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One Health: A Primer

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Introduction

Public health events are best dealt with in an interdisciplinary manner with many actors and agencies involved, each lending their expertise to solve the complex problem. Many examples exist of agencies working across boundaries to solve significant public health issues, but the examples are less frequent of agencies that work cross-disciplines. It is not a matter of desire, but one of tradition.

In recent years, the concept of One Health has become more common within public health circles. The One Health approach attempts to recognize that numerous disciplines across many sectors are required to solve the complex problems facing public health. They recognize most significant public health problems cannot be solved using the epidemiological triangle and can only be solved using a multi-approach.

One Health takes a holistic approach to address human, animal, and ecosystem health. One Health emphasizes multi-sector, transdisciplinary action across professions to ensure well-being within human, animal, and ecosystem interfaces. This paper will provide an overview of One Health, the evolution of the movement, and the current challenges. Also, this paper will showcase the application of One Health through the Canadian response to West Nile virus and will conclude with recommendations and steps forward.

Overview of One Health

Worldwide population growth, migration patterns, and environmental degradation have transformed the environment in which human and animal population's cohabitate, greatly affecting the emergence of infectious and non-infectious disease trends.[1-4] Newly emerging disease can have substantial economic and social costs, for example, the outbreak of H5N1 Highly Pathogenic Avian Influenza (HPAI). This outbreak resulted in upwards of $20 billion U.S. in global economic losses.[5] The spread of HPAI is not an isolated zoonotic disease incident. An extensive literature review identified 175 emerging diseases; 75% of those classified as zoonotic.[6] One Health has gained international attention as an approach to control infectious disease outbreaks and to address interconnected health threats affecting animal, human, and ecosystem domains.

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The definition used by the United Nations and established by the American Veterinary Medical Association defines One Health as "the collaborative effort of multiple disciplines working locally, nationally, and globally – to attain optimal health for people, animals and our environment".[7] The One Health initiative emphasizes the interconnectedness between human and animal well-being that rely heavily on their surrounding ecosystem.

One Health promotes a *whole of society* approach by incorporating human medicine, veterinary medicine, public health, and environmental information when developing policy and determining interventions to address current challenges threatening today's globalized world.[8,9] One Health approaches and policy documents, outlining the framework for One Health interventions, attempt to mitigate and prevent emerging disease[10]; however, transdisciplinary principles and unification of human, animal, and ecosystem health can be applied to additional sectors, such as food safety and security, antimicrobial resistance, and addressing implications of climate change.[10] The collaborative approach of One Health has even been suggested to alleviate poverty in the developing world through diminishing burden of illness associated with under-reported zoonotic disease and strengthening access to social services in rural settings.[11,12]

The Evolution of One Health

The approach of One Health stems from the original theory of One Medicine, developed in 1984 by Calvin Schwabe in his book titled *Veterinary Medicine and Human Health*,[13] advocating a combined medical and veterinary approach to zoonotic disease.[13,14] In recent years, new emerging diseases have led to the return of One Medicine principles and the evolvement into One Health.[15] The major difference between One Medicine and One Health is the addition of ecosystem health into the interface. Ecosystem health is included to incorporate the environment, as well as wildlife populations, and recognizes that sustainable development and continued human and animal health are dependent on healthy surrounding ecosystems.[15-17]

One Health advanced during the 2004 Wildlife Conservation Society conference to address the health of human, domestic, and wildlife populations.[18] This conference led to the creation of *Manhattan Principles* and the development of *One World, One Health*™ (OWOH™), a trademark protected term of the World Wildlife Society.[18,19]

To build upon the established OWOH™ principles, a series of conferences were held in Beijing (2006) and New Delhi (2007). The agenda of both international meetings was the curbing of avian and human pandemic influenza.[18] In October 2008, the World Health Organization (WHO), the Food and Agriculture Organization from the United Nations (FAO), and the World Organization for Animal Health (OIE) drafted the influential document *Contributing to One World, One Health: A Strategic Framework for Reducing Risks of Infectious Diseases at the Animal-Human-Ecosystems Interface.*[5] This strategic framework focuses on disease surveillance, emergency response, and collaboration with communication between public health and animal health domains.[5,20] There have been several conferences to elaborate upon objectives of the strategic framework and to expand upon the application of One Health including, but not limited to, Winnipeg, Manitoba (2009) and Atlanta, Georgia (2010). The majority of policy and conference proceedings have focused on the following objectives:

