



Anthropology and One Health: A Transdisciplinary Approach to Understanding Diseases Emergence

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Abstract

“One Health” is a holistic vision of health based on its study and management under a transdisciplinary approach of different sciences. While health is understood as the result of a balance between a set of factors that affect the interface human-animal-environment, the disease is the result of an imbalanced interface on which human activities are determinant. Health promotion and disease prevention strategies should be based on understanding the human role in this interface at the population level. An overview of the most important epidemics (pandemics) along with the history and their risk factors, most of them linked to human activities, suggests the weight of social determinants in disease emergence and evolution. Anthropology is presented not only as the science contributing to explaining these human activities that imbalance the human, animal, and environment interface in epidemics, but also as science involved in the design of strategies to solve those diseases. Medical Anthropology, a subfield of Anthropology, working together with Epidemiology and Preventive Medicine in a transdisciplinary approach, can contribute to analyzing cultural determinants and designing social education and risk communication strategies for health promotion and disease prevention from a “One Health” point of view.

Subject Areas

Global Health

Keywords

One Health, Emerging Diseases, Social Determinants, Anthropology, Transdisciplinary

1. Introduction and Analysis

1.1. “One Health” Paradigm

“One health” has been recognized as a modern paradigm to understand the interface of health and its relationship with disease emergence in populations. Even though it is based on concepts that they have a long history, the universalization of the paradigm took place in 2008 when it was adopted as an operational and political strategy by international health-related organizations such as: World Health Organization (WHO) United Nations Food and Agriculture Organization (FAO) or World Animal Health Organization (OIE) [1].

It is possible to find diverse “One Health” definitions. The Centers for Diseases Control and Prevention of the USA (CDC) defined it as: “a collaborative, multi-sectorial and transdisciplinary approach working at the local, regional, national and global levels with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants and their shared environment” (<https://www.cdc.gov/onehealth/index.html>).

Today the paradigm is mainly recognized at the scientific level but it is poorly known by the society as it was demonstrated by the survey carried out in 34 European countries, only 10.7% of the people, including scientists, high education, government agencies, and the general population, provided a complete definition [2].

The innovation of the “One Health” concept is that it introduces a holistic vision of health as “a set of different interactions between diverse elements”. If health is the result of a balanced interaction of those elements, the disease should be understood as the unbalance interaction [3] [4].

Three are the structural elements that define this perspective: “We envision a world where people, animals, and the environment are recognized as being interconnected and transdisciplinary, systems thinking methods and integrated approaches, are universally practiced for understanding, maintaining and improving the health of all”

(<https://www.ecohealthinternational.org/regional-chapters/europe/>),

(<https://theglobalvision.wordpress.com/2021/05/07/what-is-one-health/>).

Evolutionary thinking and the approach to “One Health”.

From the first civilizations until today, different types of interactions have been used to explain disease emergence. The evolutionary history in the study of diseases has been determinant in order to arrive at the modern paradigm.

Although the disease has been recognized as a consequence of supernatural forces along with the first civilizations, Mesopotamian culture introduced new theories that linked humans and animals to explain disease. The “Code Hammurabi” (1792-1750 BC) relates the risk of the death of a person after being bitten by a mad dog (rage) [5] [6] [7].

In ancient Greece, Hippocrates (460-377 BC) explained disease as a phenomenon linked to environmental elements (air, water, fire, and earth). The Roman Empire (27 BC-382 AD) associated diseases with “bad airs in the cities”.

The environment and the behavioral issues were introduced to explain diseases [4].

In the 16th century, Fracastoro suggested, in “De contagione et contagiosis morbus et curatione”, the role of sheds and the transmission of diseases. At the end of the 19th century, the evolution of the microscope (Leeuwenhoek, 17th century) allowed L. Pasteur and R. Koch to identify microorganisms [8].

The involvement of microorganisms in disease causality gave rise to the first epidemiological models [4] at the same time that R. Virchow introduced the Zoonoses concept and suggested that “between animal and human medicine there are no dividing lines nor should there be” [9].

In the 1960s, C. Schwabe proposed “One Medicine” concept that defined the transdisciplinary connections between Medicine and Veterinary sciences [10]. Then, disease perception evolved from an individual vision (person or animal) to collectivity (population) where disease was the result of multiple interactions, and multi-factorial models were adopted to explain diseases (evolution from Koch postulates to Evans postulates) [5] [6].

