

## Integrated Human Practice

### Interview and questionnaire of different stakeholders

Influenza is an infectious disease caused by influenza virus, we usually simply call it "flu". There is usually an outbreak every year in the world, Hong Kong is not excluded: According to the latest figures (up to 17 August 2017) from the Department of Health, HKSAR, 536 cases of severe illness and 388 deaths were recorded, affecting Hong Kong a lot every year undoubtedly in terms of public healthcare system, economy. We believe that we cannot only stay in the lab and clone the biobricks. Instead, we need to understand the concerns of potential users in order to let our design suit their real needs. There are 4 major potential users: medical expert, chicken farmer, government, general public.

### Medical Expert

#### 1. Professor CHAN Kay Sheung, Paul

We interviewed Professor Paul Chan at the Department of Microbiology, Prince of Wales Hospital. Professor Paul Chan is an Honorary Consultant in Microbiology of the Hong Kong Hospital Authority. He is also a member of the Global Outbreak Alert and Response Network of World Health Organization. He is an expert in molecular methods for rapid diagnosis and strain characterization.

The conversation with Prof. Chan was fruitful. He had explained the whole process of influenza detection, from sample collection to standard diagnosis procedures in very detail, which set a clearer direction on what we should focus more. For example, there is a variety of sources of sample can be collected from patient: Nasopharyngeal aspirate is the most sensitive source to be examined, however, assistance of nurse is required, while throat swab is the common method adopted in clinic due to its easier manipulation and collection, but lower amount of virus can be found here, leading to lower accuracy. Thus, He emphasized the importance of the sensitivity: if the product we designed is sensitive enough (sensitivity performance similar to PCR reaction), the source limitation is no longer an obstacle and it can then be applied in the clinic without the help of profession of collecting human specimens.

Thus, we decided to package our design as "point of care", can be applied in both hospital and clinic, especially useful in nightshift and peak season. Besides, as suggested by Prof Chan, distinguishing the subtype of influenza is not very significant in tackling flu, because currently, available medicine can already defeat all types of influenza. Reversely, subtyping is relatively important to be the parameter of deciding the release of chicken to the market.

#### 1. Professor Joseph J.Y. Sung (13 April 2016)

We have also met Prof Sung, Vice-Chancellor of the Chinese University of Hong Kong (CUHK) and concurrently Mok Hing Yiu Professor of Medicine of CUHK. Prof Sung has long been dedicated his life to public health affairs. In 2003, Professor Sung led his medical team to fight against the Severe Acute Respiratory Syndrome (SARS). He also won the name of "Asian Hero" in the Time magazine and was awarded the Distinguished Award for Scientist and Medical

Professional in the Fighting Against SARS (Medical Technology Personnel Category), in praise of his great contributions.

Similar to what Prof Chan suggested, Prof Sung also agreed that two directions of the project can be launched as subtyping detection kit of influenza is rare in the market. Thus, two directions of detection are proposed: for human, identification of the presence of influenza is enough; as for subtyping, it is more suitable to be applied in detection of virus in chicken.

In addition, he emphasized the importance of sensitivity and specificity for several times, especially the latter, as there are many subtypes of influenza. Ability to distinguish various subtypes efficiently enhance the competence of our design. Therefore, sensitivity and specificity check will be the focus of our wet lab part afterward.  
(figure)

#### Chicken farmer

Once there is one case of chicken being infected by avian influenza, government becomes quite reactive. More seriously, all the chicken, either imported or local fed, are gathered and slaughter, render them the financial loss. Therefore, we thought that if chicken farmers can take initiative to detect their own chickens regularly, it may prevent a large scale outbreak and in turn reduce their loss. Having such concerns, we have contacted an association and a chicken farmer respectively and both of them are local.

#### 1. The new territories chicken breeders association (10/7)

We interviewed a representative from the association. Before the interview, we guessed they may be interested a little bit as they suffer the loss of money during central slaughtering. However, out of our expectation, they were almost acceptable to the arrangements from the government because they thought that avian influenza detection should be conducted by neutral position, ie government, which is none of chicken farmer/associations' business.

