立法會 CB(2) 2583/03-04(01)號文件
LC Paper No. CB(2) 2583/03-04(01)

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25th May 2004

The Hon Fred LI Wah-ming, JP
Chairman
Panel on Food Safety and Environmental Hygiene
Legislative Council
Hong Kong Special Administrative Region

Dear Mr Li,

Thank you for asking our Department to give a written submission on the Administration's consultation paper on *Prevention of avian influenza: consultation on long term direction to minimize the risk of human infection.* We agree that either option will reduce the risk of poultry-related zoonosis (not just influenza A H5N1) to human and should be instituted.

1. The risk posed by live poultry is mainly related to the carriage of bacterial (*Salmonella enteritidis, Campylobacter jejuni*) and viral (influenza A H5, H7, H9 mainly but also potential risk from other avian viruses such as coronaviruses) pathogens in their alimentary tract, secretions and excreta [1, 2, 3].

2. As a result of these pathogens, they can cause outbreaks of diseases in poultry and occasionally in human. Bacterial diseases in poultry can generally be controlled by antibiotics but non-judicious use can induce antibiotic resistance [4].

3. However, outbreaks of influenza A H5 or H7 in poultry are often associated with massive deaths in chickens and occasional transmission to human. Antiviral treatment is not very effective once pneumonia develops in human. This had happened in the 1997 Hong Kong H5N1 (human and poultry outbreak at market and farm) outbreak and the recent H7N7 Holland (human and poultry outbreak at farms) outbreak which were associated with human diseases and deaths [2, 5, 6, 7, 8, 9].

4. The introduction of immunization against H5 in Hong Kong and Mainland China definitely decreases the risk of further outbreaks due to H5 but will have no effect on outbreaks caused by H7. It is not possible to quantify the risk of H7 outbreaks over time but H7 virus was isolated from waterfowls of HKSAR and China [10a]. There was serological evidence of exposure to H7 in the farmers [10b]. A total of 15 highly pathogenic H7 outbreaks in poultry (sometimes with involvement of humans as well) were recorded since 1963, i.e. 3.75 episodes per 10 years globally [2, 8, 9].

5. It is important to remember that many animal-to-human infections cannot be predicted because mutations in viruses can allow the virus to jump from animals to human (jumping the species barrier) and occasionally allows human-to-human spread. SARS is one of best example [12]. In the past, most scientists believed that every type of animal coronavirus is confined to a particular animal host. But SARS has clearly shown that such animal virus can mutate and jump the species barrier. The risk is *very low* but may be like an airplane accident (calculated United States crash rate is 8.9 crashes per 100,000 flight hours [i.e., 11.4 years]) [13]. Once it happens, it is a complete disaster with a high death rate. The Asian Development Bank estimated that China sustained US$6.1 billion losses, accounting for 0.5% of the GDP, during the SARS outbreak. Hong Kong's losses accounted for 2.9% of the GDP. [Quoted by Professor Hu Angang at the celebrations of the 20th anniversary of the founding of the China Health Economics Society on November 6, 2003.]

6. Thus, the presence of live poultry in Hong Kong poses two important risks:

   a) Massive outbreaks in poultry.

   b) Human diseases caused by H5, H9, H7 and perhaps mutated H5 (after immunization) or even novel chicken coronaviruses.

   The measures taken by HKSAR are very likely irrelevant in regard to the emergence of pandemic influenza since reassortment between avian and human influenza viruses can occur in any part of South East Asia. Such measures only aim to reduce the risk of 6a and 6b.

7. The risk of further outbreaks in poultry depends on:

   a) The effectiveness of the immunization programme against H5 and risk of escape mutants. (Seroconversion in chickens after H5 immunisation is 80% in HKSAR which is associated with very good hear immunity and protection. No antigenic drift leading to vaccine failure is yet documented in other countries.)

   b) The incursion by H7 (this risk cannot be quantified).

