



Antibiotic Resistance Competition 2019

Farm to Fork – Antibiotic Resistance in Agriculture

Farming malpractices: A global crisis in the making

by

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“Sales soar as Chinese pig farmer Wu Shen Jing breaks record amount of sales as the demand for pork increases across the country” flashed the headlines of China’s national broadcasting network, CCTV.

Wu Shen Jing, the founder of Wu Pig Industries had been raking in over a hundred thousand a month in sales, and was reaping the fruits of his labour for the past year. Mr Wu’s lack of funds when he first began his business had forced Mr Wu to think of a cost effective way of raising pigs which enabled him to earn a larger profit without needing to spend as much as his other competitors. Mr Wu realised that by cramping more pigs into congested enclosures, they would still develop as fast, and he would not need to buy large plots of land to rear more pigs. Mr Wu would squeeze thousands of pigs where hundreds would usually be kept.

“Hi Mr Wu, I think I won’t be able to make it for work tomorrow, I have been running a fever for the past week.” read a text message from one of Mr Wu’s subordinates, the head farmer Mr Li. This was the fourth person who had contacted Mr Wu and requested for a sick leave. Concerned about the welfare of his farmers, Mr Wu instructed them to pay the doctor a visit, where they would find out they had been infected with *Escherichia coli* (*E. coli*). After the doctor found out that these patients were pig farmers, he knew that the *E. coli* was likely spread when the farmers came into contact with the pigs fecal matter. The doctor instructed the farmers to take some antibiotics and also suggested the pigs be given some form of medication as well. Seeing his workers recover almost instantaneously after taking the antibiotics, Mr Wu concluded that giving his pigs antibiotics would cure them of the *E. coli* infection as well. Upon doing some simple research, Mr Wu decides to buy 10 cartons of the antibiotic apramycin, and he decides to mix it in with his pigs’ feed, certain that this would eliminate the *E. coli* bacteria.

Despite attempting to get rid of the *E. coli* with the apramycin, the confined and unsanitary conditions prevented the extermination of the *E. coli* bacteria and it would have time to mutate, spreading like wildfire due to the close proximity of all the pigs. As *E. coli* is spread through the fecal matter of the pigs, the poor living conditions only made the newly evolved bacteria spread faster. As more and more pigs became infected by the apramycin resistant *E. coli*, they began showing symptoms such as blood in their stools, nausea and their growth began slowing down significantly.

“Mr Wu, I apologise but I won’t be able to make it for work this week again. I have abdominal pain and the doctor has instructed me to stay at home and recuperate”. Mr Wu shook his head as he read a text message from his employee. With both his pigs and his employees falling ill all the time, Mr Wu had plenty of problems to deal with. Mr Wu texted his workers, telling them to rest well, before calling in the vet to examine his pigs. A few hours later, when the vet arrived, Mr Wu brought out a corpse as well as a live pig for the vet to inspect. The vet concluded that the pigs were still suffering from *E. coli*, as their intestines

were filled with watery and yellowish diarrhea. The vet suggested that Mr Wu include zinc oxide nanoparticles into the feed of his pigs, which would disrupt the gram-negative cell membrane structure in the *E. coli*, cutting up the *E. coli* cells in the digestive system of Mr Wu's pigs. The pigs were beginning to recover and the worrisome Mr Wu thought that his burdens were finally lifted off his shoulders.

Alas, Mr Wu's fears were far from over. When the vet visited Mr Wu, he had brought the pigs to the vet, which prevented the vet from seeing the horrible living conditions of the pigs. Hence, even after all this while, Mr Wu still did not know that the reason why the bacteria was evolving was due to unsanitary living conditions in the pigsties. Due to Mr Wu's lack of knowledge, his farm would be hit by the *E. coli* bacteria again. However, this time, as it had developed resistance against both the apramycin and the zinc nanoparticles, they had developed way faster than before. By the time Mr Wu found out about the infection, most of his pigs were already infected with Edema disease, caused by the *E. coli* bacteria and were suffering from various neurological symptoms such as staggering gait, as well as swollen eyelids and frontal bones. Many of Mr Wu's pigs had trouble walking straight and had trouble controlling their movements. This time, Mr Wu had brought in a new vet, as he had deemed the old vet useless due to the lack of improvements in his pigs. However, he made the same mistake and brought the pigs to the vet instead of bringing the vet to the pigsties. The vet deemed the pigs too sick to cure and told Mr Wu that if they gave the pigs stronger antibiotics, the bacteria might develop resistance against the antibiotic, which could cause a problem not only to his pigs but to the humans who consume them as well. The vet told Mr Wu that it was impossible to save his pigs and that he should stop the shipment of his pigs to slaughterhouses.

