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Incidence Rates of Diseases and Injuries in Select Climate-Change-Vulnerable Coastal and Inland Communities

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ABSTRACT

This descriptive-analytical research aimed to examine the incidence rates of five (5) categories of medical concerns in representative urban, rural, inland, and coastal areas of Negros Occidental: waterborne diseases, cardiopulmonary incidents, nutritional deficiencies, parasitic infections, and accidents and injuries. A series of medical missions was conducted between February 23 and 25, 2019 for patients in Brgy. Lopez Jaena, Murcia, Brgy. Cadiz Viejo, Cadiz City, Brgy.40, Bacolod City, and Purkos Seaside and Crossing 8 of Brgy. Sum-ag, Bacolod City. A total of 573 patients from the 4 barangays were examined by medical and allied health professionals. Medical history specific to climate change-vulnerable diseases was collected from patient-participants with written and informed consent or assent. Results showed that there were relatively high incidence rates for waterborne diseases (48.17%) and cardiopulmonary incidents (76.44%) among patient- participants. Results also showed that accidents and injuries were more likely to occur in coastal areas (8%) compared to inland areas (3%). The elderly or those aged above 64 years old were more vulnerable to climate change with a significantly higher incidence rate for cardiopulmonary diseases (96%) than any other age group.

Keywords
Incidence rates, Cardiopulmonary incidents, Waterborne diseases, Accidents and Injuries, Parasitic Infections, Nutritional Deficiencies

INTRODUCTION

Climate change, widely accepted to be the result of fossil fuel combustion that accumulates greenhouse gases in the atmosphere, is likely to have an overall negative impact on human health. Low income countries, the Philippines included, are particularly vulnerable to such negative effects, which will require adaptation from the government in the form of improved public health strategies and surveillance on top of investments in renewable energy that could improve health in the short term (Haines et al., 2006).

Assessment of climate change vulnerability has progressively included determinants which are non-climactic, integrating factors like socioeconomic status and health in order to shift the focus of assessment from the estimation to the reduction of expected damages (Füssel & Klein, 2006).

Human vulnerability to negative health impacts of climate change have been proven in a multitude of literature. Humans may be able to effectively control

biological contamination through technology development provided that observations of its effects are studied more scrupulously (Wu et al., 2016).

The public health approach to climate change involves the anticipating impacts to human health and avoiding, weakening, or effectively responding to them. Collectively, these principles are known as public health preparedness. Mitigation prevents the onset of disease or injury, and adaptation controls the advance of diseases and injury in order to reduce the health burden. These principles are essential to risk management due to the unpredictability of health events that result from climate change and other factors that may worsen its effects (Frumkin et al., 2008).

It is critical that vulnerable subpopulations, like children, pregnant women, the elderly, the impoverished, the chronically-ill, and the differently abled, are identified in particularly vulnerable areas such as coastal and low-lying riverine zones; demographic profiles contribute to heightened risk for climate-sensitive health outcomes that are also worsened by geography and socioeconomic factors (Balbus & Malina, 2009).

The frequency of major storms has increased over the past century, leading to higher total precipitation rates across most places, with emphasis on countries in the middle and high latitudes. Overflow of sewage is expected to increase alongside heavy rainfall events, which increase the risks for water source contamination and larger risks for waterborne diseases (Patz, et al., 2008).

Current information on adaptation strategies across a multitude of international communities is currently insufficient to adequately describe the effectiveness of the same against climate change. This negatively impacts the ability of government agencies to respond to the effects of climate change, with particular emphasis on vulnerable communities (Furgal & Seguin, 2006).

Evidence overwhelmingly suggests that weather, which is worsened by climate change conditions, is a factor in initiating outbreaks of waterborne diseases. Escherichia coli and Cryptosporidium spp., in particular, have been recognized to have localized outbreaks during heavy rainfall events (Charron et al., 2010).

