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Benefit-Cost Analysis

Cost-benefit analysis of three non-communicable disease interventions in Haiti

COPENHAGEN CONSENSUS CENTER

Haïti Priorise
Un plan de développement alternatif

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Canada

Academic Abstract

Background. Non-communicable diseases and associated risk factors account for half of all deaths in Haiti, greater than HIV/AIDS and malaria combined. Yet, the vast majority of health sector resources are directed towards infectious disease. To examine the economic case for investment in non-communicable disease treatment and prevention in Haiti, we assessed the cost-benefit ratios associated with three programs to address the burden of cardiovascular disease, type-1 diabetes, and cervical cancer.

Methods. We selected three prospective health interventions, based on empirical evidence and ease of implementation: (1) a hypertension media campaign, screening initiative and provision of antihypertensive medicines for those with systolic blood pressure >160 mmHg; (2) Human Papilomavirus (HPV) vaccination campaign to prevent cervical cancer; and (3) enhanced identification and treatment of children self-presenting at facilities with type-1 diabetes. Epidemiologic, clinical, and cost data were derived from primary sources such as health facilities, ministerial data, and secondary sources such as Global Burden of Disease Study estimates. Reduced morbidity and mortality estimates associated with interventions were converted to disability-adjusted life years averted, and mapped onto statistical life valuation estimates based on average GDP per capita in Haiti. Sensitivity analyses were performed to measure the effect of discounting rate (3-12%) and valuations of a health adjusted life year (1-8 times GDP per capita). As a base case scenario, we applied a 5% discount rate and used three-times GDP per capita as the value of one health-adjusted life year.

Results. Under the base case scenario, we found the benefit-cost ratio to be greater than 1 in each instance: 1.74 for the hypertension intervention, 3.84 for the HPV vaccination campaign, and 3.59 for treatment of type-1 diabetes. An exception to this would exist if the Haitian Ministry of Health were unable to leverage the GAVI Alliance for acquisition of subsidized HPV vaccine, in which case the benefit-cost ratio (BCR) for the HPV campaign would be 0.79. In health terms, the three interventions would be expected to avert 1,015 strokes and heart attacks each year, 1,046 cervical cancer deaths each year, as well as 500 deaths from type-1 diabetes overall.

Conclusion. Interventions to address NCDs in Haiti should be seen as cost-effective and life-saving, as well as presenting a positive return on investment from a cost-benefit perspective. Adoption of these interventions would save about 1,900 lives per year for roughly 9% of the Ministry of Health's annual budget. We hope these findings are situated within broader priority setting exercises about resource allocation, of which cost-effectiveness and ROI are one part.

Policy Abstract

OVERVIEW

1. Non-communicable diseases like cancer and stroke account for half of all deaths in Haiti.
2. Today, 1 in every 40 Haitian girls will develop cervical cancer, 2,300 Haitian adults die each year from heart attack and stroke, and 4,000 Haitian children are faced with the almost-certainty of death from type-1 diabetes—due to lack of insulin supply.
3. We outline three simple interventions to address these problems: (1) a media campaign, screening initiative and provision of medicines for those with high blood pressure, (2) a school-based HPV vaccination campaign to prevent cervical cancer among girls, and (3) improved access to insulin for treatment of children with type-1 diabetes.

IMPLEMENTATION CONSIDERATIONS

4. The recurrent annual costs of these three programs would be $US 9.89M for addressing hypertension, $US 2.03M for addressing cervical cancer, and $US 4.40M for addressing type-1 diabetes—a total cost of $US 16.32M per annum.
5. The major driver of these costs are medicines—antihypertensives and insulin—as well as the cost of the HPV vaccine, which should ideally be subsidized by the Global Alliance for Vaccinations and Immunizations (GAVI).
6. The second largest cost driver is personnel: health providers treating patients. This would translate to hundreds of new jobs in the health sector. The delivery model would also integrate into Haiti's existing health system infrastructure, avoiding many capital costs.
7. Today, the proposed interventions are implemented in a large majority of low- and middle-income countries, based on their cost-effectiveness. Timeline for implementation in Haiti would be less than a year—the duration to acquire medicines and train providers.

RATIONALE FOR INTERVENTION

8. The investment of $US 16.33M would yield a return of $US 40.83M—by averting roughly 800 deaths from heart attack and stroke each year, 1,000 deaths from cervical cancer each year, and 500 deaths from T1 diabetes overall. This assumes subsidization by GAVI.
9. Beyond the direct impacts, the provision of these health services would also translate to economic growth in the health sector through jobs creation.
10. Ideally, these findings are situated within priority setting exercises on resource allocation, of which cost-effectiveness and ROI are one part. Benefits to citizens' health should be seen beyond monetary value—in terms of protecting human life and dignity.

SUMMARY TABLE

*****_All figures assume a 5% discount rate and value a statistical year of life at 3x GDP per capita_

Interventions	Benefit	Cost	Benefit-Cost Ratio	Quality of Evidence
Hypertension	$17,248,584	$9,889,278	1.74	Low/Medium
Diabetes	$15,786,614	$4,403,441	3.59	Low/Medium
Cervical Cancer	$7,797,983	$2,032,963	3.84	Low/Medium

Contents

1. Introduction

1.1. Under-investment in Non-Communicable Disease

The four largest non-communicable disease (NCDs) killers, globally, are cardiovascular disease, cancer, respiratory disease, and diabetes—accounting for over 30 million deaths per year [1]. Over three-quarters of these occur in low- and middle-income countries (LMICs). Furthermore, in many LMICs, the NCD burden dwarfs that of infectious diseases such as HIV/AIDS and malaria. [2].

