TAFS

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TAFS INFORMATIONAL PAPER ON SWINE INFLUENZA AND 2009 PANDEMIC H1N1 INFLUENZA

Introduction:

In April 2009, H1N1 influenza A virus infection was reported in people[13] in North America, in particular in Mexico and the United States of America. The virus was described as being of putative swine origin, since several gene segments originated from historical swine viruses[21]. The virus was also comprised of avian and human components. Further human cases were rapidly described in North America, none of which reported contact with or exposure to pigs[14]. The subsequent proven human-to-human transmission and significant global spread led to a declaration by the World Heath Organization (WHO) that the outbreak was now categorized as a pandemic (level 6)[5].

By definition an influenza pandemic virus is a human strain to which people have little or no immunity. It spreads person-to person with relative ease. The spread of the 2009 Pandemic H1N1 influenza virus did not result from pig to human transmissions. Nevertheless, the choice of names for the virus and suggested link with pigs has also caused concern in many countries in relation to the safety of pork or other products derived from pigs. This position paper reviews the situation with the benefit of eight months experience, but particularly addresses potential concerns relating to food safety. It is notable that none of the authorities with responsibility for co-ordinating the global and national responses to this influenza pandemic consider food to be a factor in the transmission of infection[4, 8, 30, 31].

Influenza viruses – terminology and classification

Three groups of Influenza viruses are generally recognised, termed groups A, B and C. Types B and C are found only in humans [3, 6, 25]. The viral genome, of RNA, consists of eight discreet segments, which can vary independently of each other. This core is enclosed within a coat that contains two variable glycoproteins, haemagglutinin (HA) and neuraminidase (NA). Internal proteins, nucleoprotein and matrix proteins, are less variable. Although current scientific study involves analysis of all of these variables, including the genome, the historical accessibility of haemagglutinin and neuraminidase, and the consequential serological response to them in infected hosts, has resulted in their use to sort isolates into additional sub-types. A total of 16 HA and 9 NA variants have been

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identified so far[24]. This is why the 2009 pandemic isolate is referred to as H1N1. Additional variations, involving two of the eight gene segments, which code for neuraminidase and matrix protein, differ from any previously isolated in North American pigs[12]. It is the additional genetic variations that make it a novel subtype of H1N1.

What is swine flu?

Swine flu is caused by influenza A viruses, and most large populations of pigs around the world are considered to be endemically infected[3, 6, 8, 9, 12, 25]. Infections in pigs can cause a range of clinical signs, from sudden onset of severe respiratory illness that affects a large number of exposed pigs, often with low mortality, to less severe illness that may be characterised as a chronic respiratory disease syndrome, usually affecting groups of pigs. Breeding pigs can also suffer reproductive problems. Some pigs can also be infected without showing signs of illness. The virus is primarily, if not solely, confined to the respiratory tract. Recovery in uncomplicated infections is usually quick (within 10-14 days)[8, 25, 27, 32]. Other factors, such as the presence of other infections can make disease more severe or seem to last longer.
Influenza A viruses of subtypes H1N1 (a different strain from the pandemic H1N1), H1N2 and H3N2 are present in many pig populations around the world[3, 6, 12, 25]. There is significant variability within each of these subtypes, which can often be dependent on source geographical region. Periodically, other subtypes have been detected in pigs, but generally these fail to persist or become established.

Is it true that the virus causing disease in humans in Mexico and elsewhere is swine flu?

Although the pandemic H1N1 2009 influenza virus had been termed "swine influenza" the virus is actually a compilation of virus segments from humans, pigs and birds[17]. As a result authorities generally refer to it as pandemic (H1N1) 2009, but media reports commonly retain the shorthand "swine flu" terminology, despite the fact that the pandemic is occurring in humans, and not pigs.

Where did A/H1N1 come from, and where did the reassortment take place?

It has long been established that influenza viruses are highly variable, with regular reorganisation (reassortment) of their genetic core[3, 6, 25]. The mixing of genetic material when different influenza strains meet, perhaps when animals or humans are infected with multiple strains, produces new variants that possess some of the characteristics of each of their predecessors[25]. The hypothesised origins of the pandemic (H1N1) 2009 virus has been elucidated following antigenic and genetic analyses, which revealed that seven of eight gene segments originated from historical Eurasian swine influenza viruses[21, 10]. The evolution of the pandemic (H1N1) 2009 virus has also included historical 'triple reassortment' events in North American swine populations[20], as well as the apparent introduction of neuraminidase (NA) and Matrix (M) genes from Eurasian-lineage swine influenza viruses[21, 10]. The likely genesis of this pandemic strain has probably occurred during the last ten years, but there are some significant uncertainties due to lack of data. Although first recognised in Mexico, the introduction of some characteristics that were not previously associated with North American pigs suggests a possible origin in another country. Evidence for infection in pigs has subsequently been found in Argentina, Australia, Canada, Indonesia (detected in exports to Singapore), Norway, Northern Ireland and the United States of America[9, 19, 33]. Infection in turkeys has been reported from Chile[9, 33] and the United States[24].

Reassortment events form a natural part of influenza A virus biology, with co-infection of susceptible hosts forming an integral part of this process[3, 6, 25, 12]. As such, steps to limit the infection of animals and people with influenza A viruses may mitigate against the risk of reassortment. The artificial mixing of different host populations including pigs, such as the introduction of infected animals into an existing herd, has been shown to be a contributory factor.

Why is there so much confusion over the identity of the virus?

Confusion initially arose with respect to the terms used to describe the virus rather than the subtype, which is a novel H1N1 influenza A virus. Use of the term 'pandemic (H1N1) 2009' has since been adopted as the appropriate descriptive term by the WHO, OIE and FAO.

Do influenza viruses in animals usually transmit to humans?

