Stop AMR Global Media Monitor

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Virologists weigh in on novel coronavirus in China's outbreak

An unexpected outbreak of pneumonia in Wuhan, the 10th largest city in China, is still without explanation. With no new cases announced since the 5th of January 2020, the number of victims is 59 in total. Previous tests had ruled out influenza, avian influenza, adenovirus, severe acute respiratory syndrome (SARS), and Middle East respiratory syndrome coronavirus (MERS-CoV).

However, there is now evidence that, at least in some of the cases, a novel coronavirus is the culprit. Wall Street Journal sources close to the investigation have confirmed that it has been genetically sequenced in one patient and then observed in several others. It is still unknown whether it is the culprit in all 59 cases.

Prior to this event, 6 coronaviruses were known to infect humans, with 4 causing common cold symptoms and two being potentially deadly, SARS and MERS-CoV. The latter two are zoonotic pathogens, in other words they are transmitted from an animal host to humans and it is likely that the newly discovered virus follows a similar pattern with a seafood/exotic animal market being the epicentre of the epidemic.

With this potentially third coronavirus pathogen that can cause serious infections in humans developing in the last two decades, developing proper responses to such epidemics is crucial. China's health and research systems have greatly evolved since the SARS outbreak in 2003 that claimed 774 lives and it is now "their opportunity to prove to the world that they are capable and can do this themselves", as per Tim Sheahan, PhD, a coronavirus expert from the University of North Carolina.

Source: CIDRAP, 08 January 2019

Denmark Raises Antibiotic-Free Pigs. Why Can't the U.S.?

According to a 2018 report by the Natural Resources Defense Council American pork producers use antibiotics at a rate seven times higher than Danish pork producers. In the US, industry officials maintain that antibiotics are necessary to keep animals healthy and food costs low; Denmark is challenging this belief by showing their successful reduction in antibiotic use without harming productivity.

The American pork industry continues to insist that reducing the use of antibiotics would lead to sick animals going untreated and that Denmark's efforts have not led to any real impact on public health. However, experts are skeptical of this argument: Dr. Lance Price, director of the Antibiotic Resistance Action Center at George Washington University states "The American pork industry's arguments are spurious and downright embarrassing,".

Public perception has been the most crucial motivator for change in the US. Consumer backlash has led to fast-food chains like McDonald's, Taco Bell and Wendy's abandoning chicken producers that use medically important antibiotics. According to the National Chicken Council more than half of chickens are raised without antibiotics in the US following this shift in public opinion. According to the FDA the use of medically important antibiotics in chickens has fallen 47 percent and has fallen 35 percent in pigs since 2015.

The Danish government began to grow concerned about drug-resistant infections in 1995 and thus passed legislation to block veterinarians from selling antimicrobial drugs to farmers. After this legislation veterinarians could continue to prescribe antibiotics, but only pharmacies were able to sell them. To offset disapproval from veterinarians, the government added

regulations that required farmers to pay for regular visits. In the following years Denmark also phased out the use of antibiotics as growth promoters, introduced higher taxes for medically important antibiotics, and largely banned the use of drugs critical to human health in pigs.

To monitor these changes, the Danish government rolled out the "yellow card" system in 2010. National targets for antibiotic reduction began at 10 percent and has now been increased to 15 percent. Farms that fail to meet these targets receive a yellow card; out of 3,1000 farms, only 30 received a yellow card in 2018. No farms have ever earned a red card for repeated offenses. In order to deal with the reduction in antibiotics farmers have made changes in husbandry conditions to organically improve the health of their pigs. For example, many have increased the time allowed for babies to wean from their mothers and expanded the size of their cages.

The initiative has shown success. Researchers noted that following the 1995 ban on avoparcin in livestock there has been such a large reduction in avoparcin-resistant bacteria in Danish chickens that is can be considered essentially wiped out.

Source: New York Times, 06 December 2019

Researchers identify key structure of C. difficile bacteria that could lead to future treatments

Clostridium difficile is a potentially deadly bacteria that is complicated to treat, in particular when antibiotic treatment has been used to treat another infection, which can harm the beneficial bacterial population that usually acts as an infection barrier. The pathogen produces a deadly toxin, the *C. difficile* toxin (CDT) or the "binary toxin", which, as of now, is not targeted by any drug on the market thereby making it a prime research objective.

Researchers from the University of Maryland School of Medicine have characterized the structure of CDT in what is a major step forward for potential drug production. "We identified two structures that help explain the molecular underpinnings of C. difficile toxicity," said study co-author David Weber, PhD, a Professor of Biochemistry and Molecular Biology and Director of the Center for Biomolecular Therapeutics at UMSOM. "These structures will be important for targeting this human pathogen using structure-based therapeutic design methods."

Future research by the team will aim at elucidating how the active binary toxin complex is assembled and disassembled as well as how it can bind to a healthy gut cell and enter it.

EurekAlert! 02 January 2020

The Ganges Brims With Dangerous Bacteria

The Ganges River, sacred in the Hindu religion for its ability to cleanse humanity's sins, begins its journey from glaciers in the Himalayas free of bacteria. However, even before the river flows past common bacterial hotspots such as cities and farms the Ganges starts to pick up more and more resistant bacteria.

