Case Identification, PPE

The CDC originally recommended considering 2019-nCoV in a patient with fever, respiratory illness, and coughing who has traveled to Wuhan city in the last 14 days or has been in contact with a confirmed case of the coronavirus. With China closing down travel out of Wuhan, and the virus reported in other cities throughout the country, the CDC was expected to expand screening of travelers from China.

"If they come in with fever and respiratory symptoms, we are asking whether they have recently been in China or have been in contact with someone from China," says **William Schaffner**, MD, an infectious disease physician at Vanderbilt University Medical Center. "We may have to update that very quickly because we know already that this virus has been exported to Singapore, Japan, and Thailand. We might have to include all of Southeast Asia."

EDs will bear the brunt if suspect cases descend on hospitals. "Previous outbreaks have forced us to be more forward-thinking," says **Shannon Sovndal**, MD, of Boulder (CO) Emergency Physicians. "New processes, such as updated triage questions and isolation techniques, have better prepared the ED to face new threats. We have a foundation in place that should aid us in addressing threats such as coronavirus from China, but vigilance, aggressive intervention, and constant modification will be needed."

Suspect patients should don a surgical mask and undergo evaluation in a private room with the door closed, ideally an airborne infection isolation room, the CDC recommends. "Healthcare personnel entering the room should use standard precautions, contact precautions, airborne precautions, and use eye protection (e.g., goggles or a face shield)," the CDC states.[3]

Airborne precautions call for use of an N95 or equivalent. The mask vs. respirator issue has caused some controversy in the past, but the emergence of several epidemics and pandemic flu in the first 20 years of this century should translate to preparedness in many hospitals.

"We have a robust respiratory protection program. Our healthcare workers are fit-tested annually with N95s," says **Lydia Crutchfield**, MA, BSN, RN, CLC, director of corporate teammate health at Atrium Health in Charlotte, NC. "I don't anticipate any challenges with that; it is hardwired into our safety program."

Likewise, the facility is proactive about personal protective equipment (PPE) supplies, and is ready to replenish stock as needed. "We're always mindful of these emerging infectious diseases," says Crutchfield, president of the Association of Occupational Health Professionals in Healthcare. "This is a novel disease, and we emphasize respiratory etiquette like covering your cough. To report back to work, [employees] have to be fever-free for 24 hours after taking an antipyretic."

Employee health works very closely with infection control in these types of situations, she says. "We actually have an infectious disease team of nurses within occupational health," she said.

Given the many documented instances and studies of healthcare workers contaminating themselves while doffing PPE, it may be helpful to have someone observe workers removing gear after treating a patient.

"If they have a confirmed or suspect case, make sure there are observers who are watching as they don and doff PPE going in and out of the room to ensure the healthcare workers' safety," says **Connie Steed**, MSN, RN, CIC, FAPIC, president-elect of the Association for Professionals in Infection Control and Epidemiology. "I have talked with our infection prevention team about doing just-in-time-reminder competencies for frontline healthcare workers on how to put on and take off respirators. That seems to be the biggest issue, as the hands [touch] the face."

Infection control and PPE are critical because there is no antiviral treatment or vaccine for 2019-nCoV. "Infection prevention is the best thing we have, and that worked after a while with SARS," says Lucey. "It's not just about the equipment. Like with Ebola, it is knowing how to use it safely every single time, especially when you are taking it off, and the virus is on your gown, gloves, or goggles."

On Dec. 30, China reported an

outbreak of respiratory disease in Wuhan City. Reports indicate some of the first patients in China were at a Wuhan seafood market that also sold chickens, bats, snakes, marmots, and other wild animals. However, in reviewing case reports, Lucey theorizes the virus may have been circulating under the radar for weeks or months before the first cases were linked to the food market. *(For more information, see related story, page 29.)*

"It didn't just suddenly appear in December and somehow mutate and become very contagious," he says. "My hypothesis is it has been around for several months, and it has been sort of accelerating and developing the ability to spread quickly."