Despite this evidence, funding allocations—both domestic and international—have been heavily focused on infectious diseases. One recent study, by Sridhar and Batniji (2008), found that the four largest funders in global health allocate $1029 per death averted due to HIV/AIDS, compared to $3 per death averted due to NCDs [3]. Meanwhile, the World Economic Forum has estimated that $30 trillion in costs will be observed over the next 20 years if morbidity and mortality associated with NCDs remains unaddressed [4].

The absence of investment in NCDs is not for want of cost-effective interventions. A growing body of evidence has demonstrated that interventions for each of the four major NCD killers are cost-effective [5]. For example, antihypertensive medicines to avert ischemic heart disease and stroke [6], and HPV vaccination to prevent cervical cancer [7] are cost-effective in most low-resource settings. However, most of these analyses are divorced from the local context in which policymakers might consider implementation [7], [8]. Failure to articulate the scope, scale, costs, and benefits in specific low-resource settings creates the potential for ministries to overlook clear opportunities to invest in population health as an end in and of itself, as well as a means to the broader end of stimulating the economy: through the contributions of a healthy and productive workforce [9].

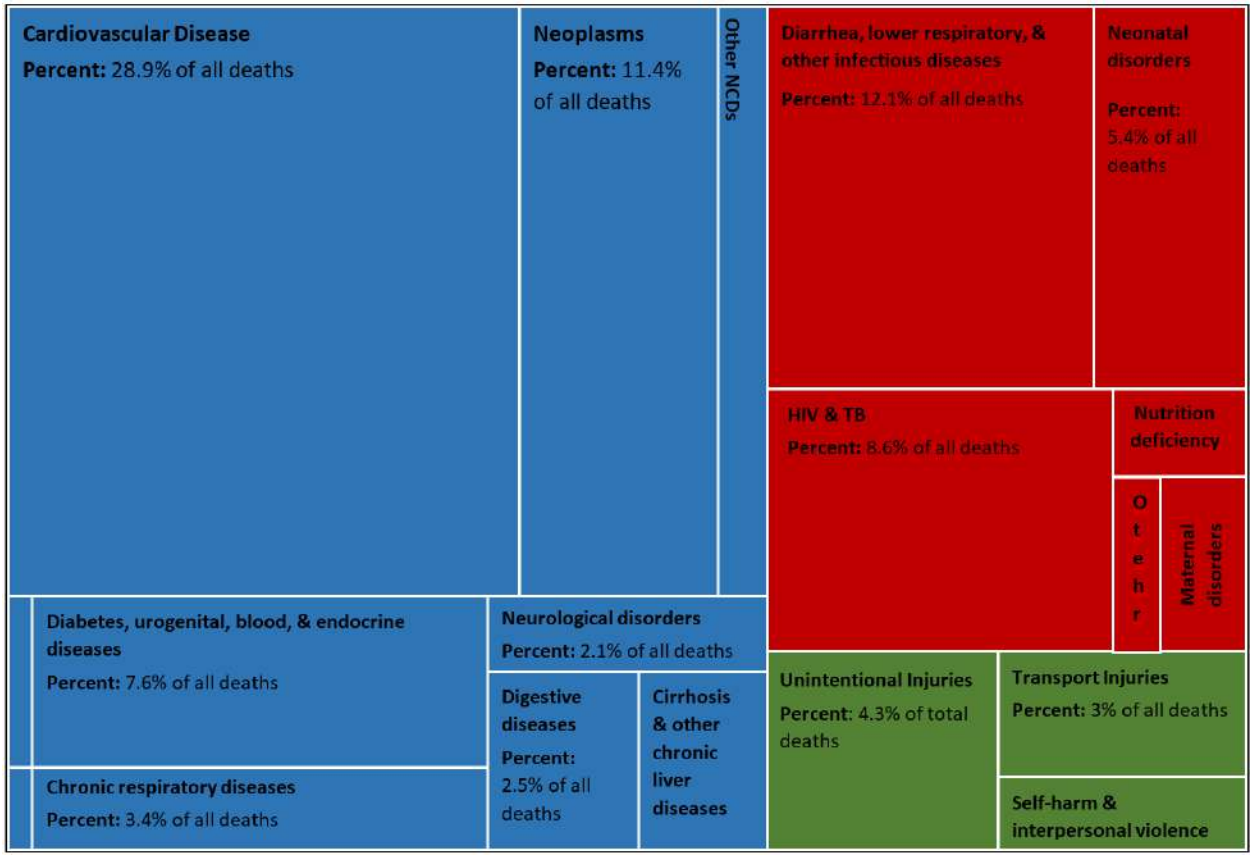
1.2. Non-communicable Disease and the Haitian Context

Haiti represents a paradigm case. With an overwhelming disease burden, the average life expectancy is 63 years, the lowest in the Western hemisphere [10]. However, the government spends only $12 per capita annually on the health of its citizens [11], [12]. The majority (80%) of health spending therefore is out-of-pocket and supported through international aid.

Non-communicable diseases account for over half of all deaths in Haiti (See Figure 1) [13]. Specific to the context of Haiti, we present an overview of three interventions to address the NCD burden associated with cardiovascular disease, cervical cancer, and type-1 diabetes, and perform both a

cost-effectiveness and cost-benefit analysis of them. Based on the existing literature, we anticipated that all three interventions would be cost-effective using a standard threshold of three-times GDP per quality-adjusted life year (QALY) gained, if not at the level of one times GDP per capita per QALY.

