Sustainable Development goals and their Impact on Control of Zoonosis

Muhammad Ifham Naeem[1,*], Qamar un Nisa[2], Ammar AL-Farga[3], Ayah Talal Zaidalkilani[4] and Shamreza Aziz[5]

[1]Faculty of Medicine, Health and Social Care, School of Allied and Public Health Professions, Canterbury Christ Church University, Canterbury, United Kingdom
[2]Department of Pathology, University of Veterinary & Animal Sciences, Lahore, Pakistan
[3]Department of Biological Sciences, College of Science, University of Jeddah, Jeddah, Saudi Arabia
[4]Faculty of Pharmacy and Medical Sciences, Department of Nutrition, University of Petra, Amman, Jordan
[5]Department of Epidemiology and Public Health, University of Veterinary and Animal Sciences, Lahore, Pakistan
*Corresponding author: afhamnaim4@gmail.com

Abstract

Zoonotic diseases are defined as those illnesses transmitted between humans and animals. Over the decades, zoonoses have drawn the attention of researchers as they pose a serious threat to the health of both humans and animals. The primary reasons behind the emergence of zoonoses include ecological imbalance, climate changes, increased interactions of humans and animals, and wildlife disruption. SDGs comprise a comprehensive framework which directly and indirectly helps in the control and prevention of the zoonotic diseases. This chapter aims to explore what is zoonosis and how it becomes a greater threat to public health. The global impact of the zoonoses as they disturb the economy of the countries especially low-income countries and cause suffering of both humans and animals. The chapter discussed various SDGs such as SDG 2, SDG 13, and SDGs 15, how the achievement of these goals and their associated targets will eventually help to control zoonoses.

Keywords: Zoonosis, SDGs, Economy, Humans, Animals and Wildlife.

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Introduction

The term sustainable development refers to the process of decision making which will meet all the development goals of humans today while maintaining the capabilities of the natural systems to fulfill the need of resources of the future (Burton, 1987). The struggle for excellence and growth by humans has resulted in differences in the economic growth among countries and outcomes of this may cause depletion of natural resources at an enormous level which threatens the ecological balance. Sustainable development is a novel concept in the current scenario which makes sure that the growth and development occurs at a rate that natural resources are sustained for the present and passed onto future generations without any impairment (Ghosh & Begam, 2021). Sustainable development consists of three pillars which include economic, environmental and social but there has been an additional pillar (fourth pillar) called culture, institutions of governance (Draft, 2017). All UN states are devoted to achieve the 2030 Agenda of 17 goals of Sustainable Development Goals (SDGs) consist on 169 targets, covering three dimensions of social, economic, and environmental development. Among all the challenges of global health, the spread and increasing burden of the zoonotic diseases is an emerging challenge which include socio-economic, environmental, and ecological factors, in turn these factors also affected by globalization changes (Frazzoli & Mantovani, 2010). The components of One Health, (humans, animals, and environment) plays an important role in the development, emergence, and transmission of various infectious diseases (Thompson & Kutz, 2019). Among different infectious diseases, different diseases affecting humans are of the animal origin. According to the report of "Asia Pacific strategy for emerging diseases: 2010" among 60% of the emerging infectious diseases of humans are zoonotic in nature, and that too 70% of these diseases originated from different wildlife species (WHO, 2014). The emerging diseases in recent decades that affect humans were reported to be of animal origin and associated with the foods of animal origin (Slingenbergh, 2013). Zoonoses derived from a Greek word "Zoon" meaning animal, while the word "nosos" means illness. The World Health Organization (WHO) defined zoonosis as "any infection or disease that transmits naturally from vertebrate animals to humans and vice versa" (WHO, 2020). Among all the pathogens that cause disease in humans, 61% are reported to be zoonotic in nature (Taylor et al., 2001). Zoonoses is considered as a major public health concerns, as it poses serious hazards to human health that may lead to death. There are 13 most common diseases which affect the poor livestock workers in low income countries and cause an estimated 2.4 billion people to get the illness and 2.7 million deaths in humans annually worldwide (Grace et al., 2012). In addition to their harmful effects on human health, the zoonotic diseases also affect the health of animals and lower the livestock production (Grace et al., 2012).