1) To promote interagency and cross-sectional collaboration and communication; ultimately strengthening partnerships across human, animal, and ecosystem domains[5,21];

2) To minimize the impact of newly emerging disease through integrated disease surveillance and emergency response preparedness at the local, national, and international level.[21]

Lately, there has been a push by public health practitioners and academia to incorporate a broader perspective of One Health. This is founded in the conference report taken from the *1st International One Health Congress* held in Victoria, Australia (2011).[22] This initial congress focused on a multitude of subjects related to One Health and addressed the traditional One Health theme of surveillance of zoonotic disease, yet expanded to include: contemporary issues to be explored, such as food security; community participation; and inclusion of disciplines, such as economics, social behavior, and microbiology into the One Health movement.[22]

These conferences bring together professionals from human, animal, and environmental sectors including, but not limited to, policy analysts, toxicologists, medical doctors, and veterinarians. Experts, from various geographic locations and knowledge background, provide the opportunity to discuss implementation of One Health, as well as challenges and opportunities within the field.[18]

One Health is not alone in its holistic approach to the interconnectedness of human, animal, and ecosystem health. *Ecosystem Approaches to Health*, commonly referred to as Ecohealth, have also emerged. Ecohealth has been defined as "systemic, participatory approaches to understanding and promoting health and wellbeing in the context of social and ecological interactions".[23] Both One Health and Ecohealth attempt to address complex public health challenges.

Challenges for One Health

The evolution from One Medicine to One Health included the addition of the ecosystem interface; however, to date the literature and strategic framework for the implementation of One Health has been predominately focused on curbing the emergence of zoonotic disease within the human, animal interface with little focus on the ecosystem.[5,10,24] Professionals within the One Health field argue there is a disconnect between professions working within the framework, specifically those from veterinary and medical communities.[7,15] The inability to effectively coordinate professional services could jeopardize communication and surveillance regarding emerging zoonotic disease and curb the opportunity for collaboration in other interconnected matters of public health concern. Lastly, the challenge of capacity can be an issue for government bodies as not all countries have the ability to support a One Health agenda. This lack of resources and informed personnel may prove difficult in establishing networks between animal, human, and environmental health professionals.[5]

Case Study: West Nile Virus in Canada

The first case of West Nile Virus (WNv) reported in the Western Hemisphere was documented August 1999 in New York City.[25] By the fall of 2001, WNv had entered Canada and was reported in bird populations by 12 Ontario Health Units.[26] Human cases were reported in 2002 in both Ontario and Quebec.[26] Within the human population, WNv has a range of symptoms known to vary on a case-by-case basis. These symptoms include, but are not limited to, mild

influenza-like fevers and aches to severe neurological symptoms, paralysis, and death[10] Certain species of birds are considered the primary vertebrate reservoir for the virus, while mosquitoes are the primary vectors which carry the virus from animal to animal and animal to human.[10]

To address the emergence of WNv in North America, national, provincial, local, and non-government organizations responded in parallel to One Health concepts; transdisciplinary collaboration among sectors to tackle challenges affecting human, animal, and ecosystem domains. Professionals and organizations from the human and animal health sector successfully integrated surveillance and response plans to mitigate the impact of WNv.

By 2000, Health Canada had created the *West Nile Virus National Steering Committee* (WNVNSC). This committee developed guidelines and mandates for surveillance and response to the looming threat of WNv. The WNVNSC was composed of various actors from the human, animal, and ecosystem interfaces. A sample of stakeholders who collaborated across sectors include: the Public Health Agency of Canada (PHAC), Parks Canada, the Ministry of Health, Canadian Cooperative Wildlife Health Centre (CCWHC), Health Canada's First Nations and Inuit Health Branch, Canadian Blood Services, and Héma-Québec.[26,27]

In 2003, Health Canada put forward a *Prepared and Prevention Plan,* with assistance from multiple actors.[10] An integrated surveillance system was implemented and led by the PHAC. Data continues to be collected with collaboration from various actors with regional and provincial ministries responsible for reporting positive cases diagnosed in humans, while the CCWHC is predominately responsible for the collection and reporting of positive WNv cases found in the national bird population.[28] Surveillance data is then compiled and accessible via PHAC's website. This surveillance system enables appropriate public health measures are taken in affected geographic locations. The collaboration between organizations and professionals working toward a common goal, from both the human and animal interface combined with effective integrated surveillance, has led to control of this emerging infectious disease within Canadian borders.