Figure 1. Percent of 2015 deaths attributable to NCDs, communicable diseases, and injuries in Haiti



Note: Blue = NCDs, Red = Infectious disease, Green = Injuries. Data Source: IHME [14]

2. Literature Review

2.1. Hypertension: Disease Burden and Intervention

High systolic blood pressure, a primary risk factor for stroke and ischemic heart disease events, causes 17.8 percent of all deaths in Haiti [15]. About 47 percent of Port-au-Prince residents are hypertensive, meaning they have systolic blood pressure levels ≥140 mmHg [16]. In rural Fontaine Haiti, high rates of hypertension were found in a convenience sample of residents, with 23.4 percent of males and 40.2 percent of females reported as hypertensive [17].

High blood pressure is caused by several factors. The WHO's (2013) Global Brief on Hypertension maps the concomitant role of social determinants (e.g., housing, income, education), behavior (e.g., unhealthy diet, physical inactivity, harmful use of tobacco or alcohol), and metabolic risk factors (e.g., obesity, diabetes) on increasing blood pressure levels [18]. In this analysis, we focus on behavioral drivers of hypertension given the opportunity to empower individuals to generate lifestyle changes that can reduce blood pressure and improve overall health. In Haiti, the extent to which behavioral risk factors play a role in hypertension is difficult to pin down given a general lack of evidence and especially of nationally-representative surveys. Nonetheless, descriptive evidence and cross-sectional surveys provide some evidence surrounding diet, physical activity, and harmful use of tobacco or alcohol.

In Haiti, salt intake may be part of an unhealthy diet that can increase blood pressure. While few formal studies of salt intake have been undertaken, Kenerson (2014) describes Haitian cultural and culinary attachments to salt, including the use of salt as a preservative in a country where refrigeration remains scarce; the common belief that salt imbues vitality and strength, and; the high use of salt in traditional Creole dishes [19]. In partnership with the Ministry of Health, Jean Charles (2014) estimates that a Haitian individual's salt intake averages 30-35 grams per day, almost nine times the WHO's recommended daily limit [20]. Methods and data are not reported, but the author claims that the high salt content of staple Haitian foods, including use of an average of 10 bouillon cube servings per day (2.4 grams per serving), drive high salt diets. A recent convenience survey (modelled on the WHO's STEPS survey) of 572 individuals in Fontaine, Haiti estimated much lower levels of salt intake: about 13.3 grams per day [17].

The WHO's Global Health Observatory data repository does not contain any data for on the prevalence of low physical activity among adults for Haiti [21]. A cross-sectional survey of 1,620 adults in Port-au-Prince classified 31.3 percent of males and 36.9 percent of females as sedentary, meaning that they participated mostly in leisurely activities during free time and that they did not participate in physically active labor [22]. Rural patterns of physical activity may be different. Residents of Fontaine average about 202 MET-hours per week [17], roughly the equivalent of 50 hours of heavy yard work or 61 hours of brisk walking per week [23]. About 13 percent of men smoke daily (lower than the LIC average), compared to 3.4 percent of women (higher than the LIC average) [24]. Ten percent of the male population participates in heavy drinking, meaning they have consumed more than 60 grams of pure alcohol at least once in the past month [25].

While blood pressure is modifiable with changes to behavior and proper treatment, several studies report low rates of awareness among Haitians about hypertension. A 2001 population based survey of 382 individuals in Port-au-Prince finds that among 93 individuals identified as hypertensive, 61 percent were not aware that they had high blood pressure [26]. Only three of those who *were* aware were actually receiving treatment. A more recent 2016 study found

similarly low levels of awareness, but among those who were aware of their condition, 90 percent had been treated—though two out of five of them still had uncontrolled hypertension [17]. Additional evidence indicates that understanding of risks and symptoms may be low: A cross-sectional study of 175 Haitians found that 52% believed that hypertension only affects people beyond middle-age, and 95% believed that individuals with hypertension show symptoms of sickness when blood pressure is high [27].

Given the need to grow awareness, generate behavior change, and increase control of existing hypertension, as well as a broad literature on potential interventions to address hypertension [28], we propose an intervention that contains two components: education and clinical treatment. We evaluate a mass media campaign to educate people on how to reduce dietary salt intake, and how to mitigate other factors that have bearing on hypertension. The campaign will motivate viewers to come to local health clinics for blood pressure screening and testing. At these local health clinics, individuals who are diagnosed with systolic blood pressure (SBP) levels ≥ 160 will be eligible for clinical treatment. Over the course of the year, these individuals will be encouraged to participate in a full treatment schedule including a drug regimen (amlodipine and hydrochlorothiazide), diagnostic tests, and four clinic visits. These clinical visits incorporate counseling on dietary and behavioral factors that can improve individuals' hypertensive state.

The comparator for this is no mass-media campaign, as well as diagnosis and limited treatment among those who are severly hypertensive and present at health centers. This was estimated to be as low as 10% of those who are hypertensive, in part because hypertension is rarely diagnosed and in part because availability of drugs and patient follow-up are limited.

2.2. Type-1 Diabetes: Disease Burden and Intervention

In 1922, the discovery of insulin and the first successful treatment of a diabetic patient named Leonard Thompson altered the trajectory of diabetes treatment [29]. Prior to 1914, mortality from type-1 diabetes due to diabetic ketoacidosis (DKA) was certain [30], [31]. With the advent of insulin, however, by the mid 1960's, with proper treatment the life expectancy at birth of type-1 diabetics born between 1965-1980 in the United States was only about five years less than the general population [32].

Unfortunately, these gains remain elusive in many low- and middle-income countries. Though little primary data exists in Haiti, Partners In Health clinicians in Haiti estimate that only 10-15 percent of the estimated 3,952 Haitian children under age 15 who have type-1 diabetes have access to insulin, based on a review of their facilities. Low rates of access to treatment have been reported in a wider context in sub-Saharan Africa. A recent pooled analysis of nationally representative

surveys in 12 sub-Saharan Africa countries found that among individuals with all types of diabetes, only one-tenth reported insulin use and one-fourth reported using oral medication [33].

