

## The Effectiveness of Stray Dog Control and Zoonotic Disease Prevention in Global Health: An One Health Approach from Grenada

Research Article

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### Abstract

**Introduction:** The purpose of this study is to evaluate the effectiveness of stray dog control and disease prevention in Grenada by using a one health approach and address the associated global health implications.

**Methods:** A review of stray dog policy in Grenada, descriptive statistics analysis and interviews were conducted. World Organization for Animal Health's and Grenada Dogs Registration and Control Act were reviewed. Quantitative data from 2008-2012 on registration, vaccinations, number of dog complaints filed and outcome of dog captures. Retrospective, one-on-one interviews with 14 stakeholders from three groups identified as being directly associated with the stray dog prevention and control were performed.

**Results:** The Grenada Dogs Registration and Control Act provided an adequate framework for stray dog control. There was a decrease in the number of dogs registered and vaccinated and a steady increase in dogs captured and related complaints. Interview data suggested that community education, dog ownership, non-governmental organization involvement, and Grenada's Stray Dog Control Program (SDCP) responsibility are needed to strengthen stray dog control programs and disease prevention.

**Discussion:** Expansion of SDCP services is needed to reduce free-roaming dogs and disease risk to humans. A positive response from program users suggested that the SDCP is well-received by the community. Integration among stakeholders and increased access to the program's services in rural communities is needed. These findings have implication for further policy development to reduce global health risks associated with zoonotic diseases found in stray dogs.

**Keywords:** Global Health; Zoonotic Diseases; Rabies; One Health; Stray Dogs.

### Introduction

Global health is described as health concerns that transcend national boundaries and governments in addition to call for actions on global forces that determine the health of people [1]. There are several diseases, which transcend national boundaries impacting both animals and humans. Over the past decades, emerging diseases have had a global presence negatively impacting humans. These emerging diseases include HIV/AIDS, Ebola, influenza, hepatitis C, Lyme disease, hantavirus pulmonary syndrome, Severe Acute Respiratory Syndrome (SARS), rabies and Leptospirosis [2]. The burden placed on society by these diseases is so detrimental that the World Health Organization (WHO) has determined a list of pathogens that represent those most likely to

cause the greatest impact. The main purpose of this prioritization is to ensure preparedness for the likely development of these diseases and will be reviewed yearly or when necessary [3]. Emerging diseases significantly impacts quality of life and in extreme, fatality. In addition to the negative impacts related to quality of life, the economic burden for the patient and society is also a concern. Lastly, due to the growing incidence of emerging diseases, the resistance to antibiotics and vaccinations to treat the diseases can be a challenge.

Zoonotic diseases are another area within global health that needs public attention. Zoonotic diseases negatively impact human populations via transmission from animals. The most commonly neglected zoonotic diseases are Anthrax, Bovine tuberculosis,

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**Received:** April 20, 2016

**Accepted:** May 03, 2016

**Published:** May 06, 2016

**Citation:** Deliso M, EK Cotran, Bidaisee S, Keku EO (2016) The Effectiveness of Stray Dog Control and Zoonotic Disease Prevention in Global Health: An One Health Approach from Grenada. *J Translational Diagn Technol*. 1(1), 1-6.

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Leptospirosis, Brucellosis, Cysticercosis and neurocysticercosis, cystic echinococcosis and rabies [4, 5]. Rabies is the most common zoonotic disease [4]. “Rabies is caused by a virus, which enters through the body through a bite or skin lesion and eventually enters the brain [4].” Approximately, 30-50% of human rabies cases occur among children under 15 years. More than 99% of human deaths as a result of rabies are in developing countries. Post exposure treatment ranges from USD \$40-49 in areas where the average daily income is less than USD \$2 [6].

Rabies can only be contracted through animal contact via broken skin. Dog bites account for over 10 million injuries annually with children having the highest risk. In general, rabies is a concern with dog, cat and monkey bites [7]. Virus transmission via infected dog bites account for approximately 95% of rabies induced human fatalities [8]. In the U.S. dogs bite approximately 4.5 million people each year, approximately 885,00 seek medical care, 30,000 have reconstructive procedures; 3-18% develop infections and 10- 20 fatalities occur [7].

