Current Topics

Summit Seeks To Boost “One Health” Concept

When it comes to infectious diseases, we live in a “triple-threat” world, says Lonnie King, Dean of the College of Veterinary Medicine at Ohio State University in Columbus. That tripartite threat comes at the confluence of human, animal, and environmental forces—leading him, other veterinarians, microbiologists, public health specialists, and a broad range of experts from other specialties to embrace the “one health strategy” for combating infectious diseases.

He and others spoke last November during the summit conference “One Health: Improving Health in an Interconnected World, People-Animals-Environment,” convened at the National Academy of Sciences in Washington, D.C.

“We have a new appreciation today of the diseases passing from animals to humans,” King says. The expanding human population, an expanding population of animals grown on farms to feed those people, migrations of people and animals, and a steadily growing international food trade provide a kind of “Club Med” for microorganisms, he says. That club operates a metaphorical playland for pathogens, some of which make new “friends” in terms of host species, leading inevitably to a continuing onslaught of emerging infectious diseases.

King calls Escherichia coli O157:H7 the “poster child” for the one health concept, citing instances in 2006 of foodborne illnesses that were traced to spinach contaminated with this pathogen. That outbreak and others like it exemplify how human, animal, and environmental factors collide in ways that require teams with disparate expertise to unravel what has happened in each instance. In that case involving illnesses from consuming contaminated spinach, one set of experts implicated feral pigs and cattle as carrying the bacterial pathogens to the fields where the spinach grew, he says. Yet another set of experts drilled down further to assign some of the problem to the irrigation system used to water those fields, noting that the irrigation water became cross-contaminated with groundwater.

Of course, diseases go in both directions, sometimes moving from humans to animals, says conference participant Ali Khan, who is from the Centers for Disease Control and Prevention (CDC) in Atlanta, Ga. “Part of the power of the one health concept is that it [leads us] to think about this from the perspective of what diseases in humans affect animals,” he says. In practical terms, this approach calls for emphasizing “early detection” and focusing on “upstream protection” because it has “the greatest impact.”

Some efforts to keep track of diseases in animal species such as fish and wildlife go on mainly at the state level, according to David Schad, who works in the Division of Fish and Wildlife, Minnesota Department of Natural Resources. Yet, some of those outbreaks may have important consequences for human health, even if indirectly. Consider, for example some of the broader potential consequences of white nose syndrome, a fungal disease that is killing bats throughout at least an eight-state region. Thus far, its impact appears limited to bat populations. However, they play an important role by hunting and thus curbing flying insects, some of which serve as vectors for other animal and human diseases, Schad points out. “We are poorly prepared to deal with those consequences.”

In terms of the one health movement, zoonoses take the “central focus of protecting humans on a global scale,” says microbiologist Ron Atlas of the University of Louisville in Kentucky, who represented ASM on the One Health Commission board of directors. This approach to public health entails a “shift to preventing diseases in animals first as a way of protecting humans,” he continues. “And ‘vaccinate cattle against E. coli O157:H7 to prevent this infection in humans’ is what I was hearing at the summit.” To some extent, this emphasis reflects the fact that veterinarians are now a predominant force within the one health movement.

Jeffrey L. Fox

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Some Alcohol Sanitizers No Better than Soap and Water against Norovirus

Rinsing contaminated fingers with water alone, or with triclosan-containing soap and water, was considerably more effective for removing Norwalk virus than was using an alcohol-based hand sanitizer, but the antibacterial soap showed no advantage over water alone, according to a report in the January Applied and Environmental Microbiology (76:394–399). These findings are from the first known direct test of an alcohol-based hand sanitizer against a human norovirus strain, according to Christine Moe and Pengbo Liu of the Rollins School of Public Health at Emory University in Atlanta, Georgia, and their collaborators there and at
Researchers find that washing hands with water alone was as effective as using antibacterial soap in removing Norwalk virus—and more effective than using alcohol-based hand sanitizer. Noroviruses are highly infectious and cause an estimated 23 million cases of gastroenteritis in the United States annually.

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“Our findings have greatest significance for food service and health care settings because over-reliance on alcohol-based hand sanitizers may put them at greater risk for norovirus outbreaks,” Moe says. Noroviruses spread readily through fecal contamination of food, water, hands, and surfaces, notably those involved in food preparation. An estimated 23 million cases occur annually in the United States, affecting about 8% of the population, according to a 1999 report from the Centers for Disease Control and Prevention in Atlanta. Norwalk virus, named for an Ohio municipality which had an outbreak of the virus in 1968, causes nausea, vomiting, diarrhea, and abdominal cramps, often accompanied by headache and fever.

Moe, Liu, and their collaborators compared the effectiveness of liquid soap and alcohol hand sanitizers in removing or killing viruses on finger pads, following methods developed by the American Society for Testing and Materials. After finger pads were inoculated with norovirus and then washed, the researchers used quantitative reverse transcriptase PCR to measure viruses that remained. In another set of tests, sodium hypochlorite (bleach) eliminated virus, while ethanol, regardless of concentration, did little to reduce virus titer. In vivo rinsing either with water or with antibacterial, triclosan-containing soap proved about equally effective in reducing viruses on finger pads.