The transmission of influenza A viruses from animals to humans is a well-recognised phenomenon in the epidemiology of influenza viruses, but the reverse, transmission from humans to animals (reverse zoonosis), has been rare[12]. The pandemic H1N1 influenza virus does seem to differ in that there have been multiple reports of transmission of disease from humans to various animal species including swine, cats, ferrets, and dogs[24,32].

The apparent frequency of transmission of influenza viruses of swine origin to people is very low, usually with only sporadic clinical cases reported, mostly in people who have been in contact with pigs, such as farmers, veterinarians and employees involved in the slaughter of pigs for human consumption[1, 11, 15, 16, 18]. Transmission was frequently only suspected as a result of the detection of antibodies to the virus in the blood of such close contacts versus the isolation of virus. The results of such investigations must always be interpreted with caution, because of the possibility of cross-reactivity with antibodies produced after earlier exposure to human influenza viruses[26]. There is only limited anecdotal evidence of subsequent transmission between humans after initial infection from pigs. Although sporadic clinical cases of swine influenza occur in humans, the true incidence of swine to human influenza virus transmissions is unknown.

How does the virus transmit from animal to animal, and animal to humans?

The transmission of infection with swine influenza viruses between pigs usually only occurs over short distances (within pens, buildings or farms) by direct or indirect contact between susceptible animals, via droplets/aerosols generated by infected animals when coughing or sneezing[8, 25, 31, 32]. Transmission over longer distances, such as between farms, occurs through the movement of infected pigs. Although inhalation of droplets is the most common route of infection, directly providing access to the respiratory organs, the exposure of other mucosal membranes, such as conjunctiva, may be a risk. Ingestion is not considered to be a likely route. Swine influenza is reported to be inactivated by low pH (pH2)[32], which is within the range normally encountered in the human stomach (pH1-3)[7]. Animal feed is not known to be associated with the transmission of influenza viruses, but this is no surprise in view of the recognized need for close contact between animals for transmission to occur.
As suggested by the serological evidence of infection with swine influenza viruses in general, it is likely that transmission from pigs to humans requires close contact between humans and infected animals. As a result, farmers, veterinarians and slaughterhouse operators are the most likely to be exposed. There is no evidence that transmission of any swine influenza strains to humans is associated with food (see below).

Is there any evidence that 2009 Pandemic H1N1 influenza transmits through meat, meat products or other food products?

To date, there is no evidence that the consumption of pork transmits the virus. In addition to the epidemiological observations, very recent studies conducted by Veterinary Laboratories Agency in the United Kingdom and the USDA's Agricultural Research Service has detected virus only in the respiratory tract and associated lymphoid tissues of swine experimentally infected by the pandemic

H1N1[2, 23,25,28, 29]. Furthermore, virus was not detected in samples of muscle, serum, spleen, liver, kidney or feces. Meat from infected pigs would therefore be free of infection.

A joint statement on the safety of pork was issued by the WHO, OIE and FAO[30,31] :

> "Influenza viruses are not known to be transmissible to people through eating processed pork or other food products derived from pigs.
>
> Heat treatments commonly used in cooking meat (e.g. 70°C/160°F core temperature) will readily inactivate any viruses potentially present in raw meat products.
>
> Pork and pork products, handled in accordance with good hygienic practices recommended by the WHO, Codex Alimentarius Commission and the OIE, will not be a source of infection.
>
> Authorities and consumers should ensure that meat from sick pigs or pigs found dead are not processed or used for human consumption under any circumstances."

Spread of 2009 H1N1 virus is thought to spread in the same way that seasonal flu does. Flu viruses are primarily spread from person to person through coughing or sneezing by people with influenza. Sometimes people may become infected by touching something – such as a surface or object – with flu viruses on it and then touching their mouth or nose.

Does cooking kill/inactivate the virus?

Influenza viruses are considered to be relatively labile, and do not survive long outside living infected animals, although cold generally prolongs survival. Mammalian influenza viruses usually survive a matter of hours outside the body[32]. A temperature of 56˚C, maintained for 60 minutes is claimed to inactivate the virus, while survival time is shorter at higher temperatures. Current advice suggests that core temperatures of 70˚C, normally achieved when cooking, should result in inactivation[8, 31] The current WHO/OIE/FAO time/temperature recommendations are based on inactivation of the highly pathogenic avian influenza virus[22] as research for 2009 Pandemic H1N1 influenza has not been completed. Meat, whether cooked or uncooked, has not been implicated in the transmission of any porcine influenza isolates from animals to humans. It can be expected that processes that involve the treatment of raw materials with heat (in particular rendering) for the production of animal feed will ensure that the end product is safe with respect to the spread of influenza viruses.

Does this mean that the virus will not survive during the manufacture of animal feed?

The production of animal feed under regulated procedures, which aim to minimise risk from other pathogens as well, should also provide assurance that influenza virus is not transmitted via feed. The heating of raw materials, coupled with additional heating stages, such as pelleting, and the likely delay of several days between the slaughter of source animals and consumption of finished feed derived from them, will all mitigate against transmission via feed. The feeding of pigs on feed derived from porcine raw materials is in fact prohibited in some countries, but this is for reasons unrelated to swine influenza.

What recommendations can be offered to reassure consumers that it is still safe to eat pig meat?

Realistically TAFS can only reiterate advice offered by International and National authorities with respect to the safety of pig meat. To protect oneself against many pathogens it is always recommended that the handling and preparation of all food should involve the use of clean hands and equipment, avoidance of cross-contamination between raw and cooked food, thorough cooking of

food, and chilling of food when stored. The preliminary experimental evidence provided by the Veterinary Laboratories Agency and USDA[2, 28, 29] study support these assurances of safety.
Additional sources of guidance are referenced below.

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