To assist in reducing the incidence of zoonotic diseases experienced by stray dogs, a one health approach to increase awareness and establish control and prevention programs are essential initiatives of the Centers for Disease Control and Prevention (CDC) and WHO. A specific goal of the WHO is for the, “elimination of rabies as a public health problem, defined as zero human rabies deaths [8].” Although there has been an increasing amount of resources and publications regarding the one health concept, it has not been significantly embraced in developing countries where its implementation may result in the greatest impact [9]. While these programs are progressive and promising, the cost prohibits their full implementation in countries of all income levels. An effective dog rabies control program is costly on public health resources among several countries [10]. The estimated annual expenditure for rabies prevention in the U.S. is 300 million, with majority of the funding being spent on dog vaccinations [10]. While zoonotic diseases associated with stray canines transcend national boundaries, stray dog population in Grenada will be emphasized.

Grenada is a small island located in Eastern Caribbean and is home to a significant population of stray dogs. Stray dogs pose a serious public health risk, as they are associated with an increased prevalence of zoonotic disease. Rabies virus causes fatalities in both dogs and humans and has the potential to enter Grenada’s stray dog population, as it is enzootic on the main island due to the presence of the reservoir host, the mongoose *Herpestes auro-punctatus* [11, 12]. Leptospirosis is another disease of public health significance in Grenada, and evidence suggests dogs can serve as a reservoir host for the *Leptospira serovar canicola* [13]. In a 2010 study performed in Grenada, antibodies to *American trypanosomiasis* were found in 4.3% of the study population of dogs, which act as a reservoir for the disease. [14] In another study performed in Grenada in 2014, the seroprevalence for this parasite increased to 10.5%, with 76.2% of these positive results coming from stray dogs and the remainder from owned dogs [15]. This pathogen may be spread to humans via the Triatome bug and cause the development of Chagas disease [16]. Grenada is a popular tourist location, which makes the spread of zoonotic diseases to humans a global health concern.

In addition to zoonotic disease, stray dogs in Grenada also cause damage to livestock, are a considerable public nuisance due to

noise and fecal pollution, and can be a cause of and traffic accidents due to their presence on roadways. In a tourism-driven economy such as Grenada’s, the negative impact that the latter factors may have should also be considered. In 2002, the “Dogs (Registration and Control)” Act was passed by the Parliament of Grenada in order to reduce the spread of zoonotic disease. This legislation serves as the foundation for Grenada’s Stray Dog Control Program (SDCP), which was launched by the Ministry of Health in 2007.

This justifies the need for ongoing prevention and control investigation and protocol development globally surrounding stray dog management. Inadequate literacy among populations regarding zoonotic diseases, importance of dog vaccination and registration, emphasizes the need for an interprofessional approach among medical and veterinary providers to educate the public. The purpose of this study is to evaluate Grenada’s stray dog control practices and obtain the knowledge level of stakeholders involved with SDCP. The operational hypothesis is, limitations in the SDCP compromised the effectiveness to decrease stray dog numbers, promote overall dog health, and prevent dog-associated disease in humans.

## Materials And Methods

This qualitative study consisted of reviewing and collecting the following data in Grenada: regulatory and legislative documents, quantitative analysis of documented dog registration and vaccinations and interviews from key stakeholders associated with SDCP.

Legislative and regulatory documents were analyzed and pertinent similarities and differences summarized in a table consisting of three parallel columns. The first document was the World Organization for Animal Health’s (OIE) “Guidelines on stray dog population control,” obtained from the OIE website<sup>5</sup>. The second set of documents was the “Dogs (Registration and Control)” Act 24 found in Laws of Grenada 2002. The third column noted which parts of Act 24 are currently being enforced, as described by the Senior Environmental Health Officer in charge of SDCP activities (Table 1).

Quantitative data analysis on registration/vaccination rates, number of dog complaints filed, number of dogs captured and outcome of dog captures for the years 2008-2012 was performed. Totals and trends were identified and described.

Lastly, interviews with key stakeholders (n=14) from three groups directly involved with dog population control; The Grenada Society for Prevention of Cruelty to Animals; St. George’s University Small Animal Clinic; and SDCP’s Dog Control Unit. The stakeholders were recruited through a snowball sampling process where persons were identified based on a referral process as one stakeholder participant recommended another to be interviewed. Community members who have made use of the SDCP’s services were also interviewed (n=5). Interview recordings were transcribed and analyzed to identify emerging themes. These themes were ranked according to the frequency with which they appeared, and main concepts identified by linking related themes.

