การประชุมวิชาการและนำเสนอผลงานวิจัยระดับชาติ ครั้งที่ 14

เรื่อง "วิถีนวัตกรรมเพื่อการพัฒนางานวิจัยสู่เศรษฐกิจชุมชนไทยให้ยั่งยืน"

สัตวแพทยศาสตร์

วันเสาร์ที่ 27 และวันอาทิตย์ที่ 28 เมษายน พ.ศ. 2562

ณ อาคารคณะทันตแพทยศาสตร์ มหาวิทยาลัยเวสเทิร์น อำเภอตำบลกา จังหวัดปทุมธานี

Influential Factors of Collaboration between Different Sectors and Disciplines in One Health Surveillance System and Potential Benefits from Integration

Theethawat Uea-anuwong
Faculty of Veterinary Medicine, Western University,
Kanchanaburi, Thailand

Abstract

Recently, One Health concept has received much attention and has been applied to many surveillance systems which integrate human, animal and environmental compartments. Such system could provide more benefits compared to the conventional surveillance system. However, it is not simple to develop and operate such system due to several potential factors. This article identify various factors potentially affect this particular system in both positive and negative directions retrieved from the prevailing surveillance systems. In conclusion, there are two major groups of factors; beneficial factors originated internally or externally from the working group as well as barriers; organizational and functional. Those factors are needed to be considered when developing One Health surveillance system from local to national level. Moreover, several One Health surveillance systems have proved the potential benefits from the integration of human, animal and environmental compartments in the system.

Keywords : Integrated, Interdisciplinary, Intersectoral, One Health, Surveillance

Introduction

Nowadays there is an international consensus that highlights the necessity to develop an integrated and systemic policy, across sectors and disciplines, in order to manage health issues at the human-animal-environment interface. Indeed, the international community recognized that the recent health crisis, caused by issues such as the highly pathogenic avian influenza (HPAI) or Ebola highlighted that conventional surveillance system is inefficient to manage health hazards with complex epidemiology involving several compartments; human, wildlife, domestic animal and environment.

The collaboration promoted by international organizations including the World Organization for Animal Health (OIE), Food and Agriculture Organization of the United Nation (FAO) and World Health Organization (WHO) and supported by donors such as World Bank (Note, 2010). Such paradigm has been defined as the One Health concept. This concept can be defined as the collaborative efforts of multiple disciplines, working locally, nationally, and globally to attain optimal health for people, animals and our environment (L. J. King et al., 2008). Intersectoral and interdisciplinary approaches are strongly encouraged, particularly in the field of health hazard surveillance at the interconnectedness of human, animal and the environment.

One Health surveillance describes the systematic collection, validation, analysis, interpretation of data and dissemination of information collected on humans, animals and the environment as a method to inform of decisions for more effective, evidence- and system-based health interventions (Stärk et al., 2015).

Recently, many One Health surveillance systems have been developed in many countries and contain interdisciplinary and intersectoral collaboration involving three major compartments; human, animal and environment (Stärk et al., 2015 ; Uchtmann et al., 2015). Such systems are certainly believed to have the potential to improve health-related outcomes (Asokan & Asokan, 2016) and fulfill the knowledge gap of the complex health situation emerging at animal-human-environment interface (Binot et al., 2015). Nevertheless, several factors were not focused or less focused which had led to poor performance of the integrated surveillance system. Therefore, it is critical to take into account the barriers and beneficial factors in order to have an effective One Health surveillance program.

Barriers and beneficial factors of existing One Health surveillance system

Barriers are factors which obstruct or hamper the collaboration between distinct sectors and organizations. They are from two major origins; organizational and functional origin. Barriers from organizational origin are any characters specific to one organization or sector do not fit and support the collaboration. While, barriers from functional origin mean actions or components which are not fully developed to aid or ease the mechanisms of integrated surveillance system (Table 1).

Beneficial factors are factors that induce or encourage the collaborative effort between different sectors. They can be categorized into two main groups; internal and external beneficial factors. Beneficial factors from internal origin are any actions of working group sustain or support the collaboration. While, favoring factors from outside the working group; policy level and other emergences, are categorized as beneficial factors from external origin (Table 2).