The scientific consensus is that both SARS and MERS coronaviruses arose in bats before transferring to palm civet cats in China and camels in Saudi Arabia, respectively. The animal reservoir of 2019-nCoV has not been determined definitively, but China has closed all live animal markets in the wake of the outbreak.

A recently published genetic analysis by Chinese scientists revealed that the 2019-nCoV may be of snake origin via bats. "Results obtained from our analyses suggest that the 2019-nCoV appears to be a recombinant virus between the bat coronavirus and an origin-unknown coronavirus," the researchers reported.[4] "The recombination occurred within the viral spike glycoprotein, which recognizes cell surface receptors. [O]ur findings suggest that snake is the most probable wildlife animal reservoir for the 2019-nCoV."

Identifying that the palm civet cat was the intermediary host for SARS led to a mass culling of the animals from markets where they were sold live as food. In addition to that and other aggressive actions, the SARS outbreak ended relatively quickly, and the virus has not been seen again. In contrast, the Saudis have resisted culling camels, an animal central to their culture. Thus, MERS remains in the region, although it has not shown the ability to sustain transmission to other parts of the world.

"Each of these rogue coronaviruses that jump species from animals to humans has its own characteristics and personality," Schaffner says.

THE CDC REPORTS THAT GENETIC SEQUENCING OF THE VIRUS IN THE U.S. CASES MATCHES THOSE IN CHINA, SUGGESTING NO MUTATION HAS TAKEN PLACE THUS FAR.

"From a scientific point of view and a better comprehensive understanding, we would like to figure out what the animal source is for the people in China. If snakes are indeed the source, then it is important for the local public health people to take that into account."

Coronaviruses can possibly mutate, and "although there was some mutational change in both the SARS and the MERS virus, all in all they were pretty stable viruses," Schaffner says. "Given that this new virus has just recently adapted to humans, there is a concern that it may become more readily transmissible. That's the big issue."

The CDC reports that genetic sequencing of the virus in the U.S. cases matches those in China, suggesting no mutation has taken place thus far. The CDC first alerted clinicians on Jan. 8 to be on the lookout for patients with respiratory symptoms and a history of travel to Wuhan. The agency has activated it Emergency Operations Center and developed a diagnostic polymerase chain reaction (PCR) test to detect the virus in clinical specimens. Currently, testing must take place at CDC, but the agency was expected to distribute test kits to state health departments in the near term.

"Once the sample is prepared at CDC, the time it takes to actually do the test is four to six hours, which is a very typical time for a real-time PCR," Messonnier said. "Part of the delay is the sample getting to CDC, and that's one of the reasons we are focusing on getting these tests out closer to the patients so the results can become available more quickly." The CDC also has posted a blueprint of how to make the test for other countries.

Initially, travelers from Wuhan were routed to one of five major U.S. airports for screening in Atlanta, Chicago, New York, Los Angeles, and San Francisco. However, since China moved to shut down travel out of Wuhan, this screen approach was subject to change, and may include more cities in China.

"We have seen a fairly dramatic change in the situation in China with the government's announcement of travel bans and restrictions out of Wuhan. Those are extending to additional cities as we speak," said **Martin Cetron**, MD, director of CDC's Division of Global Migration and Quarantine.

The virus has a 14-day incubation period, so the CDC was focusing on arriving flights in the two weeks following the Chinese travel ban, he

said. For planes with suspect cases, other passengers are advised to check symptoms for two weeks.

The Chinese took the extraordinary step of quarantining Wuhan, a city of 11 million people. However, a large portion of the city's population reportedly left before the measures went into effect. The real-time spectacle played out somewhat cinematically, with some comparing the outbreak to the movie *Contagion*, which was based in part on the rapid emergence of SARS.

"Can you imagine trying to semi-quarantine a city of 11 million people? What does that mean in real life?" Schaffner says. "The first three things I thought of were food, medicine, and fuel. How do they get that into a quarantined city?"