Waterborne pathogens peak in surface water with increased overflow. Drought, meanwhile, risks groundwater contamination with a variety of other waterborne pathogens. Warmer weather can allow pathogens like amoeba to emerge (Schijven & de Roda Husman, 2005).

The most common pathogens reported in outbreaks related to heavy rainfall and flooding between 1910 and 2010 were Vibrio spp. and Leptospira spp. Drinking water supply is contaminated during such events, which threatens the food security of localities and developing countries disproportionately (Cann et al., 2012).

Freshwater sources are critical to countries in the Pacific region, and its security depends heavily on rainwater, making them particularly susceptible to waterborne diseases caused by contamination from overflow. Annual average temperature and water availability have direct relationships with average annual rates of diarrhea in adults, which has been consistently observed by other climate change studies. Climate change can exacerbate the incidence of diarrheal diseases in Pacific Island countries (Singh et al., 2001).

Changing weather patterns facilitate the transport and spread of pathological agents via rainfall and runoff, and their survival through factors like temperature. Food security is compromised when food is exposed to such pathogens from the farm through irrigation and weather exposure to the table with food preparation (Rose et al., 2001).

Research already suggests that parasitic infections in food sources like fish will be superimposed on

ecosystem stressors like habitat loss, contamination, and the introduction of invasive species (Marcogliese, 2008). This will exacerbate human conditions as food sources become risky to consume due to parasitic presence. Climate change interferes heavily on the host specificity and transmission dynamics of parasites, allowing them to emerge without evolutionary changes in host utilization capacity (Brooks & Hoberg, 2007).

As global temperatures increase, heat and heat waves are expected to be more severe and more frequent, affecting mortality rates across urban areas and increasing the temperature of the environment to which the population is accustomed. The elderly, infants and young children, economically-disadvantaged people, and the immunocompromised are particularly at risk as overall death rates rise during the summer. Behavioral adjustments like the use of air conditioning or the increase in fluid intake do little to mitigate the problem (McGeehin & Mirabelli, 2001).

The increase in cardiovascular and respiratory disorders, exacerbated by climate change and impacted further by other disorders like diarrhea and vector-borne diseases, have negatively impacted labor productivity and dramatically increased demand for health care. This situation overloads local health systems, resulting in falls for welfare, investment, and overall productivity, which are often underestimated (Bosello et al., 2006).

Climactic factors and climate change have negative impacts on physiological functions and on cardiovascular and kidney diseases. Both are likely to increase the risks for chronic diseases such as respiratory illness and malnutrition, exacerbated by extreme weather events (Kjellsrom, Butler, Lucas, & Bonita, 2010).

This study aimed to examine incidence rates of diseases and injuries in select coastal and in-land communities in Negros Occidental. It specifically examined the incidence rates of five categories of medical concerns (waterborne diseases, cardiopulmonary incidents, nutritional deficiencies, accidents and injuries, and intestinal parasites) that have been previously established to be exacerbated by weather conditions that worsen with climate change.

Research was conducted in February 2019 following ocular inspection from August to September 2018. Collection of data was performed during medical missions conducted for the purpose of this research, the participants of which were pre-selected by barangay health workers according to need; the open nature of the medical mission facilitated participants who were not pre- selected. Volunteers for the study included medical technologists, pharmacists, medical doctors, and students who were properly oriented and trained in collecting vital signs. Patient confidentiality was ensured through the use of consent and assent forms. Incidence rates in this study refers only to the proportion of patients examined who had a history of a disease or injury classified under waterborne disease, cardiopulmonary incident, nutritional deficiency, parasitic infection, and accidents and injuries.

METHODOLOGY

This quantitative study used a descriptive-analytical design to determine the incidence rates of waterborne diseases, cardiopulmonary incidents, nutritional deficiencies, accidents and injuries, and intestinal parasites by sex and age from respondents in four identified barangays chosen using inclusion criteria. Ocular inspection of each area was conducted prior to its final selection as an area of representation in this study.