Global Impact of Zoonosis

There are infinite impacts of zoonoses on the health of animals and humans. Although it is almost not possible to measure the impact of

zoonoses, there are several parameters through which the impact of zoonoses can be assessed for example incidence, prevalence, mortality, morbidity, and economic loss (Meslin, 2006). Zoonoses severely affect both the livelihood and well-being of humans. The ultimate results of zoonoses are the negative impact on social status of one as individuals suffering from any zoonotic disease may not be able to support his family. Such conditions are widely seen in low income countries such as Asian and African countries. As a result of several zoonotic infections, the infected individuals are isolated from the rest to avoid the risk of transmission, which may increase the risk of mental health issues in the relevant individuals. Another factor that increases the risk of zoonotic infections is antimicrobial resistance as the treatment will not be effective against many bacterial zoonoses. So if there are individuals suffering from a zoonotic infection with a pathogen that is resistant to antimicrobial therapy, they require special care, expensive treatment, and so increase the burden on the health care sector in developing countries (McMichael, 2004). Deaths of animals due to zoonotic infections pose economic losses on livestock sector on a country. If the animal survives the illness, it still not able to regain the same health and production status. These significant losses include the low production of eggs, milk, and meat upto 70%. The loss of milk, meat, and eggs ultimately exhibit serious impacts on human health as there is a shortage of high protein products of animal origin (Arámbulo & Thakur, 1992). Some zoonotic infections such as toxoplasmosis and brucellosis cause abortion, infertility and unhealthy offspring, this situation affects the farmers and at the end disturbs the economy of the whole country. Zoonotic diseases for example avian influenza, bovine spongiform encephalitis (BSE), and anthrax can hinder the trade of animals, animal products such as milk, eggs, and meat, and animal byproducts across countries worldwide. The measures for the control of zoonoses include surveillance, isolation and quarantine, diagnostic methods, prevention of animal transmission, vaccination and treatment programs, inspection of animal products such as meat and milk, and biosecurity. All these measures also affect the economy of a country tremendously. The economic impact of zoonotic diseases from 1995 to 2008 has exceeded 120 billion USD globally (Cascio et al., 2011). UK has been facing serious economic losses due to various food-borne illness such as *Campylobacter spp., Salmonella* (non-typhoidal), *E. coli* VTEC O157, *Listeria monocytogenes*, and norovirus (Bennett & Ijpelaar, 2005; Martins et al., 2014). Several other countries also faced dramatic losses in their economy as a result of zoonotic food-borne diseases. Due to the contamination of Salmonella in the pork products, Ireland has faced drastic economic loss (Martins et al., 2014). According to the report of World Bank (Bank, 2012), Australia has faced almost 16% loss in the total value of the livestock sector due to the outbreaks in beef and sheep (Rahman et al., 2020). One of the major outbreaks, SARS outbreaks affect the global economy while impacting various sectors such as the tourism sector. The countries severely impacted by the SARS outbreak include China, Singapore, Taiwan, and Hong Kong (Tsai et al., 2010). The emergence of highly pathogenic avian influenza in Mexico causes severe economic losses (Rassy & Smith, 2013). In India, due to the plague in 1994, there was a restriction on tourism which affected the economy of the country (Tsai et al., 2010). There was a ban on international trade due to the outbreak of highly pathogenic avian influenza in poultry and posed drastic impacts on the European Union economy (Martins et al., 2014). The risk of emerging zoonoses is high in developed countries while the risk of endemic zoonoses is high in developing countries (Grace et al., 2012; Bidaisee & Macpherson, 2014).

SDGs and Control of Zoonosis

The application of some SDGs such as SDG 2, SDG 13, and SDG 15 plays a significant role in the prevention and control of zoonosis. By achieving these goals and their respective targets helps directly and indirectly to control zoonosis.