The efforts to rapidly build new hospitals in the area also were unsettling. All signs indicate that the case numbers out of China will continue to escalate before 2019-nCoV is brought under control. ■

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WHO Declares Coronavirus Outbreak an International Emergency

'In effect, it puts a country in quarantine'

The World Health Organization (WHO) declared the 2019 novel coronavirus (2019-CoV) outbreak in China a Public Health Emergency of International Concern (PHEIC) on Jan. 30. WHO emphasized China will not be isolated from the global community, which can happen after a PHEIC is issued.

"[Nations] implementing additional health measures that significantly interfere with international traffic (refusal of entry or departure of international travelers, baggage, cargo, containers, conveyances, goods, and the like, or their delay, for more than 24 hours) are obliged to send to WHO the public health rationale and justification within 48 hours of their implementation," the announcement stated. "WHO will review the justification and may request countries to reconsider their measures. WHO is required to share with other States Parties the information about measures and the justification received."[1]

Unfortunately, that already was happening with the rapid expansion of cases, and China will likely become more isolated until cases begin to decline.

"The decision was anticipated. I think it makes formal what had been happening already," says **William Schaffner**, MD, an infectious disease physician at Vanderbilt University Medical Center. "Namely, travel to and from China was being interrupted informally in many circumstances. Our own university, for example, has let all students know that they were not to go to China on any kind of scholarly pursuit. That's prudent, of course. This will have major economic implications for China, and it's unfortunate that it has been instituted. In effect, it puts a country in quarantine."

WHO will dispatch a multidisciplinary team to China to review and support efforts that will investigate:

- the source of the outbreak;
- the clinical spectrum of the disease and its severity;
- the extent of human-to-human transmission in the community and in healthcare facilities;
- the current efforts to control the outbreak.

WHO particularly emphasized the importance of finding the source, to rule out hidden transmission and to inform risk management measures. As with SARS and MERS, 2019-nCoV likely is from an intermediate animal host that contracted the virus from bats. WHO emphasized

the need for enhanced surveillance in regions outside the epicenter in Hubei province, including pathogen genomic sequencing, to understand whether local cycles of transmission are occurring.

One infectious disease expert who is closely following the outbreak theorizes that 2019-nCoV has been circulating for some time, well before the first cases were discovered in the city of Wuhan.[1] A recently published study of 41 cases suggests infections were occurring earlier in November, and perhaps October, but there was no available diagnostic test at that time,[2] says **Daniel Lucey**, MD MPH, FIDSA, FACP, an infectious diseases physician at Georgetown University Medical Center.

"I think this outbreak started before the December outbreaks in the seafood and live animal market," he says. "That paper shows 41 patients and what day they became symptomatic. The very first patient became sick on Dec. 1. The most important thing is that the patient had no exposure to that seafood market. In fact, 14 of the 41 patients had no exposure to the seafood market. It didn't start with the seafood market in Wuhan. It started somewhere else. How far back does it go? Is there a chain of initial cases that we didn't know about, maybe from other markets? Also, to me, that explains why there is such rapid spread now to all the other provinces and other countries: because the virus has been around for a while, maybe even since September."

In the absence of a test, prior cases were likely assumed to be pneumonia and flu that are common in the winter months in China, he said.

"They developed the rapid diagnostic test after they first discovered the virus on Jan. 7," Lucey explains. "Now, they are testing all of these people in hospitals with pneumonia, and they are finding positives. That's not because all of a sudden in December and January we have this mutated virus that is very contagious. It's because the virus has been circulating for months in Wuhan."

WHO acknowledged that there are still many unknowns, as cases have been reported in five WHO regions in one month, and human-to-human transmission has occurred outside Wuhan and outside China.

"The committee believes that it is still possible to interrupt virus spread, provided that countries put in place strong measures to detect disease early, isolate and treat cases, trace contacts, and promote social distancing measures commensurate with the risk," WHO stated.