**Table 1: Review of Stray Dog Policy**

OIE Guidelines - Stray Dog Population Control	Grenada Dogs (Registration and Control) Act	Act legislation in effect/enforced?
Registration and identification of dogs and licensing of dog breeders;	Registration and licensing of dogs. Part II (3,4)	In effect, no fees collected
Vaccination against rabies and other preventive measures against zoonotic disease, as appropriate;	Owner to keep collar or harness with registration tag affixed on dog. Part II (11)	Not enforced by fine
Veterinary procedures (e.g. surgical procedures);	Vaccination for rabies is prerequisite for registration. Part II (3,4)	In effect, vaccination at no cost to owner
Control of dog movement (national and international);	Licensing of kennel operations. Part II (6)	No licensing at this time
Control of dangerous dogs;	Owner is responsible for feces removal from beaches and public places Part II (12)	Not enforced by fine
Regulations on the breeding and sale of dogs;	Owner is responsible for control of dog movement at all times. Licensing and control of dangerous dogs	Not enforced by fine
environmental controls (e.g. abattoirs, rubbish dumps, dead stock facilities);	Special leash requirement is made in the case of dangerous dogs, which must be leashed and muzzled when in public.	No licensing at this time
regulations for dog shelters;	Specifies requirements for record keeping of licensing and registration documents	N/A
animal welfare obligations of owners and authorities.	Owner liable for fines if the above requirements are not met	In effect, records kept at Animal Control Centre
No specific regulations suggested for record keeping of licensing and registration documents, No system of fees or fines recommended except in the case of differential fees as financial incentive for sterilization of dogs		

Column 1 OIE Guidelines- Stray Dog Population Control states that a regulatory framework that would help authorities establish successful dog control programs could include the following key elements. Column 2 Grenada Dogs (Registration and Control) Act is an Act to regulate the keeping of dogs, to control the importation and keeping of dangerous dogs, and for connected purposes. This Act mandates the following.

**Table 2: Themes Ranked by Frequency Mentioned**

Theme Rank (#times mentioned form most to least frequent)	Frequency (total # times themed mentioned)
Community Education	52
Dog Ownership	50
NGO Involvement	35
SDCP Responsibility	30
Resources	19
Zoonotic Disease	15
SDCP Perceptions	3

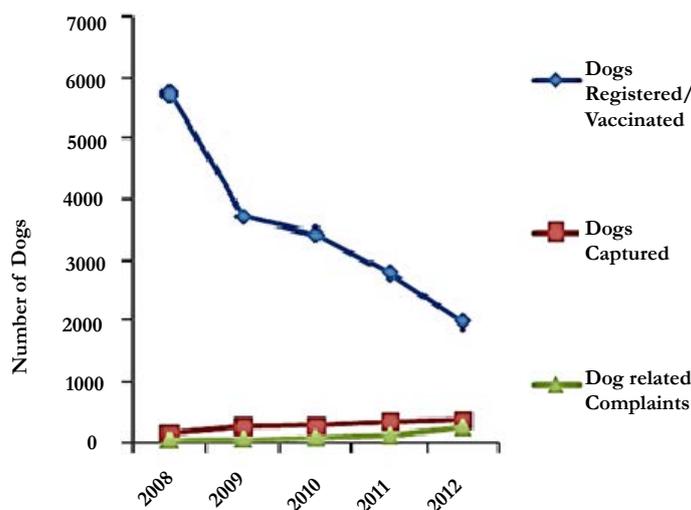
Saturation of data was achieved in interviews with both Stakeholders and Program Users. Themes which emerged from interviews were prioritized in accordance with the frequency with which they appeared, in interview transcripts and main themes that emerged.

**Results**

Results demonstrated that Act 24 of 2002 provided adequate framework for stray dog control. However, limitations in resources, due primarily to mandatory fiscal reductions in government public services in the aftermath of Hurricane Ivan in 2004, have to date resulted in only partial implementation of legislative provisions. Registration of dogs has been ongoing during the program, yet there has been an annual reduction in the number of dogs registered/vaccinated by the SDCP. Dog complaints and

captures have increased during the same time period. There was a decrease in the number of dogs registered/vaccinated, (5751 dogs in 2008), (3721 in 2009), (3435 in 2010), (2781 in 2011) and (1971 in 2012). Meanwhile there was a steady increase in both dogs captured and dog related complaints (Figure 1). The majority of dogs captured by the SDCP control officers were euthanized, while a small number were adopted out from the SDCP facility or from the GSPCA kennel, some were returned to the owner, and a small number died while held in the SDCP facility (Figure 2).