Recommendations

One Health is an approach that can only be successful if it maintains partnerships across various professional sectors and engages stakeholders within the human, animal, and environment categories. Therefore, the following recommendations are put forth to encourage successful implementation of One Health mandates:

1. Agencies must understand One Health and share their knowledge with relevant stakeholders. Organizations must be familiar with One Health concepts. The promotion and dissemination of One Health information will bring awareness to this approach and encourage implementation within a variety of sectors.

2. Public health organizations must become more knowledgeable regarding complex systems and recognize the importance of the ecosystems' role in public health. To date, environmental interface has been somewhat neglected in One Health literature. In order to address this gap, a more holistic approach must be taken; an approach that goes beyond zoonotic disease and the interactions between animals and humans and expands to the ecosystem in which we all live.

3. Public health agencies must enhance their capacity and ability to work with stakeholders from a variety of disciplines. To ensure the success and expansion of the One Health movement, relationships must be nurtured to create open dialogue between sectors and working groups. Professionals involved in human, animal, and ecosystem health must avoid silo thinking within their designated fields and practitioners must seek and be receptive to collaboration with personnel from diverse backgrounds.

It is apparent that complex public health challenges will continue to emerge, with little regard for borders or species. To tackle these emerging threats a united One Health approach among professionals and disciplines is crucial for human, animal, and ecosystem health globally.

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For further reading

Asokan GV, Asokan V, Fedorowicz Z, Tharyan P. Use of a systems approach and evidence-based One Health for zoonoses research. J Evidence-Based Med. 2011;4(2):62-5.

The authors focus on the benefits of approaching zoonotic diseases in an integrated way using a systems approach such as One Health. This collaborative approach with multiple disciplines working at various geographic scales is desribed as an approach of choice to achieve optimal health for people, animals, and the environment. Systematic reviews can be completed which move away from being independent and discipline oriented and, instead, enable pooling of results, etc, underpinning the systems approach and One Health.

Atlas R, Rubin C, Maloy S, Daszak P, Colwell R, Hyde B. One Health - Attaining optimal health for people, animals, and the environment. Microbe. 2010;5(9):383-9.

The authors emphasize the potential of employing a One Health approach for reducing threats to global health from infectious diseases. They highlight recent diseases and pathogens that illustrate the importance of the One Health perspective: Q fever, hantaviruses, SARS, West Nile virus, Nipah virus, cholera, malaria, and dengue. As part of a systematic One Health approach, a key activity involves increasing communications among medical, public health, animal health, and environmental researchers and practitioners.

Pappaioanou M, Gramer M. Lessons from pandemic H1N1 2009 to improve prevention, detection, and response to influenza pandemics from a One Health perspective. ILAR J. 2010;51(3):268-80.

The researchers identify and discuss lessons to be learned from pandemic H1N1 2009 from a One Health perspective. They suggest that stronger collaboration among human, animal, and environmental health sectors is required to more effectively prevent or detect and respond to influenza pandemics and improve human, animal, and environmental health and wellbeing.

Public Health Agency of Canada. One World One Health™: From ideas to action. Report of the Expert Consultation; Mar 16-19; Winnipeg, MB: PHAC; 2009.

This report is the culmination of a three day consultation where experts from 23 countries shared their knowledge of best practices, challenges and barriers to implementation of a One World One Health (OWOH) approach. These key recommendations emerged: 1) foster political will; 2) support partnership and collaboration; 3) encourage data sharing and integration; 4) build capacity; 5) develop communication strategies/plan; 6) provide incentives for reporting adverse events; 7) encourage stakeholder and community engagement; and 8) develop supra-country approaches.

Rock M, Buntain BJ, Hatfield JM, Hallgrímsson B. Animal–human connections, "One Health," and the syndemic approach to prevention. Soc Sci Med. 2009;68(6):991-5.

