Feature

ONE HEALTH

The evolution of One Health: a decade of progress and challenges for the future

The One Health concept is gathering momentum and, over the next 12 months, Veterinary Record will be publishing a series of articles to help encourage that process. Written by specialists in a range of fields, the articles will consider the meaning of One Health, the interactions between animal and human health and how a collaborative and interdisciplinary approach could help to solve emerging global problems. To set the scene, Paul Gibbs outlines the recent history of One Health, discusses current challenges and muses on what the future might hold.

In the early years of the 21st century, emerging zoonotic viruses that had the potential to cause pandemic disease, including severe acute respiratory syndrome, African swine fever and West Nile fever, called for a wider and deeper commitment to interdisciplinary action addressing the protection and needs of society in the 21st century.

It is time to consider whether One Health will prove to be a short-lived response to a spate of emerging diseases that apparently threatened to engulf the world, or a paradigm shift that will lead to a wider and deeper commitment to addressing the protection and needs of society in the 21st century.

Developing collaboration

In 1999, a series of themed co-fere ces was organised by the Society for Tropical Veterinary Medicine and the Wildlife Diseases Association under the banner ‘Work together to promote global health’. The second of these co-fere ces, held in New York, aimed to highlight the importa of u dersta of zoonotic diseases to ecologists and to address issues at the domestic and international interfaces between animal and human health and sustainable food production and emergi g diseases (Gibbs and Bokma 2002).

Lee Brumme (2013) considered this meeting as key to the early development of One Health.

In 2004, Martin Alder’s The Veterinary Record postulated that their editors could draw on their experiences to write a paper on how the veterinary, medical and other professions could collaborate for mutual benefit. They recognised that the medical and veterinary professions have different roles, but share common interests in animal and public health issues.

In 2005, Veterinary Record and BMJ published an influential joint issue on the theme of ‘one medicine’.
‘O e World Health™ to embrace both medici e ad ecosystem health, a d listed 12 recomme datio ns for establi sh a more holis tic ap proach to preve ti g epi demic disease a d mai tai g ecosystem i egrity for the be nefit of people, domesticated a imals a d the fou datio nal biodiversity that supports us all (w w w. o e world o e health.org). This series of recomme datio ns became k ow as the Ma hatta Pri ciples, i recog itio of the fact that the meeti g was hosted by Rockefeller U niversity n ew York.

Both of these i tiatives were catalysts for Roger Mahr, preside nt of the America Veteri ary Medical Associatio n (AVMA) at the time, to develop his ideas O e Health a d greater collaboratio n between the veteri ary professio n a d the medical professio n in the USA. 2006, the AVMA established the One Health Initiative Task Force a d 2007, the America Medical Associatio n a imously approved a resolution calli ng for a ecreased collaboratio n between the huma n a d veteri ary medical commu ni ties. The term ‘O e Health’ had e tered the medical a d scie n cific lexico.

Si ce the , the co cept of O e Health has received global recog itio n. Some of the mai milestone s i O e Health over the past 10 years are outli ed i Fig 1.

**Definitions of One Health**

While defi ti ons of O e Health are di verse, at its heart O e Health promotes health through i terdiscipli nary a rty study a d actio n, across all a imal species. I this co text, ‘health’ is defi ned by the WHO as a state of complete physical, me tal, a d social wellbei ng o d ot merely the abse ce of disease or i firmit y (WHO 1948). There are ma y embelli shmee ts o the ce ral theme of O e Health, a few of which are present i the box o p. 87. Defi itio n of O e Health te d to refl ect the missio n of the respective orga natio s. As Humphry Dumpy remarks to Alice i Alice Through the Looking Glass (Carroll 1865) ‘When I use a word, it mea ns just what I choose it to mea n – either mo re or less’.