Table 1 Possible barriers of collaboration between different health-related sectors in disease surveillance system

Barriers from organizational origin	Barriers from functional origin
• Lack of appropriate budget • Sectoral competition relate to external funding • Property and confidential data • Lack of comparability between laboratory methods • Inappropriate sectoral data for integration • Lack of completeness of data • Legal and ethical constraints	• Lack of joint database • Lack of framework for intersectoral collaboration • Lack of intersectoral standardization • Lack of intersectoral communication • Insufficient intersectoral collaboration • No operationalization of the intersectoral approach at local level • Lack of formal intersectoral agreement

Table 2 Possible beneficial factors of collaboration between different health-related sectors in disease surveillance system

Beneficial factors from internal origin	Beneficial factors from external origin	
	In the policy level	From other emergences
• Efficient and appropriate communication to stimulate intersectoral collaboration • Appropriate framework design to meet the expectation of different sectors • Existence of joint database • clearly defined roles and responsibilities amongst people in the working group in every level of intersectoral coordination	• Political commitment • Stakeholder commitment • Appropriate legal framework • Supervision of two or more compartments by single authority • Surveillance system is a part of a boarder One Health program	• Health crisis inducing collaborative effort in surveillance system • Scientific evidence of the efficiency of using animal sentinel or vector surveillance to protect human health

In fact, the One Health disease surveillance system is not new. Back to 1890 during Soviet Era, the Soviet Anti-Plague System (AP system) was implemented. It was a huge and unique network of facilities aiming at to control the not only disease caused by *Yersinia pestis* as its name but also other deadly endemic diseases and to prevent the exotic pathogens from outside the Soviet Union. Those target hazard included anthrax, brucellosis, bubonic plague, Crimean-Congo Hemorrhagic Fever (CCHF), and tularemia. Such effective disease surveillance system was actually authorized by Soviet Biological Warfare committee (Ouagrham-Gormley, Melikishvili, & Zilinskas, 2006) which favored the collaboration of different disciplines from distinct sectors. However, it was stated that there was in fact lack of intersectoral communication to ease the integration (McNamara, Platonov, Elleman, & Gresham, 2013).

Between 1950 and 1989, there was a comprehensive surveillance system aiming at the control and eradication of schistosomiasis in Guangxi, China. Its target compartments were human, domestic animal (livestock) and environment (snails). A single and specific multidisciplinary organization was established involving people from public health, animal health, environment, finance and commerce sector (Sleigh, Jackson, Li, & Huang, 1998). This is another successful integrated surveillance program supervised by a single institution. However, it does not mean that such characteristic is always favoring the collaboration as in the case of the Danish Integrated Antimicrobial Resistance Monitoring and Research Program (DANMAP). Although it was mentioned that DANMAP was supervised by a single authority which was beneficial to the collaboration, it was not in reality (Queenan, Häsler, & Rushton, 2016).

Actually, health crisis induced the collaborative effort and led to the establishment of a complex national antimicrobial surveillance program named DANMAP in 1999 involving both governmental sectors (public health, animal health, food safety, fishery, environment and education) and private sectors (farmers, feed operators, food operators, private laboratories and pharmaceutical industries). The same beneficial factors was also mentioned in the national Colombian Integrated Program for Antimicrobial Resistance Surveillance or COIPARS in 2007 (Donado-Godoy et al., 2015). Another important factor which allowed DANMAP to be further maintained was appropriate integrated design to meet the expectation of involved sectors and organization (Hammerum & others, 2007).

In 2006, there was an establishment of the Integrated Salmonella Surveillance Program of British Columbia, Canada. This was another example of national surveillance program which mentioned multiple barriers toward the collaboration. It was run by three major sectors including public health, animal health, academic and food safety. This program aimed at sustaining intervention design, improving knowledge and understanding of salmonellosis and monitoring disease occurrence and trend. Multiple disciplines; medicine, microbiology, epidemiology and risk assessment, were included in this system. Several benefits emerged from this collaborative program such as the improvement of risk mitigation measures, the improvement of the epidemiological knowledge and the development of an integrated surveillance framework that can be extended to other health events. The effective and appropriate intersectoral communication as well as stakeholder commitments aid the integration. Nevertheless, there are multiple barriers of this collaborative surveillance system. For example the absence of validated methodology for the analysis of integrated surveillance data, the constraints in ownership and confidentiality of data, the inappropriateness of sectoral data for integration (secondary data collected with another objective), the lack of formal intersectoral agreement on integrated surveillance and the lack of budget (Galanis, Parmley, & De With, 2012; Vrbova et al., 2016).