#### 2. Fork Eat, a local chicken farm (29/7)

We also interviewed two local chicken farmers Mr. Joe Lit and Mr. Charles Lam. They are the founder of the local chicken farm and restaurant "Fork Eat". Similar to the attitudes of chicken breeders association, they agreed that the role they play in avian flu detection is very passive. The decision, whether slaughter or not, absolutely depends on government. Moreover, they indicated that chicken farms in Hong Kong are undergone regular inspection frequently (approximately 2-3 times per month), which is more than enough in their opinions, so they can't find any incentive to detect by themselves.

Previously we have proposed government (eg department of health) and chicken farmers will be the major customers in our second direction, avian influenza subtyping, after collecting the chicken farmers' opinions, we laid the proposal of targeting chicken farmer aside, but confirmed to mainly focus on the market of hospitals/ government/ clinics.

(figure)

## Government

At the beginning, we hoped to have face-to-face interview, along with laboratory visit, unfortunately, due to the government's policies and instructions, they refused our visit requirement, in alternative, we interviewed them, Department of Health, Centre for Health Protection and Agriculture, Fisheries and Conservation Department (AFAD) through written replies.

### 1. Department of health

We interviewed Dr. Au Ka-wing, Director of Health. He admitted early treatment for patients infected with avian influenza viruses may reduce the mortality rate and higher speed of laboratory confirmation may help fasten the initiation of medical treatment, although the time lag between onset of illness and initiation of medical treatment for avian influenza infection is affected by many factors, which is also consistent with what Prof Chan said. Nonetheless, targeted treatment for avian influenza may already be initiated for suspected cases before any laboratory confirmation.

The influenza viruses test for human specimens mainly provided by the Public Health Laboratory Services Branch under the Centre for Health Protection of the Department of Health. Thus, we further contacted the Centre for Health Protection for more details.

### 2. Centre for Health Protection

There are several duties of Public Health Laboratory Services Branch under the Centre for Health Protection. Offering laboratory diagnostic services for disease surveillance and control is one of the examples. They provide not merely diagnostic services to confirm whether the samples are positive on influenza, but also laboratory support on outbreak investigation, in other words, subtyping the suspected samples. During peak season or outbreak, rapid kit with subtyping function may help alleviate the pressure of outbreak investigation.

### 3. Agriculture, Fisheries and Conservation Department (AFAD)

Unlike Centre for Health Protection, Agriculture, Fisheries and Conservation Department (AFAD) is responsible for avian specimen inspection. They described some methods of detection and their procedures, for instance, haemagglutination inhibition test and direct RNA detection by PCR. In Hong Kong, there is only one veterinary laboratory (Tai Lung Veterinary Laboratory) in Hong Kong, while the detections approximately take at least 4 hours, while the size of sanitary testing and inspecting team is not big enough, 46 people in total. It is not difficult to imagine that the workloads of the veterinary laboratory will be very large when handling a lot of avian specimens during flu peak season.

During the interview with Prof. Chan, we know that point-of-care test for human influenza is quite common nowadays in spite of their high cost, there is nearly no rapid kit focusing on avian influenza subtyping, indicating that it may be a new direction of our product.

## Citizen

[local] As our major target is local users, the questionnaire's version is different to those international versions, in which place more emphases on understanding about influenza and government's policies so as to develop customized promotion plans on both health education and product promotion in Hong Kong. We conducted the questionnaires in Science Park as there is higher public engagement than that in university, rendering a fairer result. The sample size is 60.

In the first part, 86.7% respondents have no idea what H and N represent in influenza and only very few people can correctly distinguish Avian Influenza from common flu. Noted that most people can point out H5N1 and H7N9 are avian influenza, it may be due to great media exposure during the outbreaks in 1997 and 2013 respectively, highlighting the importance of media communication. These two viruses, H5N1 and H7N9 will also be the first target in our blueprint --- we have designed corresponding toehold switches to detect them.