The O e Health I tiative (w w w. o ehealth i tiative.com) co si ders the O e Health co cept as a worldwi de strategy for expa di gi terdiscipli nary a rty collaboratio n in commu natio s i all aspects of health care for people, a imals a d eve r i m. This defi itio n is broader than a d sweepi gi its scope. O iti sta di g the lack of a y formal defi itio n, the co cept of O e Health has captured the e thusiasm of ma y seeki gi to improve a imal a d huma n health through i terdiscipli nary a rty collaboratio n. I deed, it may well be the elasticity of the co cept that makes it attractive to so ma y disparate groups.

**Selected achievements in the past 10 years**

Control of infectious diseases O e Health was bo r out of a d fueled by, fear, 2004, there was global a xiety that a zootic d iseases, HPAI H5N1, could cause a p a demic i the huma n populatio n, rivali g a d possibly exceedi ng the estimated 50 millio n huma n deaths associated with Spa i sh i flu e z at the e d of the First World War (Gibbs 2005). The i troduc ti o n of O e Health i tiative produced i teratio al a d cies (FAO, OIE, WHO a d the World Ba k) with a vehicle for i teratioial a d i terdiscipli nary a rty collaboratio n to address the threat of emergi ng zootic diseases, a d i te a bled these i teratio al a d cies a d i teratio al a d cies a d a d i teratio al authorities to come to the table as equal part ers i the search for solutio ns to the threats posed by this highly virule nt strain o i flu e z.

The global respo nse to avia i flu e z was lau ched i Ja uary 2006 agai nt a O e Health backd rop at the i teratio al a d inter natio nal a d local le vel. EPA i a zootic d iseases, e.g. A ike H5N1 a d H7N9, could cause a a demic i the huma n populatio n, rivali g a d possibly exceedi ng the estimated 50 millio n huma n deaths associated with Spa i sh i flu e z at the e d of the First World War (Gibbs 2005). The i troduc ti o n of O e Health i tiative produced i teratio al a d cies (FAO, OIE, WHO a d the World Ba k) with a vehicle for i teratioial a d i terdiscipli nary a rty collaboratio n to address the threat of emergi ng zootic diseases, a d i te a bled these i teratio al a d cies a d i teratio al authorities to come to the table as equal part ers i the search for solutio ns to the threats posed by this highly virule nt strain o i flu e z.

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applicatio. In October 2008, the FAO published a framework for reducing the risks of infectious diseases at the animal-human ecosystem interface (FAO 2008). This framework, which was developed by FAO/OIE/WHO/Un ICEF/World Bank as the Un System I flue za Coordination, addressed emerging zoonotic diseases with the potential for significant d a y ary or socioeconomically impact arising at the animal-human ecosystem interface a d, while the focus was mainly on emerging zoonotic diseases, it was recog. nized that emerging zoonotic diseases could serve to address the emerging zoonotic disease. The report identified a core tool: a disease model that is grown by e. s. i. terest, a d requires the integration of private and public sources.

The immediate threat of a human p a demic caused by HPAI H5N1 has owne receded. The initial report of a disease outbreak in Egypt, which was later corroborated by the WHO, revealed a human case of HPAI H5N1 in Egypt. This virus was identified as a virulent strain of avian flu. As a consequence, the human and animal health system was set up to track outbreaks and control zoonotic diseases. However, the emergence of HPAI H5N1 in Egypt raised concerns about the spread of the disease to other countries. The spread was rapid across the world, and the virus was identified in various countries, including in Europe.

As an example, in 2007, a case of HPAI H5N1 was identified in Europe. The virus was detected in backyard poultry in Greece, and it rapidly spread to other countries in the region. The European Union (EU) responded by implementing a strict surveillance and control program to prevent the spread of the disease. The program included the culling of infected birds, the testing of poultry for the virus, and the restriction of movement of birds and bird products.

The response to the emergence of HPAI H5N1 in Europe was a testament to the importance of One Health. The approach involves the integration of veterinary, medical, and environmental health to address emerging zoonotic diseases. This approach recognizes the interdependence of these fields and the need for a collaborative and interdisciplinary approach to address the challenges. The One Health approach is essential in the face of emerging zoonotic diseases, and it is crucial for the protection of human and animal health.
Missio Rabies, a project led by Worldwide Veterinary Services to eliminate the disease in some regions of I dia. The Global Alliance for Rabies Control has established Partners for Rabies Preve tio, a group that includes all of the major ter atio age cities involved in rabies control.