The committee emphasized that the declaration of a PHEIC should "be seen in the spirit of support and appreciation for China, its people, and the actions China has taken on the frontlines of this outbreak, with transparency, and, it is to be hoped, with success. In line with the need for global solidarity, the committee felt that a global coordinated effort is needed to enhance preparedness in other regions of the world that may need additional support for that."

Priority measures are rapid development of and access to potential vaccines, diagnostics, and antiviral medicines, which will be particularly necessary if the virus spreads to countries with few resources.

"It is expected that further international exportation of cases may appear in any country," WHO stated. "Thus, all countries should be prepared for containment, including active surveillance, early detection, isolation and case management, contact tracing, and prevention of onward spread of 2019-nCoV infection, and to share full data with WHO." ■

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First Case of Person-to-Person Transmission in the United States

The first case of person-to-person spread of the 2019 novel coronavirus (2019-nCoV) emerging in the United States has occurred, as the husband of a previously identified case in Illinois has been hospitalized, the CDC reported on Jan. 30. The man is the first U.S. case with no history of travel to China.

Public health officials announced the woman became ill after returning from Wuhan, China, the epicenter of what is threatening to become a global outbreak. She has been hospitalized, and her husband became ill and also was hospitalized. They both are in stable condition.

The CDC cautioned against overreaction, like wearing surgical masks in public, as the number of cases in the U.S. is only at six. Limited person-to-person spread also has been seen in nine other countries, as people traveling from Wuhan infect their close contacts.

All six U.S. patients have survived and all are thought to remain hospitalized. In addition to Illinois, the first five infections in American patients were in travelers who returned from Wuhan to Washington state, California, and Arizona. All their contacts are being traced to detect any other transmission.

Although it was soon followed by other cases, the first case of 2019-nCoV in the United States was unusual in that a self-aware patient who became ill after traveling from Wuhan, China, essentially self-diagnosed and reported for care.

The man returned from Wuhan on a connecting flight into Seattle-Tacoma International Airport in Washington, the CDC reported at a Jan. 21 press conference. He showed no symptoms of illness since leaving China, but was closely following his vital signs for the fever and cough that mark the onset of the coronavirus infection. He had not visited any animal markets in China, the patient said.

"This was a very astute gentleman who was looking at internet activity, had actually researched this, and shared this information with his provider on Jan. 19," said **Scott Lindquist**, MD, state epidemiologist for communicable diseases in Washington.

At a Jan. 21 press conference, **Nancy Messonnier**, director of CDC's National Center for Immunization and Respiratory Diseases, immediately drew a distinction between the new coronavirus and the Ebola virus that infected two U.S. nurses in Dallas in 2014.

"It's actually important to clarify that the precautions for this patient are standard isolation precautions," she said. "This is something many hospitals know how to do, and we're grateful that in this region in Washington state they were quite prepared for this contingency. This is not a situation like the Dallas one. This is something where most hospitals in the region should have a hospital that can utilize these kinds of precautions."

The CDC is calling for standard, contact, droplet, and airborne precautions that include an N95 respirator. Most hospitals can implement those, but it bears recalling that the CDC started its Ebola response by saying any hospital could handle a case of that virus. Ebola patients eventually were transferred to biocontainment facilities with considerably more protection for healthcare workers.

"We are very comfortable that this patient is isolated, poses very little risk to the staff or the general public in this current situation," Lindquist said. "Because of an abundance of caution, we have used pretty strict isolation requirements and hospitalization because it is the first person in the United States."

The patient was recovering in a hospital and no secondary cases have been identified. Four additional U.S. patients — all travelers from Wuhan — were identified shortly after the first case, with patients hospitalized in Illinois, California, and Arizona. Again, no transmission has been found in any contacts of these patients. The CDC is investigating 80 people in the U.S. as possible cases, and predicts that more will be identified linked to travel from China.

