**Case Investigation #:** 972491

Investigators,

Numerous patients at Central Midwest Hospital have been suffering from recurrent *Clostridium difficile* (*C. difficile)* infections. When *C. difficile,* a type of bacteria, grows uncontrollably it causes extreme diarrhea. After treating the infection with vancomycin, the standard antibiotic prescribed, the patients’ symptoms seem to disappear but a *C. difficile* infection occurs again. This is called a recurrence.

One researcher at the hospital, Dr. Rivera, thinks that the high recurrence rates of *C. difficile* infections are due to a decrease in the number and diversity of microbes in the patients’ guts, leading to less resilience in the microbiome. Resilience refers to an ecosystem’s ability to recover after a disturbance. Dr. Rivera hypothesizes that vancomycin is killing more of the native microbes than is necessary, leading to a slow recovery of the gut microbiome. During the time of recovery, the *C. difficile* can return, taking advantage of the under populated gut, and thus causing another infection.

Dr. Rivera and his team have been working for several years to develop new types of antibiotics to treat *C. difficile* infections. Recently, he and his team developed fidaxomicin; an antibiotic they think could be used to treat *C. difficile* infections more effectively. They have done all the tests in the laboratory and on animals and are now ready to start a clinical trial on patients at CMW. Dr. Rivera has spent many years developing and testing fidaxomicin and has successfully demonstrated, per the FDA guidelines, that there will be very little risk for human participants in the clinical trial. Dr. Rivera has gotten permission to run a clinical trial at CMW to test the effectiveness of fidaxomicin in humans.

In order to test the effectiveness of fidaxomicin, Dr. Rivera will treat some patients with vancomycin, the standard antibiotic, and some with fidaxomicin. Dr. Rivera is particularly interested in finding out if the fidaxomicin group will have fewer recurrences of *C. difficile.* When patients are given an antibiotic, many different types of microbes are killed, not just the pathogenic ones. He thinks that the recurrences are related to the competition between different types of microbes. He hypothesizes that fidaxomicin will kill fewer of the native microbes than vancomycin, allowing these microbes to out compete the *C.difficile* for space and resourcesand, therefore, reduce the infection.

This case study is based on a clinical trial discussed in: Louie T.J., Cannon K., Byrne B., Emery J., Ward L., Eyben M., Krulicki W. (2012). Fidaxomicin preserves the intestinal microbiome during and after treatment of *Clostridium difficile* infection (CDI) and reduces both toxin reexpression and recurrence of CDI. *Clinical Infectious Diseases, 55*(S2), S132-42.