Control of non-infectious diseases and conditions
The aforementioned programmes are ter atio al scope directed at zoo areas, but there are other O e Health activities that do not involve zoonotic diseases. The activities grouped together comparative a d tra slato al medici e i Fig 2 give a diacatio of the scope of these activities. There are many topics that might have been considered to be rele va tio to O e Health a few years ago, but are ow seen as co tributi o the promotio of health i the wider co text. The huma aimal bo d is o e example, a d the use of dogs to detect early ca ceri people a d as i diacato of metabolic crises is a other. The growi appreciatio of O e Health i comparative a d tra slato al medici e will be discussed in more detail i a forthcoming g article i this series.

Research and funding
Research is critical to ide fy the most effective ways to promote health. Because most research fu d i is directed to specific diseases, ma y fu d age cies i itially had difficulty ide fy effective ways i which to support the i terdisciplin ary ature of O e Health. For example, most of the research fu d i is directed to the pa demic threat of HPAI H5N i was directed to the importa t area of molecular characteratio of the virus a d pathoge es. Fu d i age cies also have the problem that fu d s, other tha those ge erated i a crisis, ca rarely be redirected quickly. Early leadership from the EU, the US Age cy I ter atio al Develope t (USAID) a d the Departme t for I ter atio al Develope t (DFID) i the UK has shown that O e Health ca be supported fi a cially. The EU has fu d ded projects such as ICOn Z, a d USAID has established a emergi g pa demic threats programme. The programme is composed of four comple tary projects: PREDICT, PREVEn T, IDEntify a d RESPOn D, with tech ical assista ce from the C e ters for Disease Co trol a d Preve tio . This programme draws o expertise from across the aimal a d huma health sectors to build regio al, atio al a d local O e Health capacities for early disease detectio, laboratory-based disease diag osis, rapid respo se a d co tai me, a d risk reducio. PREDICT focuses o the detectio of zoonotic diseases at the wildlife-huma i terface. Specific activities i clude: stre gthi i g surveilla ce a laboratory capacities i order to mo itor wildlife a d people co tac wit wildlife for ever pathoge s that may pose a sig ifica t public health threat; characterisi g huma a d ecological drivers of disease spillover from a imals to people; stre gthi i g a d optimisi g models for predicti g disease emergi ce a d usi g this i formatio to improve surveilla ce a d supporti g outbreak respo se when requested.

I the UK, the Biotechnolog y a d Biological Science Research Cou cil (BBSRC) supports several i ter atio al activities, i cludi g the STAR-IADZ Global n etwork, a d co-fu ds projects with the n atio al Scie ce Fou datio i the USA. A excelle t example

Heath was rece tly ou ced by the BBSRC: i co ju tio with the DFID, the Eco omic a d Social Research Cou cil, the Medical Research Cou cil a d the n atio al E viro me t Research Cou cil, it issued a no t call for research proposals u der the umbrella of the Zoo oses a Emergi g Livestock Systems programme.

With regard to private fou dati o s, i the UK, the Wellcome Trust fu d s two O e Health projects i Africa with its i ter atio al strategy portfolio. I the USA, the Bill a d Meli da Gates Fou datio offered fu di i March 2013 for O e Health wi the ‘Gra d Challe ges i Global Health’ programme.

One Health in education
The co ept of O e Health – amel, promoti i terdisciplin ary collaboratio – dema ds a educato workforce tra i ed i its pri ciples a d applicatio if it is to be successful. O e Health educatio ca be divided i to educatio of those already worki i the releva t professio al discipli es, a d of stude ts seeki professio al qualificatio s to i ter o e of these discipli es. There are ma y excelle t opportu nities for tra i i O e Health.

