

Three Decades of Contagious Disease Research in the Philippine Journal of Science (1990–2020)

On 31 Dec 2019, fatal pneumonia cases of erstwhile unknown cause at Wuhan City in the People's Republic of China were reported to the World Health Organization (WHO). The highly contagious disease, officially named the Coronavirus Disease 2019 (COVID-19), rapidly spread with 84,469 confirmed cases nationwide and 4,338,658 cases in all 214 countries and territories as of 15 May 2020, 10:00 Central European Summer Time. The death toll reached 297,119 globally—with 4,644 in China—65 days after the WHO declared COVID-19 as a pandemic on 11 Mar 2020. In the Philippines, the disease has caused 790 deaths among 11,876 confirmed cases as of 14 May 2020, 11:43 PM Philippine Standard Time—105 days after the first case in the country was reported on 30 Jan 2020.

Common signs of COVID-19 infection—which typically appear within 11.5 days of exposure (Lauer *et al.* 2020)—include cough, fever, and shortness of breath that can escalate to pneumonia and kidney failure. Standard WHO recommendations to prevent its spread include avoiding crowded places, observing physical distancing of at least 1 m, regular hand washing with soap or alcohol-based sanitizer, and covering of one's mouth and nose when coughing and sneezing.

COVID-19 is brought about by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Gorbalenya *et al.* 2020), which belongs to the same family of viruses that set forth other transnational outbreaks in recent years—namely the Middle East Respiratory Syndrome (MERS-CoV) identified in 2012 and the Severe Acute Respiratory Syndrome (SARS-CoV) in 2002. All three diseases are zoonotic but, whereas SARS-CoV was found transmissible from civet cats (*Paguma larvata*) and MERS-CoV from dromedary camels (*Camelus dromedarius*), SARS-CoV-2 was reportedly introduced to humans from horseshoe bats (*Rhinolophus* sp.) through pangolins (*Manis* sp.).

A number of peer-reviewed medical articles on contagious—and often zoonotic—diseases have been published in the Philippine Journal of Science (PJS) during the last thirty years, mostly on nosocomial or hospital-acquired infections.

Dr. Marilen P. Balolong spearheaded a 2019 study on *Klebsiella pneumoniae*—a bacterium that can cause different types of healthcare-associated infections such as pneumonia, bloodstream infections, wound or surgical site infections, and meningitis. As per the Centers for Disease Control and Prevention of the United States, the bacterium can spread from person to person through physical contact and blood contamination but not through air inhalation. Twenty-three (23) out of 100 isolates of this bacterium obtained from four provincial hospitals in Luzon, Philippines were found to be resistant to at least half of the β -lactam antibiotics. Out of these 23, 18 were found capable of producing extended-spectrum β -lactamases (ESBLs), enzymes that render these antibiotics ineffective by destroying their β -lactam ring. Out of these 18, five harbored all of the four β -lactamase genes tested, suggesting that these pose a serious threat in the healthcare industry because of their resistance to a wider range of antibiotics. Because of the widespread occurrence of these genes in *K. pneumoniae*, Balolong *et al.* stated that there is an urgent need to develop a rapid and accurate method of ESBL testing.

A 2012 article co-written by Dr. Esperanza C. Cabrera focused on methicillin-resistant *Staphylococcus aureus* (MRSA)—a group of bacteria that can infect the skin, blood, and lungs (in the form of pneumonia). It can spread from person to person through contact with a contaminated wound or by sharing personal items that have touched infected skin or blood. Certain strains can be acquired by humans through close contact with pets and livestock (Petinaki and Spiliopoulou 2012). Five of the 30 health workers found to have *S. aureus* were MRSA-positive, placing the overall carriage rate to 4.35% among the 115 subjects sampled in the provincial hospital of Rizal, Philippines. The *mecA*

gene, which enables the protection of bacterial cell wall from damage, was found in all MRSA samples. The *lukS-lukF* Panton-Valentine leukocidin gene, which aids in the destruction of the host's defense cells, was present in three out of six isolates. Cabrera *et al.* underscored the need for the consistent review and strict implementation of hospital policies on infection control among hospital workers—a significant yet easily overlooked source for MRSA transmission.

In the same year, Dr. Ephrime B. Metillo co-reported on the Enterobacteriaceae, a family of bacteria that can cause different types of healthcare-associated infections—including those in the urinary tract plus the respiratory and even nervous systems. As with other nosocomial pathogens, the bacteria can spread from person to person through physical contact and blood contamination (Chitnis *et al.* 2012). From a total of 583 isolates collected at the Mindanao Sanitarium and Hospital in Iligan City, Philippines, 30 were confirmed as ESBL producers. As for their interaction with antibiotics, most (89%) were resistant to quinolones but all remained susceptible to carbapenems and 61% to aminoglycosides. These findings are important in understanding the level of ESBL prevalence in the country, which remains scarce as most laboratories do not detect their presence.

