



TAFS – The impact of COVID-19 on food safety and global health

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The extent to which the COVID-19 pandemic has had an impact on food safety and the control of other infectious diseases both in people and in animals globally is becoming more evident. There have been short-term impacts such as the suspension of routine activities as well as long-term impacts such as the stimulation of industries and organizations to act and collaborate in the name of global health resilience.

Food safety in the short and long term

In the early phase of the COVID-19 pandemic, through approximately May 2020, there was an urgent public concern that food safety would be compromised due to transmission of SARS-CoV-2 from meat to people and reduced operations, especially reduced food inspection activities.

There is no evidence to date that SARS-CoV-2 persists in domestic food-producing animals or is spread to humans through the consumption of animal products (FAO, 2020a). Nevertheless, competent authorities for food safety around the world have faced challenges to continue conducting routine functions and activities in accordance with national regulations and international recommendations (WHO and FAO, 2020).

Food workers are at high risk of becoming infected with SARS-CoV-2 because of long work hours indoors and close interaction with coworkers (CDC, 2020). As such, food workers experiencing COVID-19-like symptoms were advised not to participate in food processing or preparation due to the risk of contamination of their environment (FAO, 2020a; Wozniacka, 2020). While no official policies that endorsed the relaxation of food inspection protocols were found, food safety checks may not have been conducted as intended due to personal health concerns (Wozniacka, 2020).

However, concerns for food safety were largely refuted by food companies globally (Djekic, 2021). In a survey conducted in 16 countries involving 825 food companies, companies asserted that food safety was not compromised at any moment during the pandemic (Djekic, 2021). On the contrary, companies strongly agreed that they have implemented more restrictive hygiene procedures during the pandemic.

For the long-term, there have been concerted international efforts to not only ensure but also enhance food safety during and after the COVID-19 pandemic. Risk analysis principles, including risk assessment and risk prioritization, are cornerstones to the Food and Agriculture Organization of the United Nations' (FAO) approach to the food safety component of a comprehensive COVID-19 response and recovery programme (FAO, 2020b). The risk-based approach, in combination with a shift toward more modern and sophisticated controls in processing, testing, traceability, and distribution (Lacombe, 2020), can create more resilient food safety systems in the face of the COVID-19 pandemic.

Short-term risks to food security and animal welfare

In the early phase of the COVID-19 pandemic, many slaughterhouses around the world had to either shut down or reduce their capacity to cope with infected workers, which had implications for both food security and animal welfare.

Slaughterhouses had a disproportionate share of employees infected by SARS-CoV-2 due to prolonged contact with infected co-workers, inability to follow social distancing at the workplace, shared working areas, and common transportation methods to and from work (Ijaz et al., 2021).

The closing of these facilities in many countries such as Germany, France, the Netherlands, and the U.S. contributed to **dramatic interruptions to the food supply chain** (Aday & Aday, 2020; European Parliament, 2020). Meat production and processing were compromised globally due to difficulty of purchasing production inputs such as feed for animals, restrictions of transportation of live animals including seasonal border crossing restrictions, accessing professional services and workforce, and restrictions in supplying meat and meat products to the markets (FAS, 2020). In the U.S. for example, the production capacity loss reached 25–43% for beef slaughterhouses (Hashem et al., 2020).

The closure of slaughterhouses led to **serious animal welfare concerns** around the world. In the U.S. and Canada, millions of chickens that could be slaughtered were killed on farms using methods such as ventilation shutdown, leading to death from overheating in violation of the World Organisation for Animal Health (OIE) guidelines (European Parliament, 2020; Kevany, 2020). The most severe animal welfare problems caused by COVID-19 were in the pork industry (Grandin, 2021). Compared with poultry, stopping or slowing the production cycle of pigs is harder, mainly because pig growing periods are about six months compared to six weeks for hens (Kevany, 2020). A backlog in the pig production chain in the United States resulted in millions of pigs ready but unable to be delivered to the processing plant (Higgins, 2020).

To cope with the backlog, pig producers tried to slow down the daily weight gain of their pigs using various methods, most of which had serious animal welfare consequences. These methods included feed reduction, alternative feed that reduced growth, overstocking barns, and increasing the temperature of the barn (Shike, 2020; Patience & Greiner, n.d.). Every degree Celsius above the pig's thermoneutral zone is estimated to reduce feed intake by 0.1 pound per day (Shike, 2020).

The ultimate measure is the euthanasia of healthy finisher pigs in an attempt to deal with overcrowded pens. The pork industry warned that more than 10 million pigs could have been culled by September 2020, though exact numbers are unknown at this time (Kevany, 2020). The techniques used to cull pigs include gassing, shooting, anaesthetic overdose, or "blunt force trauma". In "constrained circumstances", techniques might also include a combination of shutting down pig barn ventilator systems with the addition of CO₂ so the animals suffocate (Kevany, 2020). For farmers, this was a real tragedy, both economically and emotionally.

Interruption in the control of infectious diseases in people and animals

There has been a two-fold effect of the COVID-19 pandemic on the incidence of other diseases of people and animals. On the one hand, the reduced contact and movement of people and animals because of official restrictions and recommendations to prevent the spread of SARS-CoV-2 may have reduced the transmission and thus the incidence of some diseases such as chickenpox and measles (Belingeri, 2020). On the other hand, diseases like tuberculosis, measles, and polio in people and African swine fever (ASF) and avian influenza in animals may be underreported for the same reason, as hospital visits and veterinary activities were reduced (Roberts, 2021). Cases of tuberculosis in India have been going undiagnosed and untreated as medical resources are diverted to tackling COVID-19 (Roberts, 2021).