"Right now, we have only a handful of patients with this virus in the U.S.," Messonnier said. "We're conducting contact tracing for every one of these patients. Contacts are watched for multiple days after the last day they were in contact with the patient. If the contact develops a fever or respiratory symptoms, they will be tested to see if they are also infected. We think this strategy will enable us to contain the outbreak."

As this story was filed, the CDC advised all U.S. citizens to avoid nonessential travel to China.

"While it's possible that some person-to-person spread with this virus may be detected in the United States, the goal of the ongoing U.S. public health response is to contain this outbreak and prevent sustained spread in this country," the CDC stated. ■

NIH Developing a Vaccine for 2019-nCoV

'We are looking at the worst-case scenario'

The National Institutes of Health (NIH) has fast-tracked vaccine development to stop a novel coronavirus emerging from China, but it will be months before it can be administered safely to an anxious public.

Anthony Fauci, MD, director of the NIH National Institute of Allergy and Infectious Diseases, described the ongoing research at a Jan. 28 press conference.

"We already started at the NIH, with many of our collaborators, the development of a vaccine," he said. "One [vaccine] has a messenger-RNA platform. When the Chinese isolated the coronavirus they put the sequence on a public database. Given the technology of the 21st century, we are able to use that sequence, pull out the gene of the glycoprotein spike of this particular virus, and make that the immunogen to be used in a vaccine. Right now, it is being prepared."

While promising, vaccine development and testing is a time-consuming process, both to ensure that it works and that it is safe in humans.

"I anticipate with some cautious optimism that we will be in a Phase I trial within the next three months," he said. "I want to emphasize that does not mean that you have a vaccine that is ready for development. It will take three months to get it into the trial, then three months to get safety and immunogenicity data. Then, you move into Phase II. What we do from that point on will be determined by what is happening with the outbreak over that time."

Considering that current trends find 2019-nCoV rapidly expanding in China and reaching other nations near and far, the general consensus is that the vaccine will be needed. "We are proceeding as if we will have to deploy a vaccine," Fauci said. "We are looking at the worst-case scenario: that this becomes a bigger outbreak."

Diagnostics and therapeutics also are in development, promising treatment until there is a vaccine to prevent infection. "With regard to diagnostics, the CDC has rapidly developed [a test] based on the published sequence of the virus," Fauci said. "The NIH, along with the CDC, will be working on next-generation diagnostics more at the point of care so we can get them to more people throughout the world."

Despite the prior emergence of SARS and MERS, there currently is no therapeutic treatment for coronavirus infection. Ongoing studies were initiated due to those outbreaks, but treatment remains elusive.

"Between those outbreaks and the current one, a number of antiviral drugs have been tested in vitro, in animal models, and even in the field anecdotally with historic controls," Fauci said.

One of them is the antiviral remdesivir, which once was used in a clinical trial against Ebola, he said. Another that is now being used by some clinicians in China is a combination of two antivirals, lopinavir and ritonavir, Fauci said.

"I must emphasize there is no proven efficacy of these but they are being pursued together with a number of agents," he said. "That is why it is so important that we get isolates of the virus, which we will soon have from the individuals in this country who have been infected."

During the SARS outbreak, researchers developed monoclonal antibodies as a potential therapeutic.

"They were only used in vitro and in animal models," he said. "Given the somewhat close homology between SARS and the new coronavirus, that could be utilized. However, what we are really trying to do — and it will happen soon as we get specimens from individuals who are infected — is to clone their cells and make specific monoclonal antibodies against this new coronavirus." ■

Surveillance Programs for Staff Working With Hazardous Medications

Linking exposures to subsequent illness can be problematic

Looking for guidance on best practices for a hazardous medication surveillance program? Many employee health professionals may be making changes to their hazardous medication surveillance program (HMSP) in response to United States Pharmacopeia (USP) <800> standards.