Barangay Cadiz Viejo in the City of Cadiz is a coastal village to the north of Negros Occidental whose coast is part of the Visayan Sea. The barangay is largely agrarian, with access to the coastal areas of the

barangay where its local government unit is located is through a sugarcane plantation. The barangay was last ravaged by the super typhoon Haiyan in 2013. It represents a coastal, rural area in this study.

Barangay Lopez Jaena in the Municipality of Murcia is a village towards central Negros situated on the mountain ranges of Canlaon. The barangay is largely agrarian and produces rice and sugarcane; an ocular inspection in early 2018 suggests that the area is prone to drought. It represents an unplanned, rural area in this study.

Barangay Tangub in the City of Bacolod is a densely populated coastal barangay in the capital city of Negros Occidental. Due to its large population, the researchers chose two of its subsidiary units, Purok Seaside and Purok Crossing 8, to represent a coastal, urban area in this study. Both puroks are situated on the coastline, with very small roads where cars and trucks have difficulty traveling. Waste management in the area is a visible problem.

Barangay 40 in the City of Bacolod is a densely populated area near a river system. The area contains a university and a public market, but includes a large population housed in make-shift homes surrounding the local government unit. The barangay represents an upland, urban area in this study. A series of medical missions involving volunteers, allied health and medical professionals, and the researchers was conducted at all barangays identified in order to determine the incidence rates of the diseases. Medical mission teams performed data gathering on February 23, 2019 at Brgy. Cadiz Viejo, February 24, 2019 at Brgy. Lopez Jaena, and February 25, 2019 at the Gymnasium of the University of Negros Occidental – Recoletos; patients from Brgy. 40 and Brgy. Sum-ag were shuttled to the venue on February 25.

Patients were gathered with the assistance of the barangay health workers in each of the barangays. Public information campaigns aided the pre-selection of patients in each barangay. Walk-in patients were also accommodated on the day of the medical mission. Each patient signed consent forms, or assent forms on behalf of minors, compliant with the requirements of the Philippine Health Research Ethics Board prior to the collection of privileged information.

Medical missions were conducted with the cooperation and approval of the barangays concerned through their respective punong barangay. Standard Philippine formats for medical missions were followed, with the inclusion of an orientation prior to the conduct of the mission and the signing of consent or assent forms prior to examination by professionals.

Patients were registered initially, data from which was used to establish demographic profile. After registration, patients were oriented again about the purpose of the medical mission and asked to sign assent or consent forms depending on age. It was followed by the measurement of vital signs and examination of medical history.

Student volunteers from a local medical college collected information about incidence of diseases and injuries using an exhaustive examination of medical history. Questions were limited to yes or no questions about diseases which are categorized under the five areas previously mentioned and tallied. Patient identity was preserved for subsequent medical examination by medical doctors.

Data gathered was tabulated and compared against the total number of participants per variable in the study to determine incidence rate among the patients. Independent t-test was used to determine significant differences between sex and age.

RESULTS, DISCUSSION, AND IMPLICATIONS

The data show relatively high incidence rates for waterborne and cardiopulmonary diseases; literature has proven that both are negatively impacted by

Table 1
Incidence and Incidence Rates of Diseases and Illnesses Among Respondents by Category