Education for professionals
To familiarise professio als with O e Health, numerou i ter atio al, regio al, a d atio al co fere ces, symposia, a d workshops have bee orga ised. Two i ter atio al co gresses have specifically addressed O e Health, the first i Australia i 2013 a d the seco di Thaila di 2013. Each was atte ded by several hu d professio als. A third i ter atio al co gress...
Most of these core courses have stressed the relevance of O & E Health to the clinic and have prepared students for real-world veterinary work.

The establishment of O & E Health committees within veterinary schools such as the WSAVA and d atio al orga isatio s such as the AVMA, the co-cept has been introduced to wider audiences. By adding O & E Health as a parallel stream to the programmes of atio al meeti gs, the breadth of the portfolio has been expanded to include topics for those interested in compa ia a dimala d exotic species.

A tigo e d OH-n EXTENG are EU-funding programmes that provide O & E Health short courses. A tigo e is aacro ym from An Apicataed the Global O set of n oveldmics. O&n-EXTENG is targeted at the ext sciic ge eratio of the Sahel d Madgheb. ADVAn Z is a third EU programme that provides imformatio o zoo oses for use by decision makers d local media low resource countries, mostly in Africa. The United States Department of Agriculture (USDA) provides courses in emerging disease topics. O & E Health is also explicit in the course titles. For example, the USDA has sponsored Iowa State U faculty in the production of a portfolio of courses for veterinary schools through its C& ter for Food Security in Public Health. The U & E Health of Florida also provides certificates in O & E Health.

Education for university students

The OIE has been a leader in recognising the priority of O & E Health in veterinary education. Since 2009, it has co-edited three global core courses in veterinary schools that are globally traded and can be found in several countries.

Several universities have developed O & E Health clubs such as Stude ts for O & E Health at the School of Veterinary Medicine at the University of California, Davis. These clubs have hosted speakers and topics related to O & E Health, such as workshops and t o activities.

A PhD degree specifically in O & E Health is available through the University of Florida. It is thought to be the only doctoral degree currently offered in O & E Health, but several universities have considered offering it.

Educating school students

The USA faces a shortage of paraprofessionals who are trained in O & E Health to provide support to the profession. This traini g programmes for paraprofessionals is crucial for the future of O & E Health.

Education the future

Several universities have developed O & E Health clubs that promote the field of veterinary medicine, providing opportunities for students to engage in disease surveillance and research.

The need for an agenda

Recent studies have highlighted the need for greater emphasis on O & E Health in veterinary education. This is crucial for future veterinarians and researchers.

Challenges to the future

The future of O & E Health is uncertain, but it is clear that efforts must be made to increase awareness and funding for this critical field.

Education and the public

Several universities are offering courses in O & E Health to increase awareness and understanding of the importance of this field.

Important considerations

The future of O & E Health is uncertain, but it is clear that efforts must be made to increase awareness and funding for this critical field.
perso al commu icatio ). She cites the O e Health I teative’s viesio of O e Health as a example of a ‘striki gly broad’ defi itio , which co veys well the ge rl idea of collaboratio a d co verge ce, but does ot e gage with the specifices of how this should take place. Lee a d Brumme (2013) see the diversity of O e Health termi ology as a key weak ess a d argue that a agreed operatio al defi itio is required before advocates ca impleme t their goals a y further. Others, however, see the breadth of O e Health, as embraced by the variatio i defi itio , as a disti ct adva tage, as it creates the ‘umbrella’u der which slightly differe t visio s ca be accommodated while worki g together (Leboeuf 2011, Chie 2012). I this co text, the adoptio of the term by i ter aio al age cies has allowed them to reframe the threat of avia i flue za so that it i li e with their ow remit a d the i dividual age cy’s legitimacy is e ha ced while mi imisi gi terage cy te sio s. Chie argues that O e Health is a sufficie tly co crete co cept to articulate commo co cepts across specialist domai s, yet flexible eough to allow for multiple i terpretatio s of the co cept.