In 2010, the government of Mongolia constructed the national intersectoral surveillance of zoonotic diseases aimed at disease control and eradication, intervention efficacy assessment early detection of health event and occurrence monitoring. Three target compartments were human, domestic animal and wildlife. Inappropriate legal framework to maintain the collaboration, ethical and legal constraints, sectoral competition for external funding, lack of operationalization of the intersectoral approach at the local level were mentioned as barriers to the integration this national One Healht surveillance program. However, one important benefit was laboratory capacity building for intersectoral collaboration (Table 3) (Batsukh et al., 2012).

A large regional integrated program named EU Antibioresistance monitoring programme included almost every member country of European Union. Such program integrated multiple sectors; food safety, public health and animal health, aiming at improving knowledge and understanding of antimicrobial resistance, supporting the intervention design, preventing human transmission and monitoring trends and occurrence of antimicrobial resistance. It seemed to be a successful program but there were various barriers behind. Lack of comparability among laboratory methodologies of animal health, public health and food safety sectors, lack of standardization and harmonization across

sector and lack of representative of data were important barriers which needed to be solved (European Centre for Disease Prevention and Control, European Food Safety Authority, & European Medicines Agency, 2015).

In 2007, there were two local integrated rabies surveillance programs which mentioned several beneficial factors to the collaboration. One was the surveillance of rabies in Bohol, the Philippines which included governmental sectors (public health and animal health) and private sectors (the owners of dogs and communities). This program aimed at human transmission prevention, substantiate freedom, timely response and rapid control of such disease. It is mentioned that several beneficial factors were this surveillance program was a part of a boarder One Health program, stakeholders commitment, appropriate legal framework and appropriate institutional organization (Lapiz et al., 2012). The other one was the surveillance of rabies in Tamil Nadu, India which cited the same objectives as the previous one in the Philippines. This program in India stated that its beneficial factors were clearly defined roles and responsibilities amongst agencies in every level of intersectoral coordination and proper political commitment for the collaboration (Abbas, Venkataramanan, Pathak, & Kakkar, 2011).

The final point to emphasize is that joint database seemed to be quite essential in order to allow collaboration among sector possible. Various One Health disease surveillance program mentioned that it was a beneficial factor and also barrier in case of inexistence. For example the Armed Forces Health Surveillance Center, Division of Global Emerging Infections Surveillance and Response System Operations (AFHSC-GEIS) (Witt et al., 2011), the Salmonella data bank for routine surveillance in Brandenburg (Talaska, 1994) and the surveillance of *Campylobacter spp.* in Switzerland (Babo Martins, Rushton, & StäRk, 2017).

Potential benefits from the integration of different health-related sectors and disciplines in disease surveillance system (Table 3)

Table 3 List of potential benefits obtained from prevailing integrated surveillance system

Potential benefits from the integration
• Improvement of the cost-efficiency due to integration • Intersectoral laboratory capacity building • Better quality information support to research studies • Improvement of the health situation • Development of an integrated framework that can be applied to other health events • Improvement of the risk mitigation measures and decision making • Improvement of epidemiological knowledge • Improvement of the surveillance performance due to integration

One of the best examples of One Health surveillance system is West Nile virus surveillance in Italy which is a national governmental program run by single sector; public health. This vector-borne disease surveillance system aimed at early detection of West Nile viral infection, timely response, rapid control, human transmission prevention and supported the intervention design. Several disciplines were included in this system such as veterinary, medicine, entomology and epidemiology. Target compartments of the system involve human,

domestic animal (horses and poultry), wildlife (wild birds) and environment (mosquitoes). This comprehensive surveillance program proved various benefits from the collaborative efforts of different sectors and disciplines such as the improvement of epidemiological knowledge in such complex disease the development of an integrated surveillance framework that could be applied to survey other health events. Although it seemed to be the best integrated surveillance system, insufficient intersectoral collaboration was a major barrier of this integrated surveillance program (Rizzo et al., 2016).