SDG 2 and Zoonosis

SDG 2 states "End hunger, achieve food security and improve nutrition and promote sustainable agriculture." In the last few decades, the consumption of wild animal meat has increased to fulfill the demand for protein source (Nielsen et al., 2018). According to a study, 39% of the sampled houses from 24 different countries of Africa, Asia, and Latin America, use consumed meat from wildlife at least once a year (Nielsen et al., 2018). These results revealed the dependence of humans on wildlife to fulfill their food demands. Besides the fact that the wildlife serves as an excellent protein source, the wildlife also serves as a reservoir host of several zoonotic pathogens (Hilderink et al., 2021). Wildlife hunting is also adopted as a way of income in low socio-economic status areas. All these factors contribute to the emergence of zoonotic transmission of pathogens from humans to animals. The activities of wildlife hunting as a source of consumption or sale is much more prevalent in countries with low socio-economic status as their survival depends on it which ultimately increases the risk of infection. In a study, it is reported that among 1415 species of pathogenic agents, 61% are zoonotic in nature (Taylor et al., 2001). The most common examples of these pathogens include Ebola virus and SARS (Coad et al., 2021). There are two ways through which the consumption of wildlife meat favors the outbreaks of zoonotic diseases, first one is the methods associated with the trade of wildlife for example hunting, handling, butchering, preparation and processing of carcasses, while the second one is consuming wildlife as food causing spread of various zoonotic diseases for example monkey pox virus, Ebola virus, and Sudan virus (Swift et al., 2007; Coad et al., 2021). The cramming of wildlife into stressful conditions, close contact to domestic animals and humans, and poor biosafety also contribute to the spillover of zoonotic infections (Xue-Hong et al., 2016; Magouras et al., 2020). By ending hunger and poverty, the risk of emergence of zoonoses will be lower than it is at present.

SDG 13 and Zoonosis

SDG 13 states that "Take urgent action to combat climate change and its impacts." Climate change due to the activities of the humans, is another factor affecting the spread of zoonoses. The climate changes include global warming, geo-climatic variations, and emission of greenhouse gases. The evidence of the impact of these climate changes on the epidemiology of the zoonotic diseases include changes in the distribution, interactions, and dynamics of the pathogens, vectors, and hosts (Rupasinghe et al., 2022). Climate changes support the onset of emerging, re-emerging, and transmissible zoonoses, particularly those spread through vectors, especially arthropod vectors such as ticks, mosquitoes, fleas, and midges (Tajudeen et al., 2021). Change in the mean temperature of the earth over the years, provide conditions which are favorable for the zoonotic pathogens and their vectors (arthropods) and facilitate the process of breeding, survival capabilities, and enhance their infectivity rate (Tajudeen & Oladunjoye, 2021). There has been much research to support the fact that climate change is linked with the

emergence of zoonoses. It has been reported that there is a link between the onset of human plague in the western United States and the weather events, temperature fluctuations and Pacific Decadal Oscillation (climate changes) (Ben Ari et al., 2008). There has been reports that there is an association between the outbreaks of plague, Rift valley fever, Hantavirus, and various other emerging zoonotic infections and the El Niño-Southern Oscillation (a drastic weather event) (Anyamba et al., 2009; Anyamba et al., 2019). Also the surges in Hantavirus infection in the United States is linked to the El Niño related weather conditions and it is assumed that these weather conditions will be more drastic in the near future (Hjelle & Glass, 2000). The incidence of dengue (an infection transmitted by the mosquito bite and more prevalent in tropical and subtropical areas) has increased by 10 folds in the previous few decades worldwide (Dengue, 2009; Bhatt et al., 2013). The condition is the result of direct and indirect impact of temperature on the breeding and prevalence of vectors. The global mean temperature rose up to 1.09 C between the year 2011 and 2020 (Masson-Delmotte et al., 2021). Under the CO_2 emission scenario, there is an increase of 1.4-4.4 C mean temperature per decade worldwide (Masson-Delmotte et al., 2021). This situation of global warming and variations of geo climate pose a serious threat of emerging zoonoses among human populations (Masson-Delmotte et al., 2021; Rupasinghe et al., 2022). So the achievement of the SDG 13 will eventually help to control the spread of zoonotic diseases.