In this research article, the authors define and discuss the syndemic approach. As well, the authors expand the syndemic concept to recognize the extent to which animal health connects with human health. In demonstrating the practical importance in relation to the concept of 'One Health', they hope to help foster collaboration and innovations in prevention.

Veterinarians without borders/ Vétérinaires sans Frontières - Canada. One Health for one world: A compendium of case studies. Frontières. 2010:1-104.

This compendium of case studies provides a useful gateway to better understanding One Health. The document includes four sections: 1) The Disease, which provides information about the disease and the related infectious agent; 2) The Animal-Human-Ecosystem Dynamics, which describes why this disease is an appropriate candidate for One Health approaches; 3) Response and Conclusions, which highlights ways in which organizations have responded to the disease using One Health principles; and 4) Policy Implications, which indicates some implications for government, business or research policies.

Waltner-Toews D. Food, global environmental change and health: EcoHealth to the rescue? McGill J Med. 2009 Jan;12(1):85-9.

The author argues that One World, One Health has limitations in that it lacks processes to address complex challenges of social-ecological systems. He asserts that Ecohealth offers an alternative to understanding and managing changing patterns of foodborne and waterborne diseases in their social, agricultural and economic trading system contexts.

Webb JC, Mergler D, Parkes MW, Saint-Charles J, Spiegel J, Waltner-Toews D, et al. Tools for thoughtful action: The role of ecosystem approaches to health in enhancing public health. Can J Public Health. 2010 Nov-Dec;101(6):439-41.

The authors discuss the emergence of ecosystem approaches to health and their usefulness, for example, in the Canadian context for diverse problems ranging from Great Lakes contamination to zoonotic diseases. They state that through collective efforts, including the lead role played by Canada's International Development Research Centre (IDRC) in supporting an international community of scientists and scholars who advanced ecosystem approaches to health, there has been a research paradigm shift that embraces transdisciplinarity, social justice, gender equity, multi-stakeholder participation and sustainability.

Welburn S. One Health: The 21st century challenge. Vet Rec. 2011;Sect. 614-5.

In this editorial, the author assesses the progress of One Health and notes that the initiative offers a paradigm shift in the approach towards zoonotic diseases. Also, she states the importance of One Health in meeting challenges due to globalisation, climate change and population growth. She adds that the initiative is broad and links animal and human health with the ecosystems in which they live.

World Bank. People, pathogens and our planet. Volume 1: Towards a One Health approach for controlling zoonotic diseases. Report No. 50833-GLB. Washington, DC: World Bank, Agriculture and Rural Development; 2010.

This is a foundational, descriptive document about One Health that moves readers forward from 1964, when veterinary epidemiologist Calvin Schwabe coined the term “One Medicine” to capture the interrelatedness between animal and human health, and

the medical realities of preventing and controlling zoonotic diseases. Recognizing the risks that zoonotic diseases pose to people, their food supplies, and their economies has led to developing coordinated policy and action among agencies responsible for public health, medical science, and veterinary services. The “One Health” concept came into use, followed by the broader concept of “One World One Health,” which is used to represent the connections among human and animal health and the health of the ecosystems they inhabit.

Zinsstag J, Schelling E, Bonfoh B, Fooks AR, Kasymbekov J, Waltner-Toews D, et al. Towards a 'One Health' research and application tool box. Vet Ital. 2009 Jan-Mar;45(1):121-33.

The authors indicate that a paradigm shift as demonstrated in One Health is required in the approach to global public health. They propose practical approaches and 'hands-on' examples by way of an open 'tool box' to translate 'One Health' into practical methods in the fields of integrated disease surveillance, joint animal-human epidemiological studies and health services development.

Zinsstag J, Schelling E, Waltner-Toews D, Tanner M. From "One Medicine" to "One Health" and systemic approaches to health and well-being. Prev Vet Med. 2011 Sep 1;101(3-4):148-56.

The authors state that there is growing evidence for added value of a coherent application of "One Health" compared to "separated sectorial thinking", however, challenges remain. Difficulties revolve around questions such as how does "One Health" evolve and what are the elements of a modern theory of health? The authors describe "social-ecological systems" and a systemic approach to health in social-ecological systems (HSES). They believe that HSES moves beyond "One Health" and "Eco-health".

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