Another point to highlight is that economic is one of the most critical component to be evaluated for every integrated surveillance program. The West Nile virus integrated surveillance system in the Emilia-Romagna region (Angelini et al., 2010) and the surveillance of *Campylobacter spp.* in Switzerland had proved there was an improvement of the cost-efficiency due to the integrated approach. Moreover, such collaboration improved risk mitigation measure and decision making as well as improved health situation caused by *Campylobacter spp.* (Babo Martins et al., 2017).

Other potential benefit such as the improvement of risk mitigation measures and the improvement of the health situation were mentioned in both the Integrated Salmonella Surveillance Programme (Galanis et al., 2012) and DANMAP (Hammerum & others, 2007). Many integrated surveillance proved the improvement of their capacities due to integration such as the surveillance of rabies in Tamil Nadu (India) (Abbas et al., 2011).

Education and research institutions could obtain the benefits from the integration as proved by numbers of One Health surveillance program such as the surveillance of Avian influenza in Taiwan (King et al., 2001), the electronic integrated disease surveillance system and pathogen asset control system (Wahl, Burdakov, Oukharov, & Zhilokov, 2012)

Conclusion

In conclusion, this article explain that there are several influential factors which are important to put into account in both authority level and working group level in order to allow the One Health surveillance system become possible. Although the integration of different sectors and disciplines had been proved for the potential benefits, it does not always result in benefits. Therefore, it is needed to be well planned considering every factor which are described in this article and carefully evaluate the system to be able to truly mention that it is '**worth**' to combine other sectors and discipline in the One Health surveillance system.

Referrence

Abbas, S. S., Venkataramanan, V., Pathak, G., & Kakkar, M. (2011). Rabies control initiative in Tamil Nadu, India: a test case for the 'One Health' approach. International Health, 3(4), 231–239. https://doi.org/10.1016/j.inhe.2011.08.001

Angelini, P., Tamba, M., Finarelli, A. C., Bellini, R., Albieri, A., Bonilauri, P., … others. (2010). West Nile virus circulation in Emilia-Romagna, Italy: the integrated surveillance system 2009. Euro Surveill, 15(16), 19547.

Babo Martins, S., Rushton, J., & StäRk, K. D. C. (2017). Economics of zoonoses surveillance in a 'One Health' context: an assessment of Campylobacter surveillance in Switzerland.

Epidemiology and Infection, 145(06), 1148–1158. https://doi.org/10.1017/S0950268816003320

Batsukh, Z., Tsolmon, B., Otgonbaatar, D., Undraa, B., Dolgorkhand, A., & Ariuntuya, O. (2012). One Health in Mongolia. In J. S. Mackenzie, M. Jeggo, P. Daszak, & J. A. Richt (Eds.), One Health: The Human-Animal-Environment Interfaces in Emerging Infectious Diseases (Vol. 366, pp. 123–137). https://doi.org/10.1007/82_2012_253

Donado-Godoy, P., Castellanos, R., León, M., Arevalo, A., Clavijo, V., Bernal, J., … Perez-Gutierrez, E. (2015). The Establishment of the Colombian Integrated Program for Antimicrobial Resistance Surveillance (COIPARS): A Pilot Project on Poultry Farms, Slaughterhouses and Retail Market. Zoonoses and Public Health, 62, 58–69. https://doi.org/10.1111/zph.12192

European Centre for Disease Prevention and Control, European Food Safety Authority, & European Medicines Agency. (2015). ECDC/EFSA/EMA first joint report on the integrated analysis of the consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals: Joint Interagency Antimicrobial Consumption and Resistance Analysis (JIACRA) Report. EFSA Journal, 13(1), 4006. https://doi.org/10.2903/j.efsa.2015.4006

Galanis, E., Parmley, J., & De With, N. (2012). Integrated surveillance of Salmonella along the food chain using existing data and resources in British Columbia, Canada. Food Research International, 45(2), 795–801. https://doi.org/10.1016/j.foodres.2011.04.015

Hammerum, A. M., & others. (2007). Danish Integrated Antimicrobial Resistance Monitoring and Research Program-Volume 13, Number 11—November 2007-Emerging Infectious Disease journal-CDC. Retrieved from http://wwwnc.cdc.gov/eid/article/13/11/07-0421_article.htm