At the beginning of the 21st century “One World One Health” was born, under the Wildlife Conservation Society (WCS) umbrella, as a proposal on which human Medicine, veterinary Medicine and Ecosystem Sciences worked together in a transdisciplinary way to promote health of the populations and environment. “One Health” and “Eco-Health” are the presence of the philosophy [11] [12] (<https://onehealthinitiative.com/>, <https://wsava.org/Committees/one-health-committee/>).

1.2. “One Health” and the Anthropology of Epidemics

Boundaries of “One Health” are difficult to establish because, in most cases, the interactions of the elements (humans, animals and environment) are represented by a complex of biological and social determinants such as economics, politics or cultural factors [13], which could be critical in vulnerability of the populations. While the complexity of their role in Health interface makes necessary the involvement of social disciplines, the real situation is that rarely they have been attended to in epidemiology investigations. [14].

According to it, the community must learn to identify and evaluate the contribution of those social determinants as risk factors for diseases emergence, which means “One Health” also should include social sciences, such as Anthropology, Economics or Politics, in the health promotion and diseases prevention strategies [15] [16] (<https://www.ecohealthinternational.org/regional-chapters/europe/>).

Anthropology is necessary in “One health” approach because human activities have been linked to the origin and evolution of the pandemics in the history. So, diseases such as Tuberculosis, that emerged thousands years ago, jumped to humans from animals after domestication in the Neolithic [17].

In the 6th century, Justinian plague (1st Bubonic plague) that killed 56 million people spread from Asia to the Byzantine Empire by commercial routes and the war against Vandals and Ostrogoths. Eight centuries later, 14th Century, Black

Death (2nd Bubonic plague) that killed 200 million people, spread from Crimea to Europe by commercial routes (skill road mainly) [18] [19].

In 1520 Small Pox killed 56 million people in the world. It was spread along America by Spanish sailors (from Cuba to the rest of America). In 1918, Spanish Flu (first described H1N1 A influence) killed 50 million people and was spread by Allied soldiers movement during the First World War [20]. In any case, history demonstrates that when “people have moved along the world, microorganisms have spread with them”.

If human activities could unbalance health interface, healthcare should begin to put special attention to control them. In ancient Greece, the Hippocratic thought (5th Century B.C.) described the ecological and anthropological causality of the diseases. Some documents such as the “Discourse on airs, waters and places” linked diseases to environment relationships and ethnographic methodology was suggested as a tool contributing to solve these diseases [6].

Today, it is impossible to understand epidemics without the comprehension of the role that people play at both individual and collective (social) level, which makes necessary the involvement of the Anthropology in that holistic vision of the health [4]-[21].

1.3. Anthropology and Human Determinants in the Pandemics

Some diseases such as Ebola virus, Hantavirus or Nipah virus outbreaks are related to human access and occupation of wild environments. Most Ebola virus outbreaks in Africa were born associated to the contact with wild animals (bats, no human primates and antelope) during hunts (bats are the natural reservoirs). After the first human cases, disease was spread through the population by means of customs and social activities such as rituals in marriage and funeral ceremonies or consumption of wild animal origin food [22] [23].

Lung Syndrome caused by Hantavirus emerged in America at the end of the last Century (it was previously known in Asia and Europe) associated to the contact of people with rodent reservoirs. Agricultural and forest professions or leisure activities (outdoor sports) are risk factors for human in both rural and urban communities [24].

In 1998 Nipah virus emerged in Malaysia associated to swine farms and agriculture development in wild areas where flying foxes (fruit bats), the reservoir of the virus, had their natural ecological niche [25].

Another disease emerged in association to Climate change, which mostly is caused by human activities (in the last Century planet temperature has increased 0.8°C). However there is no scientific evidence that natural disasters increase “directly” infectious diseases risk for the community, local Leptospirosis and Cholera outbreaks after disasters occurrence (storms, tsunamis, hurricanes, earthquakes or flood) or global expansion of vector-borne diseases such as Dengue, Crimea-Congo, Chikungunya or Zika, have been related to climate change, and the future seems to be worst because in 2030-2050 it is expected that 250,000

persons/year will dead because a climate change related cause [26] [27] [28] [29] [30].

