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"*One Health is the collaborative efforts of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, plants and our environment.*"

"*One Health implementation will help protect and/or save untold millions of lives in our generation and for those to come.*"

"*Between animal and human medicine there are no dividing lines--nor should there be.*"

Rudolf Virchow, MD (the father of cellular pathology)

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The relevance of "One Health" to South Africa

Brigid Letty MSc.Agric[1], Alan Rowe BVSc.[2], Nkululeko Manci MBChB [3] and Debbie Rowe CPDH[4]

[1]Principal Scientist - Institute of Natural Resources

[2]State Veterinarian – KwaZulu-Natal Department of Agriculture and Rural Development

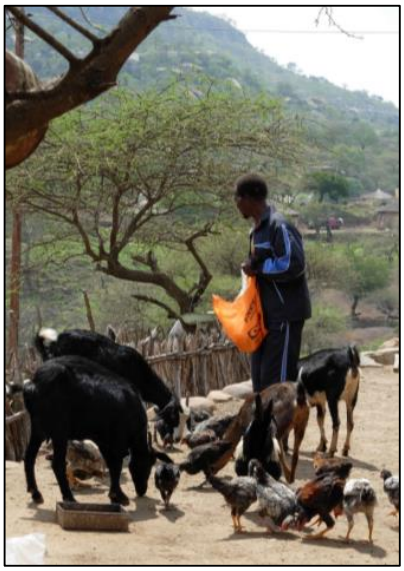
[3]Medical Manager – St Apollinaris Hospital, Centocow Mission

[4]Director - Creighton Sunflower Health Education and Life Projects

INTRODUCTION

One Health, being a strategy that aims to expand interdisciplinary collaboration and communication between actors involved in human, animal and environmental healthcare (Kahn et al. 2007), is very relevant in the context of South Africa, particularly as a mechanism for strengthening the efficacy of public healthcare (Monath et al. 2010). The need to promote the concept of One Health forms the basis for a partnership that has been established in the Creighton-Centocow area of KwaZulu-Natal Province, South Africa. St Apollinaris is the hospital based at the Centocow Mission. It provides health care support to the surrounding rural communities. Livestock healthcare support is largely provided through the services of the provincial department of agriculture's

veterinary services, which is under the management of Dr. Alan Rowe, the State Veterinarian based in the small town of Ixopo some 30km from Centocow Mission. The current programme is building on past linkages between these parties, where veterinarians and physicians worked together in an effort to control scabies outbreaks.



It is more than 20 years after democracy, but we are still dealing with the settlement patterns and associated economic circumstances associated with the apartheid era, specifically rural homelands and urban townships. The previous homeland areas are fairly densely populated rural areas where many black families have their roots, and where many people still live. These households, while relying on government grants and remittances from family members living and working elsewhere, still have a rural nature and most households own some form of livestock – at least chickens, but also goats, sheep, cattle, donkeys and/or horses. Townships and the more recently established RDP (Reconstruction and Development Programme) housing projects are urban or peri-urban settlements often established adjacent to formal middle class / upper class suburbs).

Many towns and cities are also characterised by informal settlements, where people seeking employment find accommodation. Many township and RDP households also own livestock and traditional "companion animals", namely cats and dogs. Townships, rural areas and informal settlements are characterised by varying degrees of poverty and lack of service provision. Most have inadequate municipal services in terms of refuse removal and water supply. The impacts of HIV/AIDS are also felt in these settlements, resulting in women and child-headed households, reliance on social grants (including pension, disability, foster and child support grants) to support extended families. The health of animals found within poor households in South Africa often reflects the socio-economic circumstances of their owners, but in turn the animals can affect the health and wellbeing of those same people. The interactions between human and animal health as well as environmental health warrant more attention.