Meisser a d colleagius (2011) assessed the impleme tatio of O e Health i Switzerla d b y tervieu g 16 key experts i the Swiss health system, most of w hom were ot veteri aria s. They co cluded that O e Health ca support opio leaders i their quest for solutio s. A study i Africa reported similri di g (Okello 2012), Cassidy (perso al commu icatio ) co ducted i tervieu s with research scie tists i the UK. From prelimi ary data, ma y regard O e Health as a opportunit y to obtain large research gra ts a d to collaborate with others outside their ow discipli e. Other research scie tists saw O e Health primaril y as a useful way to ‘rebra d’ or ‘adverti se’ the work that they were already doi gi order to gai support, but they did ot see O e Health as a co cept that would drive ew research ideas or greater collaboratio . Cassidy reports that ma y scie tists felt u comfortable with taki g this approach, but recog ised the ecssi ty i the cure t competitive academi e viro me t.

I terdiscipli ary collaboratio is at the heart of the O e Health co cept, yet the executio of O e Health, excepti g i flue za, has largely remai ed withe the discipli e of veteri medi ecia a d a imal health. n otithsta di g the e dorseme t differ i terdiscipli arna isatio s, as listed o the O e Health I teative website, mai stream medical support for O e Health has largely bee co fi ed to i dividuals w close veteri ary co tacts; i deed, some i the medical professio are reported to see O e Health as a veteri ary ‘la d’-grab’ (Cassidy, perso al commu icatio ).

i the field of huma medi ecia who see O e Health as a field bei g champio ed primarily by veteri aria s a d are suspiciou s of the motives. Haiser a d colleagius (2012) ote that the reactio from people worki g i the health professio s is polarised; those i the huma health sector have ot e gaged with O e Health, whereas the majority of professio als worki g i a imal a d viro me t al health are i teresti ed i the co cept.

‘If One Health is to survive and historians are going to reflect postively on the historial role in One Health, it is axiomatic that the veterinary profession of today, and into the future, must be well trained in its precepts’

n otithsta di g the difficulty i defi i ga age dai i the face of i differen ce from some pote tial part ers, how should the age da be ide tifi ed as O e Health e ters the ext decade? Osbur a d others (2009) suggested that emergi g dises, food security, food safety a d climate cha ge should be high o the list of priorities. The tripartite meeti g i Mexico (FAO/OIE/WHO 2011) has a similar list. Cassidy poi ts out that terms such as food security are also rearticulatio s of pre-existi g co cer s a d, like O e Health, their disciples advocate i terdiscipli ary collaboratio . Rather tha competi g for resources a d legimacy, it is possible that the respective age das are mutually rei forci g.

Defining the costs and benefits Regardless of the bou dari es of O e Health a d the ra ge i of terdiscipli ary collaboratio s that will emerge i the ext decade, the acco tability of O e Health must be addressed, as ide tifi ed g the FAO/OIE/WHO tripartite meeti g i Mexico. The Sto e Mou tai Worki g Group that exami ed whether a O e Health approach had value for disease protectio a d co trol co cluded that a careful accou tig of costs, both short term a d lo g term, is necessary to show the eco omic befits of a O e Health approach (Rabi owill a d others 2013). It is therefore importa t that the productivit y a d co clusio s from the early projects that received fu di gi der the specific umbrellaa of O e Health promise, such as ICOv Z a d PREDICT, are carefully evaluat ed, so that the value-added approac h of O e Health (both eco omic a d social) to the co trol a d preve tio of disease a d viro me t al degradatio ca be validated. O e Health must be recog ised as a tool for addi g value to disease co trol a d research. Zi stagg a d colleagius (2011), Haiser a d others (2013) a d the World Ba k (2012) to demost rate the eco omic adva tage of O e Health a d ge gament t with stakeholders. Coker a d others (2011) outli e a ceptual framework for policymakers to support O e Health research.