King, C.-C., Kao, C.-L., Liu, D.-P., Cheng, M.-C., Yen, H.-L., Lee, M.-S., … others. (2001). Seven integrated influenza surveillance systems in Taiwan. International Congress Series, 1219, 107–118. Retrieved from http://www.sciencedirect.com/science/article/pii/S0531513101003314

King, L. J., Anderson, L. R., Blackmore, C. G., Blackwell, M. J., Lautner, E. A., Marcus, L. C., … others. (2008). Executive summary of the AVMA one health initiative task force report. Journal of the American Veterinary Medical Association, 233(2), 259–261.

Lapiz, S. M. D., Miranda, M. E. G., Garcia, R. G., Daguro, L. I., Paman, M. D., Madrinan, F. P., … Briggs, D. J. (2012). Implementation of an Intersectoral Program to Eliminate Human and Canine Rabies: The Bohol Rabies Prevention and Elimination Project. PLoS Neglected Tropical Diseases, 6(12), e1891. https://doi.org/10.1371/journal.pntd.0001891

McNamara, T., Platonov, A., Elleman, T., & Gresham, L. (2013). The Human-Animal Interface and Zoonotic Threats: The Russian Federation Approach. Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science, 11(3), 185–195. https://doi.org/10.1089/bsp.2013.0054

Note, A. T. C. (2010). The FAO-OIE-WHO. Retrieved from https://www.unicef.org/FAO_OIE_WHO_2010_ConceptNote_Hanoi.pdf

Ouagrham-Gormley, S. B., Melikishvili, A., & Zilinskas, R. A. (2006). The Soviet Anti-Plague System: An Introduction. Critical Reviews in Microbiology, 32(1), 15–17. https://doi.org/10.1080/10408410500496789

Queenan, K., Häsler, B., & Rushton, J. (2016). A One Health approach to antimicrobial resistance surveillance: is there a business case for it? International Journal of Antimicrobial Agents, 48(4), 422–427. https://doi.org/10.1016/j.ijantimicag.2016.06.014

Rizzo, C., Napoli, C., Venturi, G., Pupella, S., Lombardini, L., Calistri, P., … the Italian WNV surveillance working group. (2016). West Nile virus transmission: results from the integrated surveillance system in Italy, 2008 to 2015. Eurosurveillance, 21(37). https://doi.org/10.2807/1560-7917.ES.2016.21.37.30340

Sleigh, A., Jackson, S., Li, X., & Huang, K. (1998). Eradication of schistosomiasis in Guangxi, China. Part 2: Political economy, management strategy and costs, 1953-92. Bulletin of the World Health Organization, 76(5), 497.

Stärk, K. D. C., Arroyo Kuribreña, M., Dauphin, G., Vokaty, S., Ward, M. P., Wieland, B., & Lindberg, A. (2015). One Health surveillance – More than a buzz word? PreventiveVeterinaryMedicine120(1),124–130. https://doi.org/10.1016/j.prevetmed.2015.01.019

Talaska, T. (1994). A salmonella data bank for routine surveillance and research. Bulletin of the World Health Organization, 72(1), 69.

Vrbova, L., Patrick, D. M., Stephen, C., Robertson, C., Koehoorn, M., Parmley, E. J., … Galanis, E. (2016). Utility of algorithms for the analysis of integrated Salmonella surveillance data. Epidemiology and Infection, 144(10), 2165–2175. https://doi.org/10.1017/S0950268816000182

Wahl, T. G., Burdakov, A. V., Oukharov, A. O., & Zhilokov, A. K. (2012). Electronic Integrated Disease Surveillance System and Pathogen Asset Control System. Onderstepoort Journal of Veterinary Research, 79(2). https://doi.org/10.4102/ojvr.v79i2.455

Witt, C. J., Richards, A. L., Masuoka, P. M., Foley, D. H., Buczak, A. L., Musila, L. A., the AFHSC-GEIS Predictive Surveillance Writing Group. (2011). The AFHSC-Division of GEIS Operations Predictive Surveillance Program: a multidisciplinary approach for the early detection and response to disease outbreaks. BMC Public Health, 11(Suppl 2), S10. https://doi.org/10.1186/1471-2458-11-S2-S10