Secondly, in terms of detection and countermeasures, 70% and 71.7% respondents think it is insufficient and the performances are unsatisfactory respectively, indicating there is a potential market of new detection methods except for current traditional approaches, not only increase the choices of customers but also alleviate the burdens in public healthcare system, even if the effect may be limited.

In the third part, we focus more on the opinions of our design, out of our expectation, more than 70% respondents are interested in and willing to purchase our products for detection, and feeling more secure and short detection time are the major motivations. On another hand, 52.4% respondents among those are not interested in the rapid test by ranking from 1 to 3 think that there is no actual need to undergo detection by themselves proactively. When we kept asking the reasons behind, almost all of them think influenza is not a big problem. However, by recalling what Prof Chan and Prof Sung had mentioned, early detection may help alleviate/reduce the damages brought by rare type of influenza under the fact that vaccine protection may be insufficient because of fast mutation rate and presence of various subtypes of virus, reflecting the significance of promotion and education, which is highly related to our design: only people with high awareness, our design can function in maximum through quick recognition and quick treatment afterwards.

As reminded by Prof Chan, if we want to develop the market of the private clinic, the price will be the determining factor because the extra detection cost most likely will be carried by the private clinic customers themselves, unlike in public hospitals, the extra detection cost is shared, or even fully borne by government. The result obtained is quite evenly distributed but more people (28.3%) think that 41-60 HKD is preferable. We could obtain a more accurate range of price if we enlarge the sample size in future.

## Pie chart

Considering negative perspectives against the use of E.coli may be held by the general public (E.coli is employed in the manufacture of biobricks), we want to evaluate their degree of acceptance, and try to explain the principles behind more. Similar to our prediction, most people feel disturbed when mentioning the involvement of E.coli, however, almost all respondents gain their composure after the explanation (emphasize that E.coli is the platform to produce biobrick—the detection tool and the users will not directly contact E.coli) and around 75% people accept such application in our design eventually.

We also conducted the same questionnaires in different countries (but with the third part of questionnaire only), including Bangladesh (16), India (26), Vietnam (33) (the number inside the bracket indicates the number of respondents respectively). Similar to the trends in Hong Kong, more than half people are interested in using our design for detection, however, half of the respondents in Bangladesh are indifferent to our design. When investigating deeply the reasons behind, they thought the detection kit is unnecessary and be afraid of the high price, meanwhile, they also concern the accuracy. Such attitudes also can be shown in the last question, no matter in Bangladesh (100%), India (75%), Vietnam (40%, but still accounts for the highest proportion among all parameters), they all regard accuracy, ie. sensitivity and specificity as their first choice, which is correspondent with the results in Hong Kong (75%), further proving that accuracy is the first priority in the whole detection design.

As for the price, for people in both Bangladesh and Vietnam, the acceptable price is around 1 USD, while the acceptable price range of Indian is higher, around 2-6 USD, which to certain extent reveals the economy of that country. If we want to promote our detection kit to the international level, especially for those influenza-prevalent regions, it is necessary for us to cut down the price. Apart from the price, people in developing countries may find it difficult to use the kit, so it is recommended to cooperate with the authorities/health department there, for instance, promote the significance of early detection.

[ending]

During interview with different stakeholders, we found they are not separated, but integrated: some cross-linkings do exist among different field, for example, healthcare system mainly focuses on detecting the presence of influenza and they will forward suspected samples, which may be infected by avian influenza to government department for further subtyping so that both medical treatment and influenza identification can be undertaken separately and efficiently. This shows the tight junction between hospital and government in defeating influenza. Apart from the collaboration, different stakeholders are associated, for instance, Prof Chan had mentioned that in spite of high mortality rate of avian influenza, there is a quite high probability that patients can be recovered if they seek medical attention as early as possible. However, when communicating with the general public, we found that some of them thought that early detection is not really important. If there is a medium between the general public and medical experts and help convey some useful advice to the public, public awareness on early detection of influenza may be escalated, and we believe that's also the mission of human practice.

[Prototype]