Scientists are studying the Ganges as an important environment to show the ubiquity of antibiotic-resistant bacteria and provide insight into the spread of resistant infections. Each year scientists from the Indian Institute of Technology test samples from the Himalayan foothills miles away from polluting factories, farms, and other hotspots; in this area bacterial levels are still "astronomically high" suggesting the source of this bacteria must be humans – particularly ritual bathers. They conduct their tests twice a year, once in the winter and once in summer, in both the upper and lower stretches of the Ganges. In the lower stretches after the river has come into contact with cities, factories, and farms showed unsurprisingly high levels of bacterial resistance. However, the upper region found low levels in winter that jumped during the summer months when religious pilgrimages are at their height.

The Ganges passes only four cities before reaching the testing site, the most famous being Rishikesh known for its access to the sacred river and attracting westerners and pilgrims alike. In winter the city is home to 100,000 people and balloons to 500,000 during the summer, which strains sewage treatment facilities and can lead to sewage flowing into the river at the lightest rainstorm. Here levels of NDM-1, a drug resistance gene directly named after New Delhi, were 20 times higher in the summer. Water from the Ganges is commonly drunk for religious reasons and directly spreads bacteria from bathers straight into the gut microbiome of otherwise healthy individuals that can then become infected by these resistant bacteria or spread them even further.

India at large has a serious resistance problem – sporting some of the highest antibiotic resistance rates in the world. Studies have shown 70 percent of four bacteria species found in hospitals were resistant to first-line antibiotics. Further, some species studied were as high as 71 percent resistant to carbapenems - last resort antibiotics. For Klebsiella pneumoniae specifically in India, around 57 percent were carbapenem-resistant.

Source: New York Times, 23 December 2019

New strain of hypervirulent, carbapenem-resistant Klebsiella in China

A subclone of the most dominant strain of carbapenem-resistant *Klebsiella pneumoniae* (CRKP) has been identified by an international team of researchers. 203 CRKP isolates were collected from patients with bloodstream infections at a Chinese hospital in the period of January 2013-January 2017 and then analysed. Results show that 174 (85.7%) belonged to sequence type (ST11), a clone that accounts for 60% of CRKP infections in Asia. Furthermore, two capsular types (KLs) were observed in the ST11 isolates: KL47 and 46, with the latter becoming more frequent over the study period and causing higher mortality rates. The latter was shown to have the *rmpA* and *rmpA2* virulence factors.

"In summary, our study identified the emergence of a high-risk subclone of CRKP-ST11, resulting in enhanced virulence and transmissibility," the authors write. "The newly emerging descendant obtained enhanced environmental survival and poses a substantial threat to healthcare networks, suggesting the urgent need for tailor-made surveillance and stricter infection-control measures to prevent further dissemination in nosocomial settings."

Source: CIDRAP, 07 January 2020

Delivering TB vaccine intravenously dramatically improves potency, study shows

Despite significant investments and efforts, tuberculosis remains the world's most deadly infectious disease. Furthermore, it can in some cases be fatal even to people who have been vaccinated. However, a new study published in Nature from the University of Pittsburgh School of Medicine and the National Institute of Allergy and Infectious Diseases (NIAID) has shown that changing the delivery mode of the vaccine could drastically improve its ability to prevent future infections.

The study showed that intravenous TB vaccination in monkeys was much more protective to the standard skin injection. "The effects are amazing," said senior author JoAnne Flynn, Ph.D., professor of microbiology and molecular genetics at the Pitt Center for Vaccine Research. "When we compared the lungs of animals given the vaccine intravenously versus the standard route, we saw a 100,000-fold reduction in bacterial burden. Nine out of 10 animals showed no inflammation in their lungs."

6 groups were formed: unvaccinated, standard human injection, stronger dose but same injection route, mist, injection plus mist, and finally, the stronger dose of BCG delivered as a single shot directly into the vein. Only the latter showed significant improvement and provided the monkeys with nearly full protection.

"The reason the intravenous route is so effective," Flynn explained, "is that the vaccine travels quickly through the bloodstream to the lungs, the lymph nodes and the spleen, and it primes the T cells before it gets killed."

Source: EurekAlert! 01 January 2020

Scientists discover how TB puts the brakes on our immune engines

Ussher Assistant Professor in the School of Biochemistry and Immunology at Trinity, Frederick Sheedy is studying how lung macrophage immune cells can help fight TB infections. Results from Dr Emer Hackett (a PhD candidate in Professor Sheedy's group), published this week in *Cell Reports*, show that persistent TB infection of lung macrophage immune cells severely hinders the body's ability to respond to infections by shutting off the supply of simple sugar glucose used for anti-bacterial activities. During a TB infection a small RNA molecule, termed mircoRNA-21, is inserted into the body and targets key enzymes that use glucose to promote an anti-bacterial response from the immune system. When these enzymes are blocked, glucose is unable to be used in this way which clears the path for bacteria to thrive.

Professor Sheedy explained that their research has found that “when TB-infected cells are treated with a key 'Interferon gamma protein signal' which is normally produced following vaccination, they will remove this microRNA to effectively relieve the brake and restore our normal immune response."

Source: EurekAlert! 08 January 2020