Variables	N	Waterborne Diseases	Cardiopulmonary Incidents	Nutritional Deficiencies	Accidents and Injuries	Intestinal Parasites
Community						
Lopez Jaena	225	103 (46%)	184 (82%)	20 (9%)	6 (3%)	0 (0%)
Cadiz Viejo	161	68 (42%)	141 (88%)	8 (%)	21 (13%)	2 (1%)
Tangub	123	68 (55%)	78 (63%)	14 (11%)	5 (4%)	0 (0%)
Brgy. 40	64	37 (58%)	35 (55%)	6 (9%)	5 (8%)	0 (0%)
Sex						
Male	193	108 (56%)	129 (67%)	15 (8%)	15 (8%)	0 (0%)
Female	380	168 (44%)	309 (81%)	33 (9%)	22 (6%)	2 (1%)
Age						
<1 year old	20	7 (35%)	4 (20%)	1 (5%)	1 (5%)	0 (0%)
1-4 years old	76	54 (71%)	24 (32%)	4 (5%)	1 (1%)	0 (0%)
5-14 years old	109	56 (51%)	59 (45%)	14 (13%)	8 (7%)	2 (1%)
15-24 years old	36	16 (44%)	30 (83%)	2 (6%)	2 (6%)	0 (0%)
25-64 years old	245	108 (44%)	224 (91%)	18 (7%)	15 (6%)	0 (0%)
>64 years old	87	35 (40%)	50 (57%)	9 (10%)	10 (11%)	0 (0%)
Total	**573**	**276 (48.17%)**	**381 (66.49%)**	**48 (8.38%)**	**37 (6.46%)**	**2 (0.35%)**

climate change (Patz et al., 2008). Generally, female respondents above the age of 64 in rural areas where agriculture is the dominant livelihood have higher incidence rates of cardiopulmonary incidents; male respondents between the ages of 1 and 4 years old in urban areas comprise higher incidence rates of waterborne diseases. Children aged 5 to 14 years old have the highest rates of nutritional deficiencies, and most are located in urban areas. Accidents and injuries mostly occur in coastal areas to male respondents who are adults. Field laboratory fecalysis did not yield many positive detections of intestinal parasites, although later tables will show diagnoses of related diseases among respondents.

Waterborne diseases occur more frequently among males, and individuals may manifest several diseases of this category, leading to inflated incidence rates cumulatively. The rates are consistently high among 1 to 4-year-olds who live in urban centers.

Cardiopulmonary incidents occur very frequently in adults aged 25 and above, and more frequently with those above 64 years of age. Individuals also manifest multiple incidences of these types of diseases, and rural areas have higher incidence rates, particularly due to the extreme heat experienced by workers who toil in agriculture.

There is a relatively low incidence rate of nutritional deficiencies among children aged below 15, although it still exists. Some older respondents are also likely to be nutritionally deficient. Accidents are more likely to occur to female respondents in the coastal rural barangay of Cadiz Viejo, which has consistently higher incidence rates of accidents and injuries against all other communities examined.

Data analysis showed that there was a significantly higher incidence rate of accidents and injuries in coastal areas compared to inland barangays. This correlates directly to an increased vulnerability for climate change for people in coastal areas, as questions gathered in medical history were specific to

Table 2
Significant Difference of Incidence Rates of Accidents and Injuries by Area Type

Accidents and Injuries	Area Type		t	df	p
	Coastal	Inland			
	0.08 (0.10)	0.03 (0.06)	2.188	24	0.039

Note: difference in means is significant when p≤0.05

injuries and accidents that are related to adverse weather conditions exacerbated by climate change. Data analysis also showed that cardiopulmonary incidents are significantly higher with people above the age of 14 compared to those in childhood and infancy. This supports earlier literature on the role of climate change in worsening health conditions for humans living in any area, and also supports literature on climate change worsening morbidity rates for aging people. It can be noted that those above 64 years of age have a higher incidence rate of any age group; climate change worsens conditions considerably among the elderly, who are among the populations that literature has described to be worse off due to climate change (Kjellstrom et al., 2010).

CONCLUSION AND RECOMMENDATIONS

The findings show that a relatively large proportion of patients have had history on cardiopulmonary incidents compared to other categories of medical concern. Accidents and injuries have higher incidence rates in coastal areas, supporting literature on increased risks in coastal areas due to climate change and associated weather conditions. Findings also show that the elderly are particularly more vulnerable to climate change in terms of the incidence rates of cardiopulmonary incidents, supporting literature on cardiovascular and pulmonary diseases spiking as global temperatures rise.

It is recommended that coastal areas are given emphasis on development of disaster risk reduction and management. Constant monitoring of environmental temperature is essential for the elderly and their comfort in an effort to reduce incidence of cardiopulmonary incidents.

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