LINKS BETWEEN ANIMAL HEALTH, HUMAN HEALTH AND ENVIRONMENTAL HEALTH

Given that many rural and urban households have dogs this is the starting point for discussions about the potential for people's health to be negatively impacted by their animals. The situation is exacerbated by the presence of many stray dogs in urban and peri-urban areas, possibly related to the high incidence of HIV/AIDS, which leads to break down of families and increasing poverty levels which see households not being able to manage or care for dogs. Many dogs are malnourished, have high numbers of internal parasites and develop conditions such as mange as people do not have access to veterinary services and furthermore cannot afford them. Since government Veterinary Services mainly focus on notifiable diseases that have serious consequences for humans, support for dog owners is mainly limited to the provision of rabies vaccinations. This is an important service as outbreaks are fairly common in the KwaZulu-Natal Province. Additional support is provided in certain communities by organisations such as People's

Dispensary for Small Animals (PDSA), Society for the Prevention of Cruelty to Animals (SPCA) and the South African Veterinary Association (SAVA) Community Veterinary Clinics.

Despite the government efforts to control rabies outbreaks, one still visits rural households and finds that cases go unreported. One household head in Msinga, KwaZulu-Natal, when visited in 2013 said that he had a rabid dog tied up in the back of the yard while he waited for it to die. He knew that it was a danger to his family and his other dogs so he had taken measures to reduce risk by keeping it isolated – but that was all that he could do.

Awareness needs to be created regarding the importance (and legal requirement) of reporting cases of rabies to police, State Veterinary Services or Department of Health. A fairly recent occurrence, or one receiving attention on news, is attacks by packs of dogs in urban and peri-urban areas. News reports have covered cases and there are certain areas where people do not walk at night for fear of such attacks.

The high incidence of mange in dogs sparks discussion about the impacts on human health. Both types are encountered, namely sarcoptic mange and demodectic mange, both of which are generally referred to in isiZulu as ‘utwayi’. Outside of the zoonotic concerns related to sarcoptic mange in dogs (which may not be substantial given that *Sarcoptes scabiei* is generally self-limiting in humans), the indirect effects of demodectic mange, which we see frequently, cannot be ignored. Dogs with severe demodectic mange are also likely to carry large populations of other parasites and these pose a danger to the humans with whom they come in contact, especially small children, who are more prone to infection. For example, the Hydatid tapeworm (*Echinococcus granulosus*) can result in infections in humans (echinococcosis). This tapeworm has a lifecycle that normally involves sheep and dogs, but can infect people where it results in the development of cysts.

Besides the dog-related zoonoses that affect people, our work in rural communities has revealed a number of other cases that are of concern, given the associations that exist between people and livestock.

Recently the Provincial Department of Agriculture’s Veterinary Services have become aware of, and are taking action to address, incidences of Bovine Tuberculosis (BTB) in cattle belonging to communities in the vicinity of the Hluhluwe-Umfolozi Game Reserve in KwaZulu-Natal. Bovine tuberculosis is caused by a bacterial pathogen, *Mycobacterium bovis*, while human Tuberculosis (TB) is caused by *Mycobacterium tuberculosis*. *M. bovis* can affect all animals (including humans), while *M. Tuberculosis* does not affect cattle. The former causes the same disease as *M. tuberculosis* in humans. Given the delays encountered in distinguishing between the two strains, this is often not undertaken and therefore the causative organism is not clearly identified. BTB can be transmitted through aerosol pathways (breathing in the bacteria), saliva and consumption of milk.

BTB was introduced with infected cattle from Europe in the 18th Century. It then moved into wildlife populations. In Hluhluwe-Mfolozi Game Reserve, there are incidences of BTB in black rhino and buffalo. The original source of recent incidences of BTB in cattle belonging to black smallholder farmers is unknown and could be due to proximity to the game reserve or due to the incidence of the disease in a commercial herd in the area in the past. The risk for people contracting BTB from their cattle is greatest for those who have close contact with sick animals during herding and milking.

For people with compromised immune systems as well as children, the elderly and the malnourished, BTB can be more easily contracted when ingesting raw milk. The BTB infections that result from consumption of infected meat and milk often present as enteric TB, which is frequently not diagnosed. BTB is more resistant to many of the cheaper TB drugs. The impacts of HIV/AIDS in terms of leaving people with compromised immune systems that make them susceptible to infection has led to government taking action to address the issue.