SDG 15 and Zoonosis

SDG 15 describes as "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss." Biodiversity describe as the diversity of plants, animals, microorganisms, and the genes they have along with their ecosystems. Biodiversity is under the pressure from anthropogenic activities and exploitation such as urbanization, deforestation, and increased agricultural activities (Scholes et al., 2005; Tajudeen et al., 2021). One of the major impacts of this explanation of biodiversity is the onset of diseases which transfer from animals to humans also called zoonoses (Tajudeen et al., 2021). Zoonotic pathogens such as bacteria, fungi, viruses, and parasites are normally present in the biological systems, and have a close relationship with their host (wildlife) over the years of evolution (Gómez & Nichols, 2013). But due to the increased encroachment of the humans into biodiversity through several activities, disturb the natural relationship between the pathogens and wildlife which result in the transmission of pathogenic agents from wildlife to the humans and this transmission is called spillover (Plowright et al., 2021). For many years, different consensuses have been done to study that how biodiversity affects the spread of zoonotic diseases and one of the well-known consensuses is presented by the Ostfeld and Keesing called hypothesis of the 'dilution effect' (Scholes et al., 2005; Gómez & Nichols, 2013). The hypothesis states that the risk of transmission of pathogen and disease is much less in highly rich biodiverse species attributed to the availability of diverse communities to embrace competent hosts for a well-known pathogenic agent, resulting in the reduction of susceptibility and exposure to such pathogen (Ostfeld & Keesing, 2000; Keesing & Ostfeld, 2021). The hypothesis of the dilution effect is only effective when occurring in a community with diverse species causing the reduction in transmission rate of pathogens to the hosts (Keesing & Ostfeld, 2021). The hypothesis has been tested widely to study the link between dilution effect and zoonoses and results support the fact that if a diverse host species is present then it will lower the risk of transmission of pathogens to human settlements (Civitello et al., 2015). The fact was supported by the results of three studies conducted in the United States, showing a positive relationship between the high risk of West Nile encephalitis infections in humans and low bird diversity (Ezenwa et al., 2006; Swaddle & Calos, 2008; Allan et al., 2009). Another study reported the correlation between the prevalence of the infection by Hantavirus and a reduction in the diversity of small mammals in Panama (Suzán et al., 2009). All these research findings support the hypothesis that the risk of zoonotic infection increases in human populations due to the loss of biodiversity. So the achievement of SDG 13 and its targets to protect the ecosystems and biodiversity will be a road to prevention of zoonoses.

Conclusion

The drastic effects of the zoonotic diseases such as avian influenza, bovine spongiform encephalitis (BSE), food-borne illness such as *Campylobacter spp., Salmonella* (non-typhoidal), *E. coli* VTEC O157, *Listeria monocytogenes*, norovirus, SARS and anthrax pose a serious threat to public health and demands a multidisciplinary approach to combat these zoonoses. The SDGs provide a framework to identify the root cause of the spread of zoonosis and its control although SDGs is not a disease-specific approach. The SDGs aim to achieve several goals such as end hunger and poverty, save biodiversity and control environmental changes, as disruption of these lead to the outbreak of zoonosis. The implementation gaps are a major challenge that's why sustainable development is yet not able to control zoonosis. The multisectoral approach such as One Health (human, animal, and environment) aligned with the SDGs policies will be helpful in achieving the goal of control of zoonosis and securing public health.

References

Allan, B. F., Langerhans, R. B., Ryberg, W. A., Landesman, W. J., Griffin, N. W., Katz, R. S., & Chase, J. M. (2009). Ecological correlates of risk and incidence of West Nile virus in the United States. *Oecologia*, *158*, 699-708.

Anyamba, A., Chretien, J. P., Britch, S. C., Soebiyanto, R. P., Small, J. L., Jepsen, R., & Linthicum, K. J. (2019). Global disease outbreaks associated with the 2015–2016 El Niño event. *Scientific Reports*, *9*(1), 1930.

Anyamba, A., Chretien, J. P., Small, J., Tucker, C. J., Formenty, P. B., Richardson, J. H., & Linthicum, K. J. (2009). Prediction of a Rift Valley fever outbreak. *Proceedings of the National Academy of Sciences*, *106*(3), 955-959.

Arámbulo, P. I., & Thakur, A. S. (1992). Impact of zoonoses in tropical America. *Annals of the New York Academy of Science, 653*, 6-18

Bank, W. (2012). People, pathogens and our planet: the economics of one health. *World Bank*.

Ben Ari, T., Gershunov, A., Gage, K. L., Snäll, T., Ettestad, P., Kausrud, K. L., & Stenseth, N. C. (2008). Human plague in the USA: the importance of regional and local climate. *Biology Letters*, *4*(6), 737-740.