"Absence of best practices for HMSPs and limitations on the ability of such programs to correlate health effects identified on surveillance with workplace exposures historically, have left healthcare institutions to determine if and how to design an HMSP for their workforce," the authors of a new study reported.[1]

They discussed designing an HMSP using resources such as a health questionnaire and declination forms. "This information is intended to generate further discussion and collaboration among leaders of employee occupational health services on a national level to address the benefits and challenges of HMSPs," they concluded.

Seeking further comment on the paper, *Hospital Employee Health* interviewed lead author **Laura Breeher**, MD, MPH, occupational medicine medical director at the Mayo Clinic.

HEH: Can you comment on whether the USP has revised any guidelines since your study was published that would have any implications for your findings?

Breeher: USP's Chapter <800> was published in 2016 with an implementation date of December 2019. USP <800> outlines standards and recommendations for "cradle-to-grave" management of hazardous medications in the healthcare setting. The survey my colleagues and I conducted of practices in hazardous medication surveillance was sent in 2017. Healthcare institutions may have reviewed their policies related to hazardous medications, and may have made adjustments to the approach to surveillance, considering USP <800>. Hazardous medication surveillance programs have been a hot topic in healthcare for the past couple of years as institutions strive to ensure the health and safety of employees; that is, whether to have one. If the institution has one, what it should include and who should be included?

> "HAZARDOUS MEDICATION SURVEILLANCE PROGRAMS HAVE BEEN A HOT TOPIC IN HEALTHCARE FOR THE PAST COUPLE OF YEARS AS INSTITUTIONS STRIVE TO ENSURE THE HEALTH AND SAFETY OF EMPLOYEES."

HEH: About half the survey respondents reported not implementing a medical surveillance program. Did you see any responses or trends that could explain why these programs are not implemented in these healthcare settings?

Breeher: Multiple survey respondents reiterated this challenge: inability to clearly connect workplace exposure to hazardous medications with adverse health effects. The primary reason for this is that many of the potential effects are common (i.e., miscarriage, cancer). The limited number of healthcare workers enrolled in smaller institutions further limits the ability to identify trends in health effects among healthcare workers handling and administering hazardous medications who are enrolled in surveillance programs. Many institutions also reported a focus on exposure controls, such as closed-system transfer devices, and environmental testing with wipe sampling to ensure controls are adequate rather than implementing an HMSP.

HEH: There were some consensus tests in those that have these programs, but can you discuss the lack of standardized recommendations?

Breeher: The survey results showed which tests are more commonly performed at institutions with HMSPs, but there was no consensus standard. Even with the most common test, 72% of HMSPs included this lab test rather than 100%. USP <800> includes recommendations for core elements of an HMSP, but these are nonspecific ("updated health and exposure history, physical assessment, and

laboratory measures, if appropriate"). I believe the flexibility within these recommendations is due to lack of clear evidence that hazardous medication surveillance programs result in improved workplace health and safety at present. I would not recommend regulations for HMSPs until evidence exists on the effectiveness of surveillance programs to guide program design.

HEH: There have been studies showing that pregnant healthcare employees work with, for example, hazardous oncology drugs, but they do not always wear personal protective equipment (PPE).[2] Does the challenge of compliance underscore the need for surveillance programs? Should clinicians working with hazardous drugs be followed long term, perhaps for life?

Breeher: Use of PPE is a primary prevention measure for health effects that may result from work with hazardous medications. I agree with the authors of the study you cited that further education and training are needed to ensure frontline staff understand the hazards and reasons for PPE, but there may be other reasons for this lack of use of the PPE. It's important to understand why the nurses aren't wearing the recommended PPE. Is it lack of availability? Poor fit? Time pressures? Concern for patient perception? Lack of knowledge of the hazards? Lack of managerial support?