There are a number of conditions seen in livestock, which can potentially affect people, though we have not actually encountered this. It does however form the basis for creating awareness regarding the need for good hygiene practices. For example, abscesses are frequently seen in goats in rural areas in KZN, often along their jaws. One of the causes of these is Caseous lymphadenitis, which involves abscessation of the lymph nodes and other internal organs caused by *Corynebacterium pseudotuberculosis*. The abscesses contain material which contaminates the environment allowing bacteria to enter other goats through any sorts of wounds, especially when goat owners do not manage the situation hygienically. Opportunity also exists for the bacteria to cause infections in people who handle infected animals. Another condition frequently seen in goats and known to also affect people is Orf, which is highly infectious and can spread to people that handle them.

Infection of humans with tapeworms is another common condition that results from poor hygiene. It is normally due to infection with the pork tapeworm (*Taenia solium*), but can also be caused by the beef tapeworm (*Taenia saginata*). Infection occurs when humans ingest raw or under-cooked meat containing larval cysts (commonly known as measles). They develop in the human intestine and the adults release proglottids that contain eggs, which in turn contaminate the environment if sanitation is poor. Neuro Cysticercosis is a more serious complication associated with pork tapeworm infections and can cause seizures and headaches if the parasite encysts in the brain. At St Apollinaris Hospital, some cases have been identified, but one major complication is that people often first visit a traditional doctor (*isangoma*) when they experience a seizure, believing it to have some link with their ancestors, before visiting the hospital. This delays treatment and leads to more damage. The persons are treated and the larva dies, but the associated necrosis often leads to continuing seizures. Neuro Cysticercosis is generally due to auto-infestation (where persons re-infect themselves with proglottids through poor hygiene practices). The need to create awareness about good hygiene as well as cooking practices to avoid tapeworm is essential.

Liver flukes are sometimes found to be responsible for symptoms of jaundice as they can result in blockages of the ducts in the liver. While this is not commonly encountered at St Apollinaris, attention should also be given to possibility of human fasciolosis in areas where people and animals are sharing the same water source – especially where animal fasciolosis is endemic.

The discussions above highlight the linkages that exist between human and animal health, but the linkages with environmental health also deserve attention, not least of all because of the anticipated impacts of climate change. Climate change is expected to raise temperatures such that winter minimums are not as low and areas that previously experienced sub-zero temperatures may no longer do so. This is likely to cause higher levels of pathogens and higher levels of disease.

Environmental health in the rural, urban and peri-urban areas where poor people reside in South Africa is often compromised by poor service delivery and lack of access to facilities such as landfill sites. Disposal of dead animals and infected material (such as material from abscesses or aborted foetuses - which is a concern due to the prevalence of *Brucella abortus* in some parts of KwaZulu-Natal) is often handled poorly. Besides lack of access to facilities, there is often a lack of awareness amongst communities about the potential dangers with simply dumping these items.

From the discussion above, it is clear that there are direct links between human health, animal health and environmental health. This calls for awareness creation of potential hazards and ways of avoiding them, further investigation of the prevalence of parasites in both people and animals and lobbying for improved access to services in townships and rural areas.

PUTTING ONE HEALTH INTO ACTION

The Centecow partnership has initiated a programme that focuses on detection, surveillance and treatment to address tapeworm infections in people and animals. The three main tapeworms that are targeted are *Taenia solium* (the pork tapeworm), *Echinococcus granulosus* (the Hydatid tapeworm) and T*aenia multiceps (the dog tapeworm),* which frequently causes Coenurus cerebralis in sheep and goats (Alcock et al. 2011), which is locally known as a*manzi ekhanda* ("water on the head"). The focus on tapeworms is seen as an effective mechanism for strengthening linkages between the livestock and human health care sectors. It is anticipated that this will form basis for improved communication and collaboration around other zoonotic infections that are prevalent in the area.

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