   c) The success of the biosecurity measures (especially against migratory birds, human and poultry traffic). Very few farms in Hong Kong are able to satisfy all the biosecurity measures as required in the USA or Australia. Few if any are applying the principles of on-farm HACCP measures. The requirement that every farm should be physically isolated and not in close proximity to other poultry facility is seldom if ever complied. In Australia, the minimal physical separations were: between commercial poultry farms, 500 metres; between sheds and boundary fence, 30-50 metres; between sheds and a public road, 100 metres; and between sheds and watercourses, 50 metres. According to the United States Animal Health Association, physical proximity (i.e. within 2 miles proximity of positive premises) is a risk factor for farm-to-farm spread of avian influenza. As a "best" advice, a minimum farm-to-farm separation of at least 1 mile (1.6 km) was recommended by some Canadian poultry consultants [14a to 14d].

d) The biosecurity measures in the retail market.

e) The number of rest days in the market per month (the percentage of H9N2 infection can go up from 0% immediately after to 8% just before the monthly rest day) and the effectiveness of the cleansing.

8. The risk of human disease primarily depends on:

a) Factors mentioned in 7 which determine the viral burden in the poultry and excreta.

b) The amount of contact between human and poultry as well as the excreta of the poultry: This increases with the number of retail market stalls (814) with live chickens, the number of buyers going into the market stalls and decreases with the amount of separation between human and poultry. There are about 2 million households in HKSAR. Assume that only one person out of four household go to the market everyday and they buy a chicken every ten days. There would be about 0.05 million buyers who may have contact with poultry or their excreta daily. Thus it is important to reduce the number of live poultry stalls, which are intimately interspersed with urban housing, as an interim measure before central or regional slaughtering is being instituted.

9. Therefore the complete banning of the sale and rearing of live poultry in HKSAR basically eliminates almost all the risk of poultry and human outbreaks. Human diseases will either be imported or a result of contact with migratory birds. The later will be very minimal and has not been documented.

10. If imported or farm chickens are allowed to be channelled to central or regional slaughterhouses for the production of only chilled chickens, the risk of poultry outbreaks in HKSAR farms remains but there will have no further market outbreaks. The risk to humans will generally be limited to farmers, lorry drivers and transporters and workers in the central or regional slaughtering facilities. The total number of this exposed population is estimated to be 6500 workers (data of HWFB).

11. If the sale of warm instead of chilled chicken is allowed at central or regional slaughtering facilities, the risk of avian influenza to human is low because most cases of human avian influenza are not related to ingestion or handling of the carcass (but to the contact with the excreta and secretions). The remaining risk to the consumers is related to bacterial infection.

12. *Salmonella* (specifically, the non-typhoidal salmonellae) and *Campylobacter* are two of the commonest causes of bacterial gastroenteritis worldwide, accounting for over 90% of all reported cases of bacteria-related food poisoning [1, 15]. Both pathogens have the reservoir in the gut of the food animals, in particular, the poultry [1, 16, 17, 18, 19].

13. Some serotypes of *Salmonella*, for example, *Salmonella enteritidis*, in addition could be transmitted by the consumption of raw eggs contaminated by the bacteria [20]. This has been a major source of *Salmonella enteritidis* food poisoning in the western countries. However, it is likely to be of lesser importance in HKSAR because of the

differences in the culinary habits in the east and the west. You can see from Table 1 that a falling trend of Salmonella isolation from stool coincides with a falling live chicken consumption despite a rise in fresh egg consumption between 1999 to 2003. In fact, a recent study in USA showed that chicken consumption is a newly identified risk factor for sporadic *Salmonella enteritidis* infections [16].

14. Nevertheless, *Salmonella enteritidis* is also one of the commonest causes of nontyphoidal salmonellosis in Hong Kong [21]. The adoption of central or regional slaughtering would have significant impact on the risk of contamination of the carcasses, and therefore the risk of subsequent food poisoning of the consumers.

15. Contamination of the carcasses is almost inevitable to a certain extent. The bacterial load on the carcasses ultimately purchased by the consumers depends on [22]:

    a) The processing of birds from transportation to killing, scalding, and defeathering, including the hygienic measures taken for the environment and the machines.

    b) Evisceration and washing of carcasses.

    c) Chilling of carcasses, including the control of microbial contamination of the water immersion chilling system by superchlorination.

    d) Whether any chemical treatment is used for the decontamination of processed carcasses.