Published in 2000, Dr. Esperanza C. Cabrera's research concentrated on *Acinetobacter*—a genus of bacteria that can cause infections in the blood, urinary tract, and lungs (pneumonia), or in wounds in other parts of the body. The bacteria can spread from person to person through physical contact, as well as through contaminated equipment and other surfaces. It can be acquired by humans through close contact with companion animals (Damborg *et al.* 2015). Of the 98 isolates taken from patients of the Philippine General Hospital in Manila, 97 were resistant to at least one of the antimicrobials, with 17 of these being resistant to all of the nine tested. Netilmicin and amikacin were shown to be the most effective against the isolates, with 61.22% and 56.12% being sensitive to the antimicrobials, respectively. These were followed by ceftazidime (40.82%) and cefoperazone (8.17%). According to Cabrera *et al.*, the results of this study serve as a timely reminder for the need to be more discriminating in the prescription and use of antimicrobials. For them, constant, vigilant monitoring and reporting, critical evaluation of treatment programs, and strict implementation of laws regulating dispensing of antimicrobials cannot be compromised.

Dr. M.C.A. Madson's 1998 study explored a similar bacterial species classified as *Acinetobacter calcoaceticus* var. *anitratus*. Out of the 25 isolates taken from patients of the Philippine General Hospital in Manila, 24 were found to be resistant to at least one of the antibiotics tested. Eighteen (18) out of 25 showed multiple resistances, some to as many as five drugs. Results of the conjugation studies showed that three isolates transferred all of the resistance to the test organism (*Escherichia coli* SF-800), while the other ten isolates transferred only some of their resistance. Based on these findings, Madson *et al.* recommended the conduct of more intensive monitoring of cases and more extensive study of local *Acinetobacter* isolates, particularly their drug resistance characteristics.

In the sub-field on zoonotic pathology, Dr. Alice Alma C. Bungay co-authored a 2002 review paper on a myriad of bacterial types that can cause campylobacteriosis—an infection that is mainly characterized by diarrhea, fever, and stomach cramps. Some of these such as *Yersinia enterocolitica* (Sabina *et al.* 2011), *Salmonella* sp., and *Campylobacter* sp. are capable of spreading from person to person through casual contact, but most can be acquired solely through the consumption of contaminated food or water. These include undercooked meat (*e.g.* poultry, beef, pork) and meat products (*e.g.* sausages, salami, hamburgers), fish and shellfish, milk and milk products (*e.g.* cheese, yogurt), and even vegetables. It can also be acquired by humans through close contact with pets and livestock—primarily cattle, sheep, and pig. In the face of the threat of “emerging” foodborne bacterial pathogens, Bungay *et al.* asserted the need to develop active surveillance systems for foodborne diseases, as well as adopt internationally validated methods for isolation and identification.

Quite similarly, a 1995 article by Dr. Celestina G. Robles focused on influenza or the so-called “flu”—a viral respiratory illness that is characterized by cough, sore throat, muscle and body aches, fever, and even vomiting and diarrhea among children. The virus can spread from person to person through droplets discharged *via* coughing or sneezing up to 1.83 m away. It can be acquired by humans through close contact with pigs, which serve as the intermediate host of viruses originally derived from birds. The influenza A virus, in particular, has given rise to various subtypes through antigenic drift and shift plus genetic reassortment and recombination among host species. This explains why the disease had been listed as one of the top three leading causes of morbidity among Filipinos during the 1990s, as the aforementioned strain can elude the neutralizing effect of antibodies induced by previous infections or vaccination.

Robles emphasized the need to conduct new researches—specifically, serological and phylogenetic studies on the virus’s ecology and evolution—as well as host surveillance to determine effective control measures.

Still on the topic of viruses, Dr. Michael O. Baclig co-reported in 2012 on the Hepatitis C Genotype 1 Virus (HCV-1), which can cause severely damaging infection of the liver. The virus can spread from person to person through the mixing of blood—primarily *via* donation, childbirth, and sharing of needles among drug users. From 2005–2008, Baclig *et al.* identified a total of 30 HCV-1 positive samples through the use of freeware bioinformatics software. Compared with direct nucleic acid sequencing, the polymerase chain reaction – restriction fragment length polymorphism method was able to accurately subtype 28 out of 30 samples. The HCV nucleotide sequences reported in this study were deposited to GenBank to make it usable for patient-specific molecular diagnostics in the future.

Documenting the emergence of novel contagious—and often zoonotic—infections would be invaluable not only to medical researchers seeking to hastily counteract their lethal consequences, but also to policymakers expected to safeguard the delicate social, political, and economic stability in their jurisdiction through timely and factually accurate communication in conjunction with effective emergency response. Moreover, with increasing globalization comes a greater degree of contact among human beings and, almost inevitably, with various forms of wildlife through illegal trade and habitat encroachment—the latter threatening to burst the door wide open for even more devastating epidemics in the near future.

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