Bennett, R., & Ijpelaar, J. (2005). Updated estimates of the costs associated with thirty-four endemic livestock diseases in Great Britain: a note. *Journal of Agricultural Economics*, *56*(1), 135-144.

Bhatt, S., Gething, P. W., Brady, O. J., Messina, J. P., Farlow, A. W., Moyes, C. L., & Hay, S. I. (2013). The global distribution and burden of dengue. *Nature*, *496*(7446), 504-507.

Bidaisee, S., & Macpherson, C. N. (2014). Zoonoses and one health: a review of the literature. *Journal of Parasitology Research*, *2014*(1), 874345.

Burton, I. (1987). Report on reports: Our common future: The world commission on environment and development. *Environment: Science and Policy for Sustainable Development*, *29*(5), 25-29.

Cascio, A., Bosilkovski, M., Rodriguez-Morales, A. J., & Pappas, G. (2011). The socio-ecology of zoonotic infections. *Clinical Microbiology and Infection*, *17*(3), 336-342.

Civitello, D. J., Cohen, J., Fatima, H., Halstead, N. T., Liriano, J., McMahon, T. A., & Rohr, J. R. (2015). Biodiversity inhibits parasites: broad evidence for the dilution effect. *Proceedings of the National Academy of Sciences*, *112*(28), 8667-8671.

Coad, L., Willis, J., Maisels, F., Funk, S. M., Doughty, H., Fa, J., & Nasi, R. (2021, September). *Impacts of taking, trade and consumption of terrestrial migratory species for wild meat*. Convention on Migratory Species.

Dengue, W. H. O. I. (2009). Guidelines for diagnosis, Treatment. Prevention and Control.

Draft, A. U. (2017). Issues Paper on New innovation approaches to support the implementation of the Sustainable Development Goals. United Nations Commission on Science and Technology for Development.

Ezenwa, V. O., Godsey, M. S., King, R. J., & Guptill, S. C. (2006). Avian diversity and West Nile virus: testing associations between biodiversity and infectious disease risk. *Proceedings of the Royal Society B: Biological Sciences*, *273*(1582), 109-117.

Frazzoli, C., & Mantovani, A. (2010). Toxicants exposures as novel zoonoses: reflections on sustainable development, food safety and veterinary public health. *Zoonoses and Public Health*, *57*(7-8), e136-e142.

Ghosh, S., & Begam, H. H. (2021). Biodiversity for Zoonotic Infectious Disease Control and Sustainable Development. *Journal of Advanced Scientific Research*, *12*(02 Suppl 1), 355-360.

Gómez, A., & Nichols, E. (2013). Neglected wild life: parasitic biodiversity as a conservation target. *International Journal for Parasitology: Parasites and Wildlife*, *2*, 222-227.

Grace, D., Mutua, F. K., Ochungo, P., Kruska, R. L., Jones, K., Brierley, L., & Ogutu, F. (2012). Mapping of poverty and likely zoonoses hotspots. Zoonoses Project 4. Report to the UK Department for International Development. Nairobi, Kenya, ILRI.

Hilderink, M. H., & De Winter, I. I. (2021). No need to beat around the bushmeat–The role of wildlife trade and conservation initiatives in the emergence of zoonotic diseases. *Heliyon*, *7*(7).

Hjelle, B., & Glass, G. E. (2000). Outbreak of hantavirus infection in the Four Corners region of the United States in the wake of the 1997–1998 El Nino—Southern Oscillation. *The Journal of Infectious Diseases*, *181*(5), 1569-1573.

Keesing, F., & Ostfeld, R. S. (2021). Dilution effects in disease ecology. *Ecology Letters*, *24*(11), 2490-2505.

Magouras, I., Brookes, V. J., Jori, F., Martin, A., Pfeiffer, D. U., & Dürr, S. (2020). Emerging zoonotic diseases: should we rethink the animal–human interface?. *Frontiers in Veterinary Science*, *7*, 582743.

Martins, S. B., Häsler, B., & Rushton, J. (2014). Economic aspects of zoonoses: impact of zoonoses on the food industry: impact of zoonoses on the food industry. In *Zoonoses-Infections affecting humans and animals: Focus on public health aspects* (pp. 1107-1126). Dordrecht: Springer Netherlands.