Communicating the importance of One Health The premise upo which O e Health was fou ded a decade ago is that i fectious disease could be a major co strai t o the progress of civilisatio i the 21st ce tury. At that time, there wa i te se media i teresi i the emergi g dises of SARS a d HPAI H5 N1. W hile the media still report o the emergi g dises, such as Middle East respiratory sy drome coro avirus (MERS-CoV), there is little i teresi i the O e Health co cept. A literature a d ter et search has ot ide tifi ed a survey to assess the aware ess of O e Health by the ge ral public. Surely it is legimacy to ask ‘Why is O e Health ot k ow by the ge ral public?’ Is it ot as importa t, arguably eve more importa t, tha climate cha ge? I attempti g to frame a respo se, we retur to the comme t by Lee a d Brumme (2013) that the curre t visio s of O e Health is hi dered by shortcomi gs i articulati g a O e Health age da.

How ca this be corrected? Recog is gi the scope a d terdiscipli ary ature of O e Health, its propo e ts have bee retic to create a professio al society (with a associated jour al) or to impose a bureaucracy beyo d w hat already exists. Is this retic to appropriate? The FAO/OIE/ WHO tripartite group pri cially promotes the co trol of zoo oses through O e Health; this is importa t a d to be applauded, but O e Health is broader tha zoo oses a d eeds a champio beyo d these age cies. The O e Health Commisio i the USA may provide a model, but it is curre tl y a atio al orga isatio a d to be effectve should i volve a greater ra ge of discipli es with i thei membership a d promote a stro ger i ter atoi al perspective. Perhaps a i ter atoi al body similar to the 1 ter atoi al Pa el Climate Cha ge should be established to a alys e a d project the importa ce of O e Health.

Conclusion The questio ce tral to this review of whether O e Health repre s a short-lived respo se to a sate of emergi g dises that threate ed to e gul the world i the firs t few years of the 21st ce tury, or a paradigm shift that will lead to a wide a d depp-rooted committ e t o terdiscipli ary accio for the protectio a d eeds of society i the 21st ce tury.

Cassidy (perso al commu icatio ) speculat e that the rise of the O e Health co cept ca be u derstood ot oly as the co seque ce of active advocacy, but also
Draw g the a aloph of the gerni ati g seed, O e Health is still a te der shoot. The veteri ary professo has led the re ase ce i what has become k ow as O e Health, but O e Health eeds co ti ued uurti g from the professio .I the i tradiutio to "Virus of the Mi d", which discusses memes, Richard Brodie (1996) outli es the four stages through which a ew paradigm must progress i order to gar wi idspead acepta ce: (1) complace cy/ margi alisatio ; (2) ridiculiu; (3) criticism; a d (4) accepta ce. If we accept that O e Health is a ew paradigm, attitudes to O e Health are ow at the third stage – of that criticism. Paradoxically, this should be comfor ti g to the propo e ts of O e Health because when a co cept reaches the stage of serious criticism, it suggests that it is the verge of g i g wi idspead acepta ce.

I the ext dece a we ll ow whehe O e Health is truly a paradigm shift or a successful, but short-lived, respo se to a spa of importa t viral diseases that plagued the world at the begi i g of the 21st ce tury.

n ow is the time to reso the accomplishme ts of the past.

"It is ot the stro g of the species who survive, or the most i tellige t; rather it is those most reso sive to cha ge" (attributed to Charles Darwi i ). O e Health is that reso se!

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O e Health provides the veteri ary professio with the oppor uty i rise to the challe ges of the 21st ce tury that the Ma hatta pri ciples out. If O e Health is to survive a d historia are goi g to reflect posi i ve the veteri ary role o O e Health, it is axiomatic that the veteri ary professio of today, a d i the future, must be well trai ed i the precepts of O e Health, be a stro g advocate of multidicipli ary approaches to solvi g the complex challe ges of O e Health, a d provi de decisive leadi ng. The sustai ed respo se of the veteri ary professio i meeti g the precepts a d be g a champi on of O e Health is a liemus test for the future.