Several recent studies in LMICs provide evidence of how levels of availability and affordability of insulin can vary widely across contexts. In a survey of six countries, Mendis et al. (2007) examined whether at least one insulin soluble injection type was available in a sample of public medicine outlets [34]. Zero percent of public outlets in Pakistan met this criteria, followed by Bangladesh (5%), Nepal (8%), Malawi (25%), and Brazil and Sri Lanka (40%). Price was also found to be prohibitive in a number of contexts, with the authors reporting that the lowest paid government worker in Brazil would pay the equivalent of 2.8 days' wages to buy a one month supply of insulin, compared to 19.6 days' wages in Malawi.

A more recent 2016 study of 14 countries[1] found similar results [35]. In the study, insulin is considered 'available' if it meets the WHO's threshold of being available in 80 percent of health facilities in the public sector. Countries where a year's supply of insulin costs less than $2.30 were considered 'affordable'. The authors report that only six countries (Kuwait, Kyrgyzstan, Mauritius, Mozambique, Nicaragua, Vietnam) meet both the availability and affordability[2] criteria.

Low levels of availability and affordability are driven by a variety of national and international factors. Value Added Taxes (VAT) and other mark ups, distribution costs, lack of competition among makers of insulin, varied distribution, government policies, and inadequate analysis of need at low levels of the health system all have a role to play in the final cost and availability of key supplies for managing diabetes—including insulin, glucometers, glucose test strips, and syringes [36].

In Haiti, published academic evidence is scarce, but interviews and news reports suggest that national policy and the private sector play a role in the availability and cost of diabetes care. A 2013 New York Times opinion piece describes how customs and distribution barriers, high cost, and the proprietary build of glucose test strips have led to life-threatening shortages that prevent Haitians from monitoring their own blood glucose levels [37]. Wendy Dorce (2013), a representative of the International Diabetes Federation's Young Leaders program, emphasized the high cost of insulin and challenges with proper storage of insulin[3] as barriers to care for type-1 diabetics [38].

[1] Burundi, Kuwait, Kyrgyzstan, Laos, Lebanon, Mali, Mauritius, Mexico, Mozambique, Nicaragua, South Africa, Sudan, Vietnam, and Zambia
[2] In these countries, costs were driven down by health insurance, donated insulin, or other government subsidies.
[3] Insulin loses potency when exposed to heat. With refrigeration options scarce, Haiti's humid tropical climate and presents challenges to proper insulin storage. See Ogle et. al. (2016) for evidence on the efficacy insulin storage techniques in Haiti.

Without access to insulin or other life-saving diabetes diagnostic tools to facilitate blood glucose monitoring, the medical outcomes of 1922 are a reality in Haiti in 2017. Indeed, in similar environments like Mozambique's, where access to insulin, syringes, and other equipment is severely lacking, life expectancy after diagnosis has been estimated at 2.1 and 0.6 years for urban and rural areas respectively [36].

We assess a two-pronged intervention that acts at both the policy- and individual-level. At the policy level, we evaluate a hypothetical intervention to address national-level barriers (*e.g.,* customs and distribution, or Value Added Taxes). We do not identify a specific policy intervention, because we do not find a policy analysis or other academic evidence that diagnoses the explicit national-level barriers lowering availability and affordability of essential diabetes medicine and diagnostic tools in Haiti.

At the individual level, we evaluate the costs and benefits of providing access to lifesaving medicine and clinical treatment. Our intervention includes four annual visits to a local clinic for each patient, annual supplies of insulin and syringes, and diagnostic tests or other equipment that can facilitate monitoring of safe glucose levels—including glucose test strips, a Hemoglobin a1 test, and a Glucosafe glucometer. Clinical sessions incorporate patient education about best practices for maintaining glocuse levels and preventing emergencies.

Relative to this, the current landscape is highly restricted: While most T1D patients already self-present at clinics due to the severe nature of the condition, diagnosis is poor and treatment is absent due to poor insulin supply. We estimated that baseline coverage was only 25%, due to these factors.

2.3. Cervical Cancer: Disease Burden and Intervention

Cancer is estimated to be the second leading cause of noncommunicable disease death in Haiti, after cardiovascular disease [15]. Cervical cancer constitutes a large portion of Haiti's oncological burden for women. The estimated incidence of cervical cancer in Haitian women is between 20.3 (GLOBOCAN [39]) and 50.02 (GBD [13]) per 100,000, and about 19 percent of years of life lost due to all types of cancer are a result of cervical cancer [13].

The majority of cervical cancer cases have viral etiology, resulting from infection through sexual transmission of the Human Papilloma Virus (HPV) [40]. The two most common HPV types, HPV 16 and 18, are associated with 73 percent of all cervical cancer cases worldwide [41]. In Haiti, at any given time, about 35% of the female population has HPV, and in areas where HIV is endemic,

cervical cancer screening may be positive for precancerous lesions in about 15-20% of the population [42].

In a community-based sample of 9,769 women in Port-au-Prince and Leogane, Walmer et al., (2013) found that exposure to HPV is correlated with being younger at the age of first sexual experience and higher numbers of sexual partners [43]. Among women who first had sex at ages of 13-17 and have had sex with three or more partners during their lifetime, 24.3 percent had contracted HPV, compared to 12.9 percent of women who first had sex later than age 22 and only had one sexual partner during their lifetime.