Figure 1: Total annual counts of dogs Registered/vaccinated, dogs captured, and dog related complaints for the years 2008-2012.

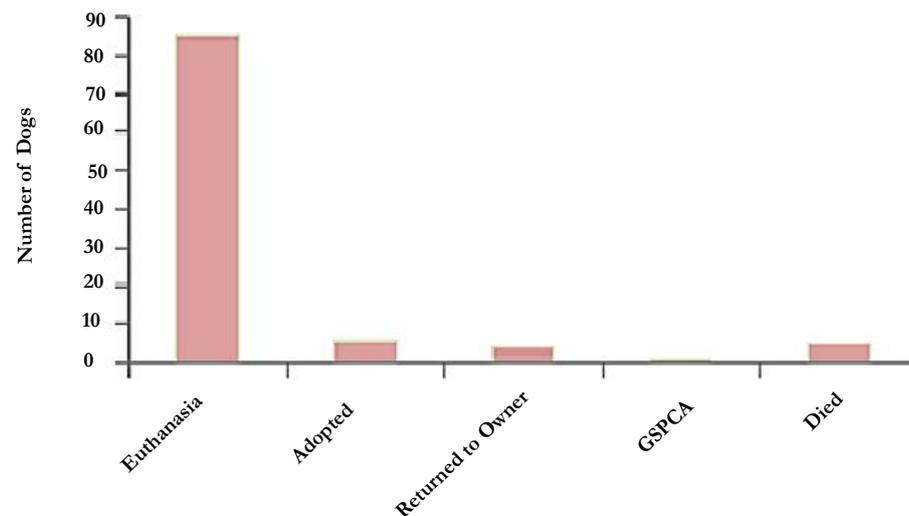


There was a decrease in the number of dogs registered/vaccinated, with 5751 dogs in 2008, 3721 in 2009, 3435 in 2010, 2781 in 2011, and 1971 in 2012. Meanwhile there was a steady increase in both dogs captured and dog related complaints.

Table 3: Emerging themes with description and representation interview questions

Related themes	Description	Quotations
<b>Resources + SDCP Perceptions+ SDCP Responsibility</b>	<ol style="list-style-type: none"> <li>1. Increased resource investment is needed for Dog Control Unit</li> <li>2. Majority public opinion of the Dog Control Unit is positive</li> <li>3. Community education on the role of Dog Control is needed.</li> <li>4. Current awareness of the law is insufficient to allow for enforcing legislation without community backlash.</li> <li>5. Rabies control is considered the responsibility of the government.</li> </ol>	<p>“Before you start enforcing laws you must make sure that people know what the violations are, the aim is not just to punish someone, you want someone to be given a fair chance to do what is right...and if it then is clearly set out so the public knows, not just us officials, then we can enforce the penalties.” (SAC3:37).</p>
<b>Dog Ownership + Zoonotic Disease+ Community Education</b>	<ol style="list-style-type: none"> <li>1. Stakeholders and Program Users have observed an improvement in animal welfare standards.</li> <li>2. There is still a need for education to support welfare for owned dogs.</li> <li>3. Education of children is considered an effective strategy as they are often the animal caretakers in the home.</li> <li>4. Television and Radio advertisements are effective tools for education.</li> </ol>	<p>“In past 10-15 years, people have had a great change in how they think about animals. Now they think ok there is a stray, let’s call the GSPCA. Before, the response would be to throw rocks at the dog. People have a very different attitude...which is due to the work of all the stakeholders involved in education” (GSPCA1:7).</p>
<b>NGO Involvement + SDCP Responsibility</b>	<ol style="list-style-type: none"> <li>1. The Dog Control Agencies invested in controlling dog populations in Grenada, specifically the Dog Control Unit, GSPCA, and SGU Small Animal Clinic, can benefit from increased interagency collaboration and communication.</li> <li>2. The Dog Control Unit, under the Ministry of Health, should be a leader in dog control and community education efforts, as this is seen as a responsibility of the Grenadian Government</li> <li>3. Police support needed for proper enforcement of Act and for responding to animal welfare calls.</li> </ol>	<p>“I would like to see animals be a priority for our government, we get no funding. I would like to see them do more, because without us, we wouldn’t have a tourism sector. People want to go to an animal friendly island, they must understand the importance of the GSPCA in promoting tourism, whether or not the government can see or acknowledge that.” (GSPCA2:54).</p>
<b>NGO Involvement + Resources + Dog Ownership + Community Education</b>	<ol style="list-style-type: none"> <li>1. There is a demand for increased Spay/Neuter programs in the community, identified both by Program Users and Stakeholders directly involved in community outreach services.</li> <li>2. There is a need for increased community education on the dog population reduction and dog health benefits of sterilization.</li> </ol>	<p>“I will ask “Why do you have 10 dogs?” and the answer is that the owners never knew what to do, never knew how to get the dogs fixed” (SAC2:13).</p>

Themes which emerged from interviews were described and quotations selected to represent interviewee feedback.