16. The prevalence of *Salmonella* and *Campylobacter* on poultry meat in retail markets is variable. In certain studies, Campylobacter is found in up to 85% and Salmonella up to 55% of the poultry meat [23]. In a special survey done by FEHD on 50 samples of raw chicken meat in 2002, 6% of the samples were found to have *Salmonella*; 30% with *Campylobacter jejuni* and 36% with thermotolerant *Campylobacter*.(data of HWFB)

17. The risk of *Salmonella* and *Campylobacter* infection will be higher in the present day wet markets than in central or regional slaughter facilities because one can incorporate proper equipment and supervision in the latter facilities.

18. The risk of bacterial overgrowth depends on the time during which the carcass is held at room temperature. Coliform bacteria can multiply in meat at a temperature above 8°C [24], and the rate of multiplication is increased when the temperature rises. A generation time (time required by the bacteria to double its number) of 0.74 hour has been recorded for *Salmonella typhimurium* on poultry meat kept at 30°C [25]. According to the experiments done at FEHD, the chicken will be visibly decomposed if held at 35°C for 4 hours or 25°C for 9 hours. Only proper handling and cooking will decrease the risk of food poisoning.

19. If the chicken is chilled immediately after slaughtering, the risk of bacterial infection should be much less than the consumption of a warm chicken freshly slaughtered because most chickens will not be cooked immediately but they are taken home at room temperature for some time (often bought at morning but cooked in evening)

before cooking. Any cross contamination or improper cooking will increase the risk of food poisoning during this period because the chicken was not chilled at slaughtering and not refrigerated while waiting for the cooking.

20. Between 1999 to 2003, a total of 1250 and 446 patients (mostly with diarrhoea) had *Salmonella* or *Campylobacter* isolated from stool specimens in the Queen Mary Hospital respectively. During the same period, 97 patients had blood culture positive for *Salmonella* of which 15 patients died. Of these 15 fatal cases of *Salmonella* bacteraemia, 10 of them were due to *Salmonella enteritidis* which is most likely to be related to poultry.

21. By extrapolation, assuming that QMH is serving 0.5 million population, we might be seeing 42 cases of fatal *Salmonella* bacteraemia in the whole of HKSAR every year. This represents an incidence rate of 0.6 deaths/100,000 population, compared to an incidence rate of 0.18 deaths/100,000 population in the United States of America [15]. The incidence of the disease is obviously higher in HKSAR as compared to the USA at the moment. Central or regional slaughtering with chilled chicken supply and education to housewives / maids / restaurant cooks may decrease the risk of infections and deaths due to *Salmonella* and *Campylobacter*.

22. The adoption of either the cold chain option or freshly slaughtered poultry option could be expected to be beneficial in reducing the risk of avian influenza to the general public. This is mainly due to reduced chances of contact between the public and live poultry. However, if we also want to reduce the risk of infection and death due to *Salmonella* and *Campylobacter*, cold chain will most likely have a greater impact because the chilling of carcasses will reduce the multiplication of these bacteria in the poultry carcass prior to their purchase by consumers as discussed above. If freshly slaughtered chickens are sold at central/regional slaughtering without chilling, strict HACCP measures must be applied at these facilities to ensure that food poisoning due to cross-contamination during slaughtering and unduly prolonged storage of these non-chilled chickens at room temperature would not occur.

23. There is never anything known as zero risk irrespective of the measures that are taken. Nevertheless long term measures to minimize the contact between the public and live poultry should no longer be delayed after these two painful lessons from H5N1 and SARS.

As the Head of the Department of Microbiology, I am ready to give our views at the Legco on behalf of our department at the Faculty of Medicine, The University of Hong Kong if deemed necessary.

Yours sincerely,

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Chair of Infectious Diseases
and Head, Department of Microbiology

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<u>Table 1</u>. Consumption of fresh eggs and live chickens and isolation rates of *Salmonella* species and *Salmonella enteritidis* from stool sent to QMH from 1999 to 2003

Year	Fresh egg consumption (x1000 tonnes)	Live chicken consumption (x1000000)	Salmonella isolates from stool (x10)	Salmonella enteritidis from stool (x10)
1999	73.59	36.363	35.8	11.2
2000	70.82	36.887	26.1	4.9
2001	72.15	34.634	25	7.7
2002	74.11	34.72	22.7	5.1
2003	77.938	33.516	15.4	4.1