Cervical cancer outcomes are uniquely responsive to a variety of comprehensive public health interventions that address areas such as infectious disease control, community-based health education and chronic care delivery systems. Countries with well-organized programs to detect and treat early stage cervical cancer can prevent over 70% of related mortalities [44]. In Haiti, however, the ability to detect and treat cervical cancer is currently limited. Visual inspection of acetic acid (VIA) is the primary diagnostic test used to identify precancerous cervical lesions, with follow-up cryotherapy available to neutralize abnormal growths [45]. VIA is available at the primary health care level; however, there are no data to report on the total population coverage of screening for cervical cancer [*ibid*.]. Once cervical cancer becomes invasive, surgery is the primary option available, but because cancers are often not identified until late stages outcomes are varied [46]. Chemotherapy drugs are imported and often in limited supply, and the nearest radiotherapy clinic is in the Dominican Republic [45], [47].

Exposure to HPV at young ages, and a general dearth of screening and treatment options point to the need for preventative measures. Prevention of cervical cancer can be radically impacted by prophylactic clinical intervention. Currently, there are two types of vaccines that offer immunity to the high-risk strains of the HPV 16 and 18 [48]. A PRIME modeling study published in The Lancet reviewed HPV vaccination campaigns in 179 countries and determined that HPV vaccination campaigns are likely to be very cost-effective in almost every country in the world [49].

In Haiti, vaccination for HPV prevention has been implemented [50]. However, the scope of these programs has been limited in geographic coverage and sustainability. HPV vaccination in Haiti has been limited by the lack of available vaccine and is currently not part of the Package of Essential Services.

We evaluate a school-based program to deliver and administer three doses of the HPV vaccine to 10-year old females in primary school. Studies have found that, in a wide variety of settings,

school-based models of delivery are highly effective—especially where school enrollment and retention levels are high. In Haiti, the net enrollment ratio among females (2008-2012) is 78% [51].

The comparative situation for this is treatment in the absence of school-based vaccine campaign. In Haiti, this approaches zero. International estimates suggest that existing HPV coverage in Haiti is 0.3% among all women, and roughly 1% among those ages 10-20 [52]. Additional, among those who present with cervical cancer, it is often late stage and there are few options for treatment, as approaches like chemotherapy are almost entirely absent in the public sector.

3. Calculation of Costs and Benefits

3.1. Coverage Estimates

To reduce the burden of non-communicable disease in Haiti, we propose that the Government of Haiti implement three interventions (described above) to address key drivers of morbidity and mortality: cardiovascular disease, type-1 diabetes and cervical cancer. To examine the costs and benefits of each, we modeled scenarios in which a specific level of population coverage is achieved for each population group targeted, relative to baseline coverage. Table 1 presents an overview.

Table 1. Target population and coverage, by intervention

	Target Population	Baseline Intx Coverage	Target Intx Coverage
Hypertension	Adults, 30-69 years-old	10%	51%
Diabetes	Children, 0-15 years-old	25%	75%
Cervical Cancer	Females, 10 years-old	1%	67%

For hypertension, among enrolled patients, we adjusted coverage for adherence over time. In the context of hypertension, we assumed that 54% would remain in treatment over an 8.5 year time horizon, based on a systematic review by Cramer et al (2008) [53]. For diabetes, we assumed 100% adherence based on the severe morbidity and high mortality levels if treatment is not maintained; and for cervical cancer vaccinations, we assumed 80% compliance of the vaccine based on a recent article by Levin et al (2013) [54].

3.2. Clinical Epidemiology

Clinical epidemiology. Where possible, epidemiologic information was derived from primary data sources. This included recent articles published in the medical literature, as well as facility-based

trends in case presentation throughout Haiti. Where these were absent, secondary data sources were used: First, ministerial data from the central government; and second, international estimates based from projects like the WHO and IHME Global Burden of Disease project, as well as GLOBOCAN estimates of cancer incidence and prevalence.

Specifically, hypertension prevalence and incidence were based on local cross-sectional surveys collected in Haiti [16], while estimates for ischemic heart disease and stroke were based on figures from the WHO and IHME [15]. For type-1 diabetes, prevalence and incidence were derived from the International Diabetes Federation's Diabetes Atlas 4.0, which incorporates local and regional trends [55]. Lastly, prevalence and incidence of cervical cancer were based on GLOBOCAN's international repository of cancer estimates [56]. Additional estimates, such as the average age of mortality associated with a condition, were based on a review of the medical literature, with priority given to meta-analyses, systematic reviews and cross-national estimates. A full overview is provided in the Appendix.

For the hypertension intervention, it was assumed that those who survived a cardiac event or stroke, would experience reduced health-related quality of life as a consequence. The probability of mild, moderate, and severe consequences, as well as associated decrements to health, were derived from the 2015 Global Burden of Disease study [15]. For diabetes and cervical cancer interventions, we made no assumption about the overall health of individuals receiving treatment. We assumed that health-related quality of life, following the intervention, would be comparable to the general population.

Lastly, we assumed a disutility associated with enrolment in diabetes care—resulting from the burden associated with monitoring insulin, receiving routine injections and coping with sequalae of the disease. We estimated this disultility to be equivalent to be 0.05 on a scale of 0 to 1, roughly similar to that associated with enrolment on ART among HIV patients, as outlined in the 2015 Global Burden of Disease Study.

3.3. Cost estimates

Cost data were triangulated from several sources. Whenever possible, primary data were incorporated from a regional application of time-driven activity-based costing of health services throughout Haiti's Central Plateau and Lower Artibonite [57]. Purchase prices for medical equipment, medicines and consumables were also supplied by Partners In Health, one of the largest healthcare delivery organizations in Haiti.