Reduced hospital and veterinary visits also imply reduced routine vaccinations against preventable diseases. As countries went into lockdown, mass vaccination campaigns for measles, polio, and meningitis were suspended, leaving millions of children at increased risk of these deadly, preventable diseases (Roberts, 2021). Twenty-three million children missed out on basic childhood vaccines

through routine health services in 2020, the highest number since 2009 and 3.7 million more than in 2019 (WHO, 2021a). Furthermore, restrictions on human movement may have thwarted efforts to control diseases such as ASF and avian influenza where regular interactions with farmers and the enhancement of biosecurity measures are fundamental (Stoffel, 2020).

ASF has continued to spread within affected countries and to new countries since the COVID-19 pandemic began. Spread of ASF has continued in countries such as Germany, South Africa, and the Philippines despite concerted efforts by the national competent authorities (OIE WAHIS, n.d.). ASF was introduced into Papua New Guinea, India, Malaysia and most recently in the Dominican Republic for the first time in 2020 and 2021. The introduction of ASF into the Dominican Republic marks the first introduction into the Western Hemisphere in 40 years (Ingwersen & Polansek, 2021). While the Dominican Republic controlled ASF outbreaks between 1978 and 1980, Haiti, the Dominican Republic's neighbor, continued to have outbreaks until 1983 (Danzetta et al., 2020). The entire pig populations of the Dominican Republic and Haiti were eradicated at that time in an effort to control the disease (Cody, 1983).

While the spread of ASF has not been proven to be a direct result of the COVID-19 pandemic, the stretching of resources for some countries such as Timor Leste and Papua New Guinea that are battling both pandemics simultaneously has been highlighted (ACIAR, 2020; FAO, 2020c).

Zoonotic diseases like certain strains of highly pathogenic avian influenzas are on the rise (FAO, 2021), while cases in humans and birds are potentially being underreported. Underreporting in the animal health sector may be occurring due to similar disruptions in routine competent authority activities as have been experienced by the public health sector. Underreporting or delayed reporting of disease outbreaks could also be occurring to avoid animal trade restrictions that would further jeopardize economies already destabilized by the COVID-19 pandemic (WTO, 2020).

Further epidemiological and observational studies are needed to determine if the COVID-19 pandemic has facilitated or hindered the control of other diseases of people and animals in the long run.

Long-term risk of animals reared for fur as a zoonotic reservoir

The detection of SARS-CoV-2 in animals reared for fur including mink, foxes, and racoon dogs has sparked concern over the virus establishing itself in wildlife reservoirs globally (Dalton, 2020). The detection of SARS-CoV-2 by RT-PCR in wild mink in Utah in December 2020 was particularly concerning as the first case in wildlife (DeLiberto & Shriner, 2020; Sharun et al., 2021). Since then, antibodies have been detected in free-ranging white-tailed deer in Illinois, Michigan, New York, and Pennsylvania as the only other known cases of natural SARS-CoV-2 exposure in wildlife (USDA, 2021). While it is not surprising that white-tailed deer would have become exposed to SARS-CoV-2 due to their abundance and often close contact with people, the potential of white-tailed deer as wildlife reservoir for future zoonosis should be considered for the same reasons (USDA, 2021; Timmer, 2021).

It is not yet known how this wild mink got infected, but possibilities include transmission from the high-density of infected domestic minks through infectious particles or contaminated water or manure and escaped infected domestic mink in the area (Runstadler & Sawatzki, 2021). While farmed mink-to-human transmission has been shown, it is also possible that wild mustelids, foxes and raccoon dogs can pass SARS-CoV-2 back to humans. Scientists have suggested that fur-farm raccoon dogs were the source of the first human case of COVID-19 (Delahay et al., 2020).

Stray or feral cats pose significant threats to their counterparts living in the wild (Sharun et al., 2021). Among 24 feral cats found in the surroundings of mink farms in the Netherlands, seven had antibodies against SARS-CoV-2, and one cat was tested positive for viral RNA (Oreshkova et al., 2020). These feral cats roam around the farms, stealing food and might have got the infection from an infected mink. Feral cats do contact other **wild carnivores**, constituting a risk of infection transmission to valuable wildlife populations (López et al., 2009).

Animal reservoirs of SARS-CoV-2 could provide opportunities for reintroduction of COVID-19 into humans in the future. Wildlife reservoirs carry a particularly high risk because the disease is more difficult to monitor and control among wildlife as compared to domestic animal species (Delahay et al., 2020). Infection in wildlife would also have practical implications for research, rehabilitation and conservation activities and could influence public opinion towards persecution of some species. Sustained transmission in a wild population would provide an opportunity for evolutionary adaptation of the virus, which could influence transmission dynamics and the effectiveness of diagnostics and vaccines.

Long-term impacts on collaboration and resilience

The critical short-term disruptions in routine global health functions created by the COVID-19 pandemic has stimulated industries and organizations to build pandemic resilience in the long-term. A cornerstone to global health resilience is the collaboration between sectors. A One Health international expert panel to advise four international organizations - the FAO; the World Organisation for Animal Health; the United Nations Environment Programme; and the World Health Organization - to address the emergence and spread of zoonotic diseases was launched in May 2021 (WHO, 2021b). A global plan of action to avert outbreaks of diseases like H5N1 avian influenza; MERS; Ebola; Zika, and, possibly, COVID-19 is under development (WHO, 2021b).

We are paying the price for not having been adequately prepared for COVID-19, and we have learned the hard way that the best type of medicine is preventative medicine. Fortunately, we are learning from COVID-19 that human and animal health in combination with environmental health are codependent, and that a One Health approach to global health is needed for long-term resilience.

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