Researchers find a way to detect stealthy, 'hypervirulent' Salmonella strains

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Salmonella typhimurium (red) invades cultured human cells in this color-enhanced scanning electron micrograph. Credit: Rocky Mountain Laboratories, NIAID, NIH

A recent discovery of "hypervirulent" *Salmonella* bacteria has given UC Santa Barbara researchers Michael Mahan and Douglas Heithoff a means to potentially prevent food poisoning outbreaks from these particularly powerful strains. Their findings, in a paper titled "Intraspecies Variation in the Emergence of Hyperinfectious Bacterial Strains in Nature," have been published in the journal *PLoS Pathogens*.

Salmonella is the most common cause of infection, hospitalization, and death due to foodborne illness in the U.S. This burden may continue to

worsen due to the emergence of new strains that would tax current health-control efforts. To address this problem, researchers sought out -- and found -- hypervirulent strains that present a potential risk to food safety and the livestock industry.

An international team of scientists -- which also included Robert Sinsheimer and William Shimp from UCSB; Yi Xie and Bart Weimer from UC Davis; and John House from University of Sydney, Australia — conducted a global search for hypervirulent *Salmonella* strains. They were found among isolates derived from livestock, and rendered current vaccines obsolete.

Bacteria behave like a Trojan Horse, exposing their weapons only after initiating infection. "These strains exhibit this behavior in the extreme -- essentially having a '5th gear' they can switch to during infection," said Heithoff, lead author of the paper.

Previous efforts to find hypervirulent strains were unsuccessful since bacteria behave much like their less-virulent cousins after environmental exposure. "The trick was to assess their virulence during infection -- before they switch back to a less-virulent state in the lab," said Professor Mahan.

Now that researchers know what to look for, they are developing methods to rapidly detect and discriminate the more harmful strains from their less-virulent cousins. The strategy is aided by a special medium utilized by the researchers that forces the bacteria to reveal their weapons in the laboratory -- the first step in the design of therapeutics to combat them.

Humans usually get *Salmonella* food poisoning from eating contaminated beef, chicken, or eggs. However, animal waste can contaminate fields where fruits, nuts, and vegetables are grown, thus posing a particular

health concern for vegetarians. The threat is exacerbated when these foods are not cooked. Salmonella control efforts are expensive -- recent estimates place this cost up to $14.6 billion annually in the U.S.

As hypervirulent strains pose a potential risk to human and animal health, mitigation efforts warrant researchers' careful attention. "Now that we have identified the problem -- and potential solutions -- we just need to get to work," Heithoff said.

More information: dx.plos.org/10.1371/journal.ppat.1002647

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