For each intervention, costs were collected from an activity-based perspective. Specifically, for the hypertension intervention, this included the production and advertisement costs of the media campaign, hypertension screening and treatment visits at health facilities, and the associated cost of antihypertensive medicines. For the diabetes intervention, this included diagnostic testing and treatment visits, associated consumables and the cost of insulin, and mark ups to account for structural barriers that prevent insulin from being delivered. Lastly, for the cervical cancer intervention, this included the cost of vaccine delivery at schools, as well as the vaccine itself.

For future treatments that are avoided as a result of our interventions, we neither model, nor collect costs. For example, administration of the HPV vaccine to school-age girls is likely to prevent future medical costs (e.g., diagnosis and treatments like cryotherapy or surgery). This may underestimate the true level of benefits produced by the interventions. However, Haiti's current infrastructure for screening, diagnosing and treating cancer is largely non-existent, and those with cancer are likely to present at clinics only at an advanced stage. Likewise, children with type-1 diabetes often remain undiagnosed, deteriorate and die quickly. In addition, Haiti's weak health systems infrastructure does not adequately lend itself to the treatment of individuals who experience stroke, myocardial infarction, or other ischemic disease events. Finally, expensive treatment options like radio- or chemotherapy are not readily available throughout the health system. Given that averted medical costs are likely to be relatively small, we have chosen not to include them in our analysis.

3.4. Cost-benefit analysis

Based on the parameters outlined above, we estimated the societal benefits and costs of all three interventions. The analysis was conducted using Microsoft Excel v15. Cost-benefit ratios were simulated under a range of scenarios in which we varied the discount rate from 3-12% per annum, and the value of a statistical year of life from 1-8 times average GDP per capita. Value of a statistical year of life is based, among other data, on evidence that individuals are willing to trade money for extended life expectancy and that the amount of money is often relative to earned income [58]. These simulations incorporated a variety of demographic and socioeconomic information on the population distribution and income levels in Haiti, derived from the United Nations Population Division and World Bank, respectively.

To evaluate benefits, we estimated reduced morbidity and mortality levels from each intervention, based on average health-adjusted life expectancy and average age of onset associated with each condition—i.e. cardiac event, cancer and diabetes. We further assumed

that the average life expectancy in Haiti would have been achieved, absent the condition occurring.

Lastly, we incorporated a sensitivity analyses in order to determine how sensitive final estimates were to a number of key assumptions. Specifically, for each intervention we increased the expected cost by 50% for each intervention. In addition, for hypertension we modified risk and fatality rates of stroke. In the low scenario we modeled a 10% decrease in the average risk of stroke, a .02 decrease in relative risk, and a 10% decrease in mortality rates from the base case scenario. The high scenario consisted of the opposite. Finally, across conditions we varied health state disability rates, using GBD's low- and high-end estimates for IHD and stroke events in the hypertension intervention and varying the disability weight by 10% in either direction in the cervical cancer intervention.

All costs are reported in Haitian gourdes and US dollars (2016), at an exchange rate of one US dollar to 63.38 Haitian gourdes. Benefits are reported in terms of disability-adjusted life years (DALYs).

4. Conclusion

4.1. Results overview

Table 2 presents the costs, benefits and benefit cost ratios for each intervention program in Haiti, applying a 3%, 5% and 12% discount rate and assuming the value of a statistical year as the equivalent of three times average GDP per capita in Haiti.

Table 2. Summary Table: Annualized costs, benefits and benefit-cost ratios

Intervention	Discount	Benefit	Cost	Benefit-Cost Ratio	Quality of Evidence
Hypertension	3%	$19,724,075	$9,889,278	1.99	Low/ Medium
	5%	$17,189,505	$9,889,278	1.74	
	12%	$11,384,789	$9,889,278	1.15	
Diabetes	3%	$19,883,152	$4,403,441	4.52	Low/ Medium
	5%	$15,786,614	$4,403,441	3.59	
	12%	$8,460,594	$4,403,441	1.92	
Cervical Cancer	3%	$10,822,086	$2,032,963	5.32	Low/ Medium
	5%	$7,797,983	$2,032,963	3.84	
	12%	$3,941,041	$2,032,963	1.94	

Under the base case scenario, the cost estimate for the hypertension intervention was $9.89M per year, for the diabetes intervention was $4.40M per year, and for the cervical cancer intervention was $2.03M per year, while the benefits were $19.17.19M, $15.79M, and $7.80M respectively. This produced a benefit cost ratio is 1.74 for the hypertension intervention, 3.59 for the diabetes intervention and 3.84 for the cervical cancer intervention. Appendix 2 presents a full overview of costs and benefits, assuming the value of a statistical year is one-, three, and eight-times GDP per capita.

Table 3. Cost per QALY gained

Intervention	Cost per DALY (USD)	Cost per DALY (HTG)
Hypertension	$797	50,509
Type-1 Diabetes	$316	20,055
Cervical Cancer	$81	5,133

Each intervention varied in scope, scale, as well as levels of morbidity and mortality averted. In the case of hypertension, the most expensive intervention, the information campaign aimed to reach approximately two million Haitians age 30-69, with 400,000 of these individuals having severely high systolic blood pressure (>160). Coupled with enrollment in care and adherence among roughly 50% of those who arrive at facilities, we expected this to avert 520 strokes and 495 heart attacks per year, which translated to 11,884 years of life lost due to premature death and 524 years lived in disability.

The diabetes intervention was expected to reach 3,162 children under age 15 who self-present at hospitals with uncontrolled symptoms of type-1 diabetes. Improved testing, diagnostics and supply of insulin were estimated to avert 506 deaths, which translated to 13,916 years of life lost due to premature mortality.