Biodiversity or “the variability of living organisms in one environment”, is also related to human activities. These are the origin of the Biodiversity lost which results in new species interactions making easy the inter-specific jumping of microorganisms and the associated emergence of new diseases or the increase in established zoonosis [31] [32].

In any case, emerged diseases have higher impact on poor people and countries affected not only by disasters, but also by social, economic and politic conflicts, factors that increase population vulnerability (groups and communities at a higher risk for poor health as a result of the barriers they experience to social, economic, political and environmental resources, as well as limitations due to illness or disability) [14].

Usually, the final result of vulnerability is the movement of people (migration) to another geographical area where population could be crowded under bad sanitation systems and compromised personal hygiene increasing risk of epidemics: in 2004, 17,000 Diarrheal cases reported in displaced people after flooding in Bangladesh [27]-[33].

Cultural customs and political or religious beliefs of people are hidden under biological Bioterrorism (Amerithrax, the case of Anthrax in America in 2001) (<https://edition.cnn.com/2013/08/23/health/anthrax-fast-facts/index.html>) or in foodborne epidemics associated to food handling and consumption (frequently raw or poorly cooked food) in both poor and rich countries: *Campylobacter spp* outbreaks has been the most prevalent infectious disease in Europe in the last years [34].

Sometimes, diseases emergence is the result of healthcare human activities, mainly linked to mistakes in the use of therapeutics. The misuse of antibiotics in humans and animals contributed to the emergence of resistant microorganisms (pathogen or commensal). It is the case of multidrug-resistant Tuberculosis, Methicillin Resistant *Staphylococcus aureus*, (MRSA); Extended-spectrum β -lactamases (ESBLs) *E. coli* strains or Vancomycin resistant *Enterococcus spp* are the most representative [35] [36] [37].

Globalization can transform any of those emerged diseases at local level in global pandemics because the microbial traffic [38]. Movement of humans and animals, because commercial, tourism or cooperation activities, allows microorganisms (infecting them) to travel large distances in a few hours. In the last century globalization has been related to some Ebola cases outside of Africa [7], the emergence of Zika virus in Colombia [39] or the global expansion of the last COVID-19 pandemic outbreak [40].

2. Discussion and Reflection

The previous information is the confirmation that epidemics have multiple determinants that can contribute as risk factors for their emergence. The influence

of people in diseases emergence at local and global level introduces a vision of the interface human-animal-environment on which social determinants are part of that interface and a piece to handle [41]. This suggests that, in order to prevent or control them, it is necessary an interdisciplinary “One Health” approach on which Anthropology will be involved in the analysis and handle of that human influence.

While epidemiologists study the frequency and distribution of diseases in the population [6], anthropologists are focused in illness experiences at social level. In order to identify human risk factors for diseases emergence, Medical Anthropology, a subfield of Anthropology, is working together to Epidemiology in a collaborative and interdisciplinary strategy to lead a more accurate description of human behavior [42].

After risk factors identification, Medical Anthropology also contributes to solve the outbreaks by means of its collaboration with Preventive Medicine. As suggests the Society for Medical Anthropology, “humans are part of the problem but also must be part of the solution”. Medical anthropology “draws upon social, cultural, biological, and linguistic Anthropology to better understand those factors which influence health and well-being (broadly defined), the experience and distribution of illness, the prevention and treatment of sickness, healing processes, the social relations of therapy management, and the cultural importance and utilization of pluralistic medical Systems” [43].

In order to promote health, wellbeing and welfare in humans, animals and environment, Medical Anthropology uses different tools and Education is one of the most important. Population education has been a challenge in COVID-19 pandemic, because in some countries, social and cultural customs and beliefs (disease or vaccine deniers) linked to a weak health education or a lack of information, or confusing information, could contribute to community transmission of the disease.

Different levels of education are recognized as necessary from a “One Health” approach: education for professionals, education for students (school and university) and education for general population [12]-[44]. While at professional and university levels, technical education is carried out by sciences directly related to Medicine, Veterinary or Ecology professionalism, health education at school and at general population levels, those sciences need to work linked to Anthropology, the most experienced social discipline, in order to sensitize society about their risk factors and vulnerability.

For those levels, health education strategies, including information and communication tools, should be different for every individual and social strata of the population according to their risks factors, vulnerability and possibilities to be part of the response strategy. From a “One health” perspective, a lac in the communication at inter-sectorial level it has been detected [2].