Masson-Delmotte, V., Zhai, P., Pirani, A., Connors, S. L., Pean, C., Berger, S., & Zhou, B. (2023). IPC 2021. Summary for Policymakers. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

McMichael, A. J. (2004). Environmental and social influences on emerging infectious diseases: past, present and future. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *359*(1447), 1049-1058.

Meslin, F. X. (2006). Impact of zoonoses on human health. *Veterinaria Italiana*, *42*(4), 369-379.

Nielsen, M. R., Meilby, H., Smith-Hall, C., Pouliot, M., & Treue, T. (2018). The importance of wild meat in the global south. *Ecological Economics*, *146*, 696-705.

Ostfeld, R. S., & Keesing, F. (2000). Biodiversity and disease risk: the case of Lyme disease. *Conservation Biology*, *14*(3), 722-728.

Plowright, R. K., Reaser, J. K., Locke, H., Woodley, S. J., Patz, J. A., Becker, D. J., & Tabor, G. M. (2021). Land use-induced spillover: a call to action to safeguard environmental, animal, and human health. *The Lancet Planetary Health*, *5*(4), e237-e245.

Rahman, M. T., Sobur, M. A., Islam, M. S., Ievy, S., Hossain, M. J., El Zowalaty, M. E., & Ashour, H. M. (2020). Zoonotic diseases: etiology, impact, and control. *Microorganisms*, *8*(9), 1405.

Rassy, D., & Smith, R. D. (2013). The economic impact of H1N1 on Mexico's tourist and pork sectors. *Health Economics*, *22*(7), 824-834.

Rupasinghe, R., Chomel, B. B., & Martínez-López, B. (2022). Climate change and zoonoses: A review of the current status, knowledge gaps, and future trends. *Acta Tropica*, *226*, 106225.

Scholes, R., Ash, N., & Assessment, M. E. (2005). *Ecosystems and human well-being: current state and trends*. Island Press.

Slingenbergh, J. (2013). *World Livestock 2013: changing disease landscapes* (pp. xiii+-111).

Suzán, G., Marcé, E., Giermakowski, J. T., Mills, J. N., Ceballos, G., Ostfeld, R. S., & Yates, T. L. (2009). Experimental evidence for reduced rodent diversity causing increased Hantavirus prevalence. *PloS One*, *4*(5), e5461.

Swaddle, J. P., & Calos, S. E. (2008). Increased avian diversity is associated with lower incidence of human West Nile infection: observation of the dilution effect. *PloS One*, *3*(6), e2488.

Swift, L., Hunter, P. R., Lees, A. C., & Bell, D. J. (2007). Wildlife trade and the emergence of infectious diseases. *EcoHealth*, *4*, 25-30.

Tajudeen, Y. A., & Oladunjoye, I. O. (2021). Climate Change—An emblematic driver of vector-borne diseases: Holistic view as a way forward. *Global Biosecurity*, *3*.

Tajudeen, Y. A., Oladunjoye, I. O., Adebayo, A. O., & Adebisi, Y. A. (2021). The need to adopt planetary health approach in understanding the

potential influence of climate change and biodiversity loss on zoonotic diseases outbreaks. *Public Health in Practice*, *2*, 100095.

Taylor, L. H., Latham, S. M., & Woolhouse, M. E. (2001). Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *356*(1411), 983-989.

Thompson, A., & Kutz, S. (2019). Introduction to the special issue on 'Emerging Zoonoses and Wildlife'. *International Journal for Parasitology: Parasites and Wildlife*, *9*, 322.

Tsai, P., Scott, K. A., González, M. C., Pappaioanou, M., & Keusch, G. T. (2010). Sustaining global surveillance and response to emerging zoonotic diseases.

World Health Organization (WHO). (2014). Western Pacific Regional action plan for the prevention and control of noncommunicable diseases (2014-2020).

World Health Organization (WHO). (2020). WHO Health Topic Page: Zoonoses. *World Health Organization, Geneva. Available from: https://www.who.int/topics/zoonoses/en/Retrieved on*, 20-07.

Xue-Hong, Z. H. O. U., Xiao-Tong, W. A. N., & Yu-Hui, J. I. N. (2016). Concept of scientific wildlife conservation and its dissemination. *Zoological Research*, *37*(5), 270.