A culture of safety is extremely important, and we can learn a lot about potential barriers to compliance from colleagues doing this work every day. For example, in identifying gowns for use with antineoplastics, a gown that gapes at the neck or is constricting at the wrists is less likely to be worn than one that fits well. A surveillance program is a secondary preventive measure with a goal of early identification of health effects if primary preventive measures fail, but it shouldn't be a substitute for primary prevention of exposure. I don't feel there are enough data to comment on the recommended duration of surveillance at present.

HEH: Given the lack of medication surveillance programs at many facilities, and the lack of standardization in those that employ them, do you think there could be many resulting illnesses and long-term effects in healthcare workers that are not being reported?

Breeher: I believe the absence of hazardous medication surveillance programs at some facilities and lack of standardization in those that have an HMSP reflect that there isn't the evidence-based data to show that these programs are able to identify health effects resulting from work with hazardous medications. Surveillance programs for other hazards have been shown to be effective at early identification of health effects to improve the health of the worker(s). An example includes surveillance for lead toxicity with blood lead levels in those exposed above the OSHA permissible exposure limit. *(More information can be found at: https://bit.ly/38QqXhh.)*

Another example is surveillance for silicosis where chest X-rays show characteristic findings of lung fibrosis resulting from silica inhalation. In both of these situations, surveillance can screen for a specific health effect that is more likely than not to be associated with the workplace hazard. Regulations were put in place to support these best practices based on evidence that surveillance improves the health of workers. With hazardous medications, the potential health effects from unprotected exposure also are common in the general population, which results in the challenges outlined earlier.

I don't feel sufficient research has been done to determine the significance of unreported health outcomes. That being said, I do think standardization of HMSPs is an important step toward determining if these programs add to the health and safety of healthcare workers. We need more data with purposeful statistical analysis to determine the best approach to HMSPs. Some healthcare institutions may include all workers who administer hazardous medications. Other institutions may include only healthcare workers who have an unprotected exposure (i.e., chemo spill without PPE). Still others may include anyone with a potential risk of exposure. There are benefits and challenges to each approach. In response to the survey data, USP <800> recommendations, our own experience with our historic HMSP, and input from a multisite, multidisciplinary team, we have recently standardized our HMSP at Mayo. A summary of the approach, including forms (a standardized questionnaire and a declination form) we will use at our institution across all enterprise sites was published ahead of print in *Journal of Occupational and Environmental Medicine* (https://bit.ly/310wzD6) so that other institutions could use some of these tools in their programs if they desire. ■

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2. Lawson CC, Johnson CY, Nassan FL, et al. Antineoplastic drug administration by pregnant and nonpregnant nurses: An exploration of the use of protective gloves and gowns. *Am J Nurs* 2019;119:28-35.

Continuous Visible Lighting Disinfection May Offer Benefits

The University of New Mexico (UNM) Comprehensive Cancer Center recently replaced traditional light bulbs in its operating rooms with antibacterial LEDs for a visible-light continuous environmental disinfection (CED) system.

Research suggests the fixtures can continuously kill harmful bacteria on high-risk surfaces, which should be an improvement over intermittent cleaning, explains **Stewart Livsie**, manager of maintenance and construction at UNM Comprehensive Cancer Center.

Another common option, ultraviolet (UV) lighting, is not safe for human exposure and can only sanitize spaces once patients and staff leave the room, Livsie says. The germicidal properties of UV light are well established. Many healthcare organizations use it to destroy microorganisms, but the usefulness of visible violet-blue 405 nm light has been recognized only recently for addressing environmental contamination.

The common light disinfection method uses the UV-C (250 nm) wavelength to kill pathogens by causing photodegradation of DNA. That same process is harmful to humans. Hospitals are limited to using UV light disinfection to clean rooms and equipment without exposing people to the light. Usually, these UV devices are used when rooms are cleaned between patients or on a regular schedule, Livsie explains.

UV also can degrade some plastics and other materials. The visible light disinfection systems kill pathogens through a different process and are not harmful to humans, meaning they can be employed in ways that provide visible-light CED in which people will be exposed to the light, Livsie says.