Anthropology, working together to Epidemiology and Preventive Medicine, should be able to answer some relevant questions necessary to design health promotion strategies to apply in the population from a “One Health” point of

view [14]-[45].

According to the referred authors, we think four are the most important question to answer at interdisciplinary action. These four questions and an example of them are presented below:

1) What are the most important determinants of the socio-ecological system in diseases emergence?

i.e.: A transdisciplinary “One Health” approach to socio-ecological determinants:

The study of the impact of climate changes (linked to human activities along the history) over the last 100 years on the life cycle and the spatial distribution of *Hyalomma marginatum*, a vector for zoonotic microorganisms [28] (Figure 1).

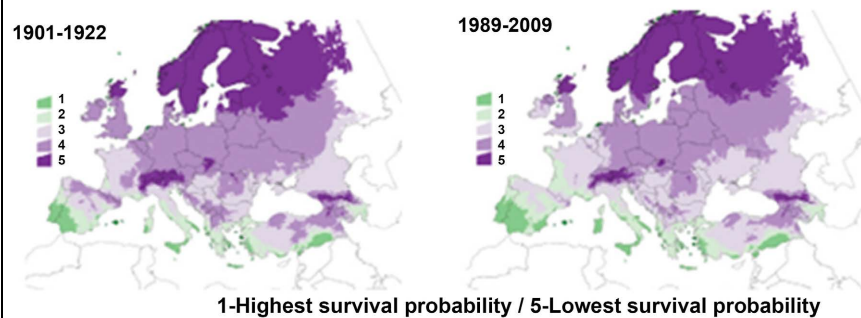


Figure 1. The evolution on the impact of climate change (over the last 100 years linked to human activities) on the life cycle and the spatial distribution of *Hyaloma marginatum*, a vector for zoonotic microorganisms. (rankink from: 1-higher probability to 5-lower probability) [28] (*) Originally published on PLOS ONE 2015 <https://doi.org/10.1371/journal.pone.0125760> and used under “authors permission”.

2) What are the characteristics of vulnerable populations?

i.e.: A transdisciplinary “One Health” approach to population vulnerability

Inequities always play a negative role in diseases emergence and evolution, COVID19 pandemic is a representative example. In some countries, racism discrimination, lac of financial resources, difficult access to healthcare or poor healthcare services, determinants that have been historically present in people living in the margins of the society, mainly in both: documented and un-documented immigrants, increased the vulnerability to the disease which suggested the necessary involvement of health care services (family doctor) in their detection [46].

3) How can be involved the society in health promotion and diseases prevention programs?

i.e.: A transdisciplinary “One Health” approach to social needs

In indigenous populations, with poor economic resources, the culture, customs, language and religion have a positive impact on biodiversity which means educational programs will be designed to preserve those human activities. In the opposite, biodiversity is threatened by the human activities in developed countries: plastic misuse and its ecological consequences, which means educational programs will focus on changing those risk activities [47] [48] [49].

4) Is it possible to design strategies based on social education taking into account the complexity of the health interface?

i.e.: A transdisciplinary “One Health” approach to inter-disciplinary education.

Rabies health promotion and disease prevention strategies, the inter-sectorial education programs of the WHO, OIE, FAO and the World Rabies Control Alliance has contributed to prevent rabies among young people in endemic countries of America or Asia, where urban rabies was re-emerging. The programs are based on education of the population together to strategies such as animals vaccination, an example of Anthropology and Preventive Medicine collaboration with a common objective: “0 Rabies deaths in 2030” [50].

3. Conclusions

Health and disease are dependent on a human-animal-environment balanced interface which is affected by social determinants, including culture, economics, and politics. In order to establish efficient health promotion strategies able to contribute to managing these determinants, education interventions in the populations are required.

Education programs carry to the society understand its role in health promotion and disease prevention, which is a bet for the future of the population. “One Health” should give priority to involving the people in their own health to be prepared for future epidemics, and at this level, Anthropology will be determinant.

COVID19 pandemic has remembered us of the words of the Nobel Prize Joshua Lederberg (1958): “We live in an evolutionary competition with microbes and there is no guarantee that we are the survivors of this battle” (Cited by Kesin R, 2020 in: <https://theberkshireedge.com/coronavirus-part-ii-what-is-to-be-done/>).

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Conflicts of Interest

The authors declare no conflicts of interest.

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