Lastly, for the HPV vaccination campaign, this was expected to reach 93,336 10-year old girls enrolled in primary school each year, and avert 1,494 cases of cervical cancer, accounting for 19,869 years of life lost due to premature mortality and 5,229 years of life lived in disability. Table 3 reports results as the cost per DALY gained for each intervention. Both the type-1 diabetes and cervical cancer interventions would historically[4] be considered “very cost effective” at less than

[4] Using the 1x and 3x GDP per capita benchmarks to denote “very cost-effective” and “cost-effective” interventions has recently been challenged on both theoretical and practical grounds [59], [60], [61]. While such thresholds can show where there is value for money, they fail to take into

the 2016 GDP per capita of 43,722 Haitian Gourdes [62]. The hypertension intervention is cost-effective at less than 2x GDP per capita (see Table 3).

Sensitivity analyses varied estimates up-and-down. When costs were increased by 50% across each intervention, all benefit-cost ratios remained greater than one in the base scenario. Hypertension declined from a BCR of 1.74 to 1.16. Type-1 diabetes declined to from 3.59 to 2.39 and cervical cancer from 3.84 to 2.56.

Varying risk of stroke and IHD events, and mortality rates up and down within the hypertension intervention resulted in significantly different BCRs. In the low scenario the BCR dropped to 0.4, while in the high scenario it climbed to 9.0. Changing health states to reflect GBD's low- and high-end disability weights resulted in less than 2% variation in the hypertension BCR, and negligible variation in the cervical cancer BCR, demonstrating the extent to which high mortality and premature loss of life drive the accrual of benefits in our analysis. In addition to these senstitivity analyses, we present BCR variations for different discount rates and valuations of a statistical life in Table 2.

4.2. Discussion

Based on the best available information to-date, we find that simple treatment and prevention interventions for addressing hypertension, diabetes and cancer disease burdens in Haiti are cost-effective, yielding a cost per disability-adjusted life year significantly less than three-times GDP per capita. In monetary terms, every $1 invested in hypertension yields $1.74 in return; every $1 invested in diabetes care yields $3.59 in return, and every $1 invested in cervical care yields $3.84 in return. Moreover, the total annual cost of all three interventions—$16.33M—represents 9% of the Haitian Ministry of Health's annual budget [63].

In health terms, these three interventions would be expected to avert over 1,000 strokes and heart attacks per year, 1,000 cervical cancer deaths, as well as 500 deaths from type-1 diabetes overall. Both the cost-effectiveness and return on investment of these interventions are corroborated by a broad body of evidence in the empirical literature demonstrating the value for money of interventions to address non-communicable disease in low-resources [8], [64], [65]. However, this represents the first analysis examine these policy questions looking at the specific context of Haiti. Moreover, the majority of assumptions incorporated, such as the capacity for national scale-up and adherence to treatment, were conservative, suggesting that the health and economic returns could be even greater than that presented here.

account practical considerations like the affordability of the intervention within different contexts, and the feasibility given resources, human capital, and other constraints [59].

This said, there are a couple key limitations of this analysis. First, many data points from primary data collection were absent, requiring the authors to look to international estimates. This issue was also addressed, in part, by the incorporation of sensitivity analyses. Second, both hypertension and diabetes interventions are focused heavily on treatment rather than prevention. Over the long-run, it would be ideal to incorporate a broader array of prevention activities, ideally targeting younger generations, to prevent diseases before they start.

Ultimately, in any setting where the budget for investment in health is severely limited—such as Haiti—the opportunity costs of investing in an area like non-communicable disease must be weighed against the opportunity costs of investing in other healthcare priorities and other sectors beyond health. Likewise, the enactment of policies will depend on close collaborations between Ministries beyond the Ministry of Health, including most notably the Ministries of Finance and Education. Nevertheless, this report provides a strong foundational justification for the economic feasibility and benefit of prioritizing treatment and prevention of non-communicable disease over and above today's status quo.

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APPENDIX 1. KEY ASSUMPTIONS BY INTERVENTION

DESCRIPTION	VALUE	SOURCE
Hypertension		
1. Prevalence of HTN (systolic blood pressure > 140)	20.0%	Jean-Baptiste et al, 2006. *Diabetes and Metabolism*.
2. Risk of stroke, 30-60	0.152%	IHME Global Burden of Disease 2015
3. Risk of IHD, 30-60	0.164%	IHME Global Burden of Disease 2015
4. Cost per person of antihypertensive medicine and 4 clinical visits for one year	$53.49	Primary facility-based data collection; 2014 WHO International Drug Price Indicator Guide
5. Cost per person of media campaign	$0.04	Asaria et al, 2007. *The Lancet*.
Diabetes		
1. Prevalence of Type-1 diabetes (0-15)	0.1%	Soltesz et al, 2009. International Diabetes Federation.
2. One-year case fatality without appropriate access to insulin	97%	Beran et al, 2005. *Lancet Diabetes & Endocrinology*
3. Cost per person for clinical visit and diagnostic testing	$28.29	Partners In Health / Zanmi Lasante Haiti Supply Chain Team
4. Insulin cost per vial, adjusting for transport and structural barriers	$0.72	Partners In Health / Zanmi Lasante Haiti Supply Chain Team
Cervical Cancer		
1. Cumulative incidence of cervical cancer (0-74)	2.45%	GLOBOCAN 2014 national estimates
2. Percent of females in primary school (age 10)	77.70%	UNICEF – Haiti Statistics, 2016
3. Cost per dose of vaccine – subsidized	$4.50	GAVI – HPV price announcement, 2013
4. Introductory cost of vaccine delivery at school, per capita	$2.99	Levin et al, 2013. *PLoS One*.
5. Recurrent cost of vaccine delivery at school, per capita	$4.17	Levin et al, 2013. *PLoS One*.

