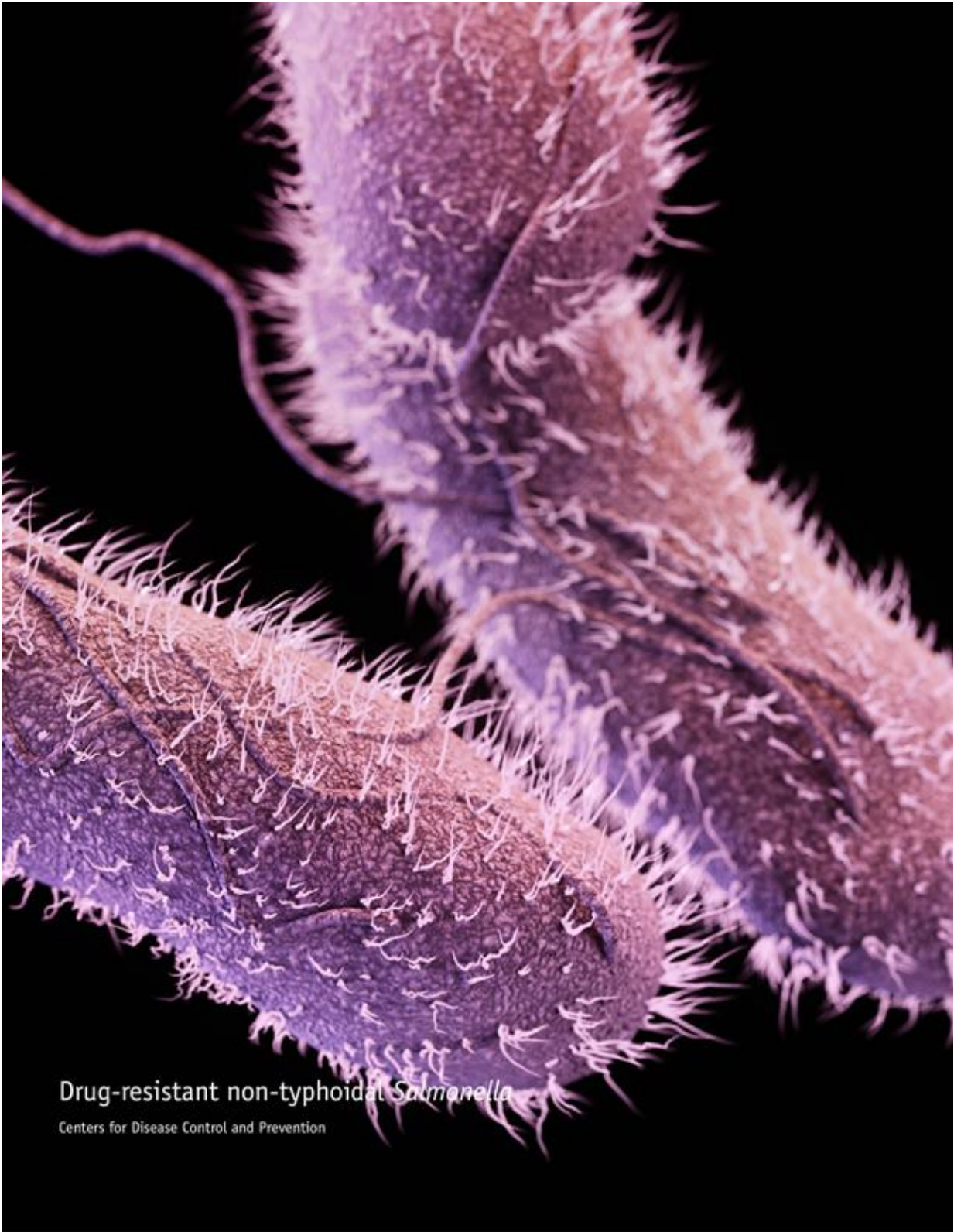


Antibiotics against severe salmonella infections in Africa increasingly ineffective

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Drug-resistant non-typhoid *Salmonella*. Credit: CDC/James Archer

Salmonella infections in the bloodstream, caused by *Salmonella enterica* bacteria, are still the cause of many deaths in southern regions and Southeast Asia. Children between the age of two and five years are particularly affected. Treating these infections could become a growing problem owing to increasing antibiotic resistance. DZIF scientists from the Bernhard Nocht Institute for Tropical Medicine have now confirmed that even the newer generations of antibiotics are becoming less and less effective.

"The affected countries will have a major problem if we do not manage to control salmonella bloodstream infections with new antibiotics such as ciprofloxacin," cautions Prof Jürgen May. He has conducted numerous studies on [salmonella infections](#) in sub-Saharan Africa, particularly in Kumasi in Ghana, where the Bernhard Nocht Institute and the DZIF are in close partnership with researchers from the Kumasi Centre for Collaborative Research in Tropical Medicine.

Nowadays, bloodstream infections with the salmonella species *Salmonella enterica* are a particular problem in developing countries; infections of the gut occur through contaminated food and unclean water. Annually, approximately 22 million people contract [typhoid fever](#), which is probably the best known [infection](#) caused by salmonella. They are specifically caused by *Salmonella Typhi* bacteria, a *Salmonella enterica* serotype. Symptoms of typhoid fever include fever, stomach ache and bowel obstruction, and the infection can be fatal if left untreated. Additionally, so-called non-typhoid salmonella infections exist which are caused by other *Salmonella enterica* serotypes. They also cause bloodstream infections, affecting a further estimated 90 million people per year. It is not known why the pathogen so often enters the bloodstream in these countries. A simultaneous malaria infection seems to be a facilitating factor.

Since the early 1990ies, multidrug-resistant salmonella strains that are insensitive to commonly used antibiotics like ampicillin and chloramphenicol have been emerging more and more frequently. Consequently, the WHO recommended using third generation antibiotics, such as ciprofloxacin from the fluoroquinolone group. In a study in Ghana, May and his team investigated whether this new antibiotic now also triggers the development of resistance. From 2007 to 2012, over 300 isolates of invasive salmonella were collected from blood cultures, i.e. those that cause [bloodstream infections](#).

The results from the study are a first warning sign: reduced susceptibility to ciprofloxacin was found in some salmonella serotypes; in one serotype, even half of the isolates were affected. Isolates of *Salmonella Typhi*, the pathogen that causes typhoid fever, did not show reduced susceptibility. However, in a multicountry analysis, *Salmonella Typhi* has already been found to have reduced sensitivity to ciprofloxacin; this being particularly high in Kenya. "This is worrying because ciprofloxacin is going to be used more frequently with decreasing costs," explains May.

Furthermore, the scientists have detected single mutations in the pathogen's hereditary information which are responsible for the reduced sensitivity.

"These results highlight that the emergence of multidrug-resistant salmonella strains must be observed carefully in order to control the burden of neglected diseases such as typhoid fever and non-typhoid [salmonella](#) infections," May emphasizes. "An important step to improving the situation has been establishing the Typhoid Fever Surveillance in Africa Program (TSAP), a multinational research programme which, together with the DZIF, collected the data in sub-Saharan Africa." In this programme, May and other scientists also conducted studies on hygiene measures, pathogen spread, vaccines and

diagnostics. The studies are published in the current *Clinical Infectious Diseases* journal supplement.

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