"If there's a will, there's a way" Mr Wu repeated to himself. A stubborn businessman, he insisted that there was a way to save his swine empire. After exploring options online, he decided to use Colistin, a last resort antibiotic used to cure patients in hospitals who were suffering from *E. coli*. After importing over 100 bottles of Colistin from the United States and adding the antibiotic into the feed of his pigs, Mr Wu believed his business would be saved. However, due to his lack of knowledge on *E. coli* and how it spreads, his pigs would fall prey to *E. coli* once again. This time, Mr Wu's workers were hospitalised and were diagnosed to have been infected with *E. coli* O157:H7. While some farmers recovered from the *E. coli* in a relatively short period of time, many farmers had begun to experience severe dehydration as well as anemia. One complication led to another and soon, a quarter of Mr Wu's farmers were suffering from a life-threatening form of kidney failure, hemolytic uremic syndrome.

Thousands of miles from Mr Wu's pig farm, there was a sudden surge of people suffering from hemolytic uremic syndrome in countries such as Singapore, Taiwan and Japan. Doctors in these countries were puzzled as to the sudden spike in kidney failures. The doctors tried all sorts of antibiotics in order to eliminate the strains of *E. coli* from the

patient's systems, which all failed to produce results. Even after the doctors used the last-resort antibiotic Colistin, the most effective antibiotic in their arsenal, the bacteria could not be exterminated. At this point, the doctors were starting to panic. If this super bacterium managed to spread, it would lead to hundreds or thousands of deaths. Upon further investigation, the doctors in the respective countries found that these patients had been consuming barbecued pork a few days before they were hospitalised. When it was uncovered that the pork originated from Wu Pig Industries, a pig farm in China, these doctors lodged a complaint to the Ministry of Agriculture and Rural Affairs (MOA) of China, and a team of scientists from MOA were dispatched to the farm in order to confirm their suspicions of improper use of antibiotics.

"These are the antibiotics I am using now, Colistin" Mr Wu explained as the MOA scientists questioned Mr Wu. Alarmed at their discovery, the MOA immediately called for all the pigs to be culled, before incinerating their bodies. The farm was also fumigated and quarantined to prevent any possible spread of the bacteria. The MOA also seized all products from Wu Pig Industries and quarantined people who had consumed the pork from Mr Wu's farm. Among those who had contracted the E. coli superbug, the older patients were not that fortunate. Due to their weak immune system as well as a lack of antibiotics to cure them, this new super bacteria would eventually lead them to their demise.

A few months after his appearance on CCTV, Mr Wu's name resurfaced on National Television, but this time for all the wrong reasons. "Owner of Wu Pig Industries, Wu Shen Jing, files for bankruptcy and sentenced to 40 years in prison for misuse of antibiotics, leaving 67 people in multiple countries dead".

References

1. (2019, August 27). Types of antibacterial medicine. Retrieved from <https://thepigsite.com/disease-and-welfare/managing-disease/types-of-antibacterial-medicine>
2. Nield, D. (n.d.). A Dangerous Antibiotic-Resistant Gene Has Spread The World. We Now Know Where It Started. Retrieved from <https://www.sciencealert.com/antibiotic-resistant-mcr-1-gene-spreads-worldwide-from-chinese-pig-farms>
3. (n.d.). Washington State University. Retrieved from <https://iacuc.wsu.edu/zoonoses-associated-with-swine/>
4. Davis, C. P. (n.d.). 25 E. coli Infectious Early and Later Symptoms, Treatment, and Prevention. Retrieved from https://www.medicinenet.com/e_coli__0157h7/article.htm