The visible light requires longer to disinfect surfaces than the UV light. Still, because the UNM Comprehensive Cancer Center is the state's only National Cancer Institute-certified facility, leaders try to stay on the cutting edge of technology, Livsie says.

"Our patients make up the most immunocompromised population. Whatever we can do to try to keep them safe is a priority for us," he says. "I was at a healthcare design conference where a big focus was on how to use the built environment to help patients and facilitate quality improvement. This was one of the strategies that was presented ... [CED] seemed to be most advantageous to us from our infection control personnel's perspective."

Most pathogens that concerned leaders at the UNM Comprehensive Cancer Center are contact transmissible. They were attracted to a technological solution that promised continuous surface cleaning.

As part of a service line change, the cancer center was bringing in interventional radiologists to help with port placements and similar needs. Thus, the center needed to renovate its operating rooms. The surgical suites had not been updated since they were built in 2009. The cancer center was ready to make structural improvements in addition to accommodating interventional radiologists.

UNM Comprehensive Cancer Center decided to replace the old fluorescent light fixtures with LED lighting because it provides better light quality and is more energy efficient. "As we were doing that project, it seemed kind of a no-brainer to use the visible light continuous disinfection LEDs because this was the most critical area in our facility," Livsie reports. "Even if it didn't work for disinfection, we'd still have LED lights in our operating facility. We really didn't feel like we had anything to lose by trying it."

The cancer center is still piloting CED, so there are no data yet to show effectiveness. However, Livsie says the research behind the disinfection technique makes leaders optimistic that they will see substantial reductions in colony counts. "We're going to keep our environmental services processes exactly the same. We're not changing anything there," he says. "This is more of a belt-and-suspenders type of approach. We will be doing everything we've always done to control infections. But we also have this lighting system that is working to kill bugs and germs any time the lights are on, and everywhere the light touches a surface."

Research on the effectiveness of the particular product used at UNM Comprehensive Cancer Center was performed largely in coastal regions, so Livsie and infection control leaders at the facility are curious to see if the drier air in New Mexico has any impact. Lower humidity tends to favor the growth of spores and some other pathogens, he notes.

"Any reduction will be good. The cost for the lights was less than what the cost of a traditional light fixture would have been. For me, there was really no risk in that sense," Livsie says. "If we start seeing that there is a significant reduction in colony counts, we will start looking at rolling these lights out to other critical areas of the facility, like the bone marrow and stem cell transplant unit and the infusion suite." ■

HOSPITAL EMPLOYEE HEALTH

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CE QUESTIONS

1. **Although bats are thought to be the ultimate source, which animal has become an intermediate host for MERS?**

   a. Palm civet cats
   b. Desert lizards
   c. Camels
   d. Jackals

2. **The epidemiologic measure of a viral reproductive ratio is called an r-naught. The conventional wisdom is that an r-naught of less than which number means viral spread will fade out?**

   a. 0.5
   b. 1
   c. 2
   d. 3

3. **The first case of 2019-nCov in the United States occurred in:**

   a. Washington.
   b. Illinois.
   c. California.
   d. New York.

4. **Laura Breeher, MD, MPH, said a common problem in surveillance programs for workers who handle hazardous medications is:**

   a. it is unclear which medications are hazardous.
   b. the inability to clearly connect workplace exposures to adverse health effects.
   c. unreported reproductive problems by men.
   d. employees working sick evaluated for exposures.

CE OBJECTIVES

After reading each issue of *Hospital Employee Health*, the nurse will be able to do the following:

1. Identify particular clinical, administrative, or regulatory issues related to the care of hospital employees;
2. Describe how the clinical, administrative and regulatory issues particular to the care of hospital employees affect health care workers, hospitals, or the healthcare industry at large;
3. Cite solutions to the problems faced in the care of hospital employees based on expert guidelines from relevant regulatory bodies, or the independent recommendations of other employee health professionals.