**Figure 2: Outcome of dog captures for all dogs captured between 2008-2012**

The majority of dogs captured by the SDCP control officers were euthanized, while a small number were adopted out from the SDCP facility or from the GSPCA kennel, some were returned to the owner, and a small number died while held in the SDCP facility.

Saturation of data was achieved in interviews with both Stakeholders and Program Users. Themes that emerged from interviews were prioritized in accordance with the frequency with which they appeared, in interview transcripts (Tables 2 and 3). The following themes were most frequently mentioned in the interviews: community education (52 times), dog ownership (50 times), non-governmental involvement (35 times) and SDCP responsibility (30 times).

## Discussion

Zoonotic diseases are obstacles to developing countries where resources for managing animal illnesses are a challenge. As a result, humans suffer from the transmission of diseases between these two distinct populations. As with any concern related to human health, an inter professional approach is needed between medical and veterinary providers. Developing community health systems as a whole is an essential aspect of the one health mentality and Developing community health systems as a whole is an essential aspect of the one health mentality and embodies this inter professional approach. To appreciate the possible positive effects of the one health approach, it must be coupled with a one world approach. Devastating diseases do not obey international boundaries and this must be recognized to properly prevent future outbreaks [9]. When zoonotic diseases affect humans, an overall impact to society occurs. In order to minimize this problem a control and prevention protocol for animals globally must be established and followed by all stakeholders.

In order to increase population awareness of zoonotic diseases and provide governmental support to countries, FAO, OIE and WHO are international organizations that have proposed five-year action items for countries to follow. The overall five-year target is to “Adopt measured behaviors, policies and/or practices that minimize the spillover of zoonotic diseases from animals to human populations [17].” Some of the five-year action items include:

“Emphasize One Health approaches across all relevant sectors of

government with the goal of detecting and controlling zoonotic threats while they are still in animal populations.

Implement joint IHR and PVS training programs for human and animal health service

Increase the compatibility of existing animal and human diagnostics and surveillance data fields, avoiding the creation of new data systems wherever possible

Introduce and advice national multi-sectoral policies and regulatory guidelines promoting poultry and livestock production and marketing practices that minimize the risk of zoonotic disease emergence, including food safety policies and guidelines as well as legislation reinforcing veterinary supervision of the use of antibiotics in animals

Support the implementation of national architecture for real-time bio-surveillance, spanning animal and human populations to support disease monitoring, reporting and analysis via bio-surveillance of high-risk wildlife groups (i.e., birds, bats, etc.)

Actively address the proposal of core competencies and systems requirements (e.g., laboratory methods, surveillance data fields) for implementation of the surveillance system.

Enhance, link, and increase analytic capability within disease reporting systems (WHO, WAHIS), to ensure that WHO, FAO, and OIE receive pertinent information

Introduce an operational framework that supports multi-sectoral notification for outbreaks of suspected zoonotic origin in the early stage of emergence (prior to efficient human-to-human transmission)

Introduce systems that promote complementary research, for public health purposes, and analysis within and across countries for enhanced prevention, detection and response activities for emerging zoonotic diseases [17].”

In Grenada, expansion of SDCP services is needed to reduce free-roaming dogs in public places and disease risk to humans. A positive response from program users suggested that the SDCP is well-received by the community. Interview data recommended that integration among stakeholders and increased access to the program's services in rural communities is needed. Community education on stray dog control regulations associated zoonotic diseases risks and prevention and responsible pet ownership were identified as key areas for continued program development. These findings have implication for further policy development to reduce global health risks associated with zoonotic diseases found in stray dogs.

### Acknowledgement & Declarations:

supported in part by Grenada's Stray Dog Control Program, Colorado State University College of Veterinary Medicine, Meril / NIH Veterinary Mentorship Program and St. George's University.

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