These results suggest that protection comes from mechanically removing the virus from the hands, rather than from inactivating the virus, says Stuart Levy of Tufts University in Boston, Massachusetts, who was not involved in this research. Elaine Larson of Columbia University in New York, N.Y. agrees. “It is likely that much of the viral removal from hands is more related to mechanical friction than to antiviral product activity,” she says. “It’s likely that plain soap would perform as well as an antibacterial product, but more data are needed.”

“Human hands play an important role in person-to-person transmission of noroviruses, and effective hand hygiene is an important way to interrupt this transmission route,” say Moe and Liu. Remarkably, dose-response, human-challenge studies show noroviruses to be the most infectious agents ever described, Moe adds. Avoiding infection is a challenge because some hosts lack symptoms, while others can excrete infectious particles for several weeks after symptoms subside. Virus concentrations can be extremely high in feces, she says. “There are examples of outbreaks where a single food service worker with dirty hands made contaminated food items that resulted in hundreds, even thousands of cases of norovirus illness.”

**CDC: Up to 80 Million H1N1 Flu Cases, More than 16,000 Deaths in 2009**

U.S. public health officials estimate from 39 million to 80 million cumulative cases of H1N1 influenza through mid-December 2009, including as many as 362,000 H1N1-related hospitalizations and 16,460 H1N1-related deaths, according to a report from the Centers for Disease Control and Prevention (CDC) in Atlanta, Ga. Those flu-infected individuals who are younger than 65 years of age were more severely affected, and approximately 90% of hospitalizations and 88% of deaths occurred within this younger cohort. Meanwhile, laboratory-confirmed data on hospitalizations and deaths underestimate the “true number,” CDC notes, pointing to “incomplete testing, inaccurate test results, or [diagnoses] that attribute hospitalizations and deaths to other causes.”
Regarding the apparent ineffectiveness of alcohol, Moe says that some viruses, including norovirus, lack envelopes, making them relatively insensitive to alcohol and, thus, “tough little pathogens.” Meanwhile, however, alcohol inactivates many kinds of bacteria as well as viruses with envelopes.

Moe and her collaborators are continuing to test commercially available hand-hygiene products to see how they perform against human noroviruses. Some new alcohol-based sanitizers “seem much more effective [than those tested earlier] in reducing noroviruses on finger pads,” she says. “These findings highlight the need for evidence-based, decision making about hand-hygiene products in settings where norovirus outbreaks occur.”

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Losses in Ancestral Microbes Pose Health Risks to Humans

Selective losses of human-associated microorganisms may be responsible for a wide range of modern ailments, including esophageal diseases, obesity, asthma, and the epidemic spread of high-grade pathogens, according to Martin Blaser from New York University Langone Medical Center in New York City. He cites *Helicobacter pylori* as a prime example of this phenomenon. “*H. pylori*, which should be the numerically dominant residents of the stomach environment, have been disappearing with remarkable speed in developed countries,” he says. This loss is bringing “significant gastric secretory, hormonal, and immune changes,” including some that harm human health.

In two to three generations, humans moved from near-ubiquitous colonization by *H. pylori*—more than 80% of people carried them—to rates in the single digits for children born in the United States and Western Europe, Blaser says. “This is an unprecedented change in human microecology,” and reflects more sweeping alterations across the human microbiota, according to Blaser and Stanley Falkow from the Stanford University School of Medicine in Stanford, Calif. They attribute this to multiple factors, including cleaner water, smaller families, births involving a higher percentage of Caesarean sections, a reduced frequency in breastfeeding, and the widespread use of antibiotics, especially among pregnant women and children. Details appear in the December 2009 *Nature Reviews Microbiology* (doi: 10.1038/nrmicro2245).

“Over the long history of its relationship with humans, *H. pylori*-provoked inflammation has progressively decreased the numbers of gastric acid-secreting glands, with a consequent decline in acid production,” Blaser says. This decline is not all bad; it has led to a drop in incidence of illnesses with long latent periods such as gastric cancer. However, the tradeoff is a rise in gastroesophageal reflux disease (GERD) and its consequent risks of Barrett’s esophagus and gastric adenocarcinoma.

The stomach produces the hormones ghrelin and leptin, both of which have multiple roles in energy homeostasis, Blaser says. “Children growing up in developed countries have little gastric *H. pylori*-mediated regulation of these adipokines, which may contribute to our current epidemic of childhood obesity, type 2 diabetes, and related metabolic syndromes.” Furthermore, he adds, “We’re exposing young children to microbiome-altering antibiotics. Because this practice increases feed efficiency in poultry, cattle, and pigs, it might also impact on our escalating numbers of overweight children.”

“People colonized with *H. pylori* have enhanced T-cell populations, particularly the subsets that regulate immune functions,” Blaser continues. For example, *H. pylori*-positive individuals—especially those carrying cag-positive strains—have lower risks of childhood asthma, allergic rhinitis, and skin allergies than do their *H. pylori*-deficient peers, he says, citing epidemiological studies.

As *H. pylori* or other microbiota disappear from an anatomic site,