APPENDIX 2. KEY ASSUMPTIONS BY INTERVENTION

		Value of a Statistical Life – 1x GDP			Value of a Statistical Life – 3x GDP			Value of a Statistical Life – 8x GDP			
Intervention	Discount	Benefit (thousands)	Cost (thousands)	BCR	Benefit (thousands)	Cost (thousands)	BCR	Benefit (thousands)	Cost (thousands)	BCR	Quality of Evidence
Hypertension	3%	$6,779	$9,889	0.69	$19,724	$9,889	1.99	$52,086	$9,889	5.27	Low/Medium
	5%	$5,934	$9,889	0.60	$17,190	$9,889	1.74	$45,327	$9,889	4.58	
	12%	$3,999	$9,889	0.40	$11,385	$9,889	1.15	$29,848	$9,889	3.02	
Diabetes	3%	$6,628	$4,403	1.51	$19,883	$4,403	4.52	$53,022	$4,403	12.04	Low/Medium
	5%	$5,262	$4,403	1.20	$15,787	$4,403	3.59	$42,098	$4,403	9.56	
	12%	$2,820	$4,403	0.64	$8,461	$4,403	1.92	$22,562	$4,403	5.12	
Cervical Cancer: *Subsidized*	3%	$3,607	$2,033	1.77	$10,822	$2,033	5.32	$18,037	$2,033	8.87	Low/Medium
	5%	$2,599	$2,033	1.28	$7,798	$2,033	3.84	$12,997	$2,033	6.39	
	12%	$1,314	$2,033	0.65	$3,941	$2,033	1.94	$6,568	$2,033	3.23	
Cervical Cancer: *Unsubsidized*	3%	$3,607	$9,853	0.37	$10,822	$9,853	1.10	$18,037	$9,853	1.83	Low/Medium
	5%	$2,599	$9,853	0.26	$7,798	$9,853	0.79	$12,997	$9,853	1.32	
	12%	$1,314	$9,853	0.13	$3,941	$9,853	0.40	$6,568	$9,853	0.67	

Chronic Kidney Disease (CKD): Direct costs of optimal care in Port-au-Prince, Haiti

Haiti Priorise

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Summary

Introduction

This is a study on chronic kidney disease (CKD) in Haiti and the direct costs of optimal care, using major determinants such as arterial hypertension (high blood pressure) and diabetes. Its aim is to reinforce other work intended to sensitize the population about and determine funding for non-communicable diseases.

Methodology

We start from a matrix developed based on the care objectives. The prices of the components of care are then added up. Adding up the different prices determines the costs of a dialysis session, from which we can deduct the monthly and annual direct cost of care for chronic kidney disease. The prices are those used principally in the public sector.

Results

The direct monthly and annual costs of providing care to a terminal chronic kidney disease patient on dialysis are 41.570,00 Gourdes (608,19 USD) and 501.590,00 Gourdes respectively. These amounts represent expenses paid for by the dialysis patient in the public center, which is equal to 25% of the cost of private care.

Discussion

The results of this work demonstrate the significant costs incurred by dialysis patients, whose income is low. In comparison to the costs of private healthcare, an important subsidy is certainly provided in the public center by the Haitian government, faced with its own limitations. The included minimum expenses for optimal care do not take account of comorbidities, additional consultations or extra hospitalizations. Hence the need to consider a budget subsidy for preventative measures.

Introduction

Chronic kidney disease is a condition characterized by a gradual loss of kidney function over time, resulting from the onset of irreversible parenchymal lesions, of which the main causes throughout the world currently are high blood pressure and diabetes. These non-communicable illnesses, prevalent in Haiti (particularly high blood pressure), are the causes but also aggravating factors of a certain level of morbidity that cannot be ignored by health policies within a population. And so, in order to raise awareness about and facilitate interventions on these diseases in Haiti, this article will evaluate the direct cost of providing optimal care for kidney disease, with all its complexities and consequences.

Context – Justification

This work can serve as an extension to other studies on the direct costs of care for non-communicable diseases. Since high blood pressure and diabetes are causes, consequences and aggravating factors of kidney disease in Haiti, estimating the costs of care for kidney disease can then serve as a tool to guide activities designed to finance medical treatment related to high blood pressure and diabetes. There are many things to consider such as: the particularities and characteristics of kidney disease itself, worldwide scientific progress on the subject, and Haiti's existing reality in this field.

The characteristics of kidney disease [1] – Chronic kidney disease, or chronic renal insufficiency, is characterized by a sustained deficit of the glomerular filtration rate (GFR< 60ml/min/1,73m^2). It differentiates itself from acute renal insufficiency by its progressive nature, the deterioration of all excretory, regulatory, or endocrinal kidney functions, and by its irreversibility. It's part of a group of diseases known as 'silent killers' because it often appears and progresses with little or no symptoms. It is the result of kidney damage often influenced by factors such as diabetes or high blood pressure, which attack glomerular, tubular, interstitial and vascular structures.

Chronic kidney disease progresses through stages of mild, moderate, and severe before reaching the terminal stage, at which point it becomes known as end stage renal disease (ESRD). At this last stage, these treatments can be used (by decreasing order in terms of cost): hemodialysis, peritoneal dialysis, and kidney transplant.

Determinants of kidney disease [2] – The factors that lead to renal insufficiency vary from one place to another. According to the National Institute for Health and Medical Research in France, the disease is linked to high blood pressure in almost a quarter of all cases, and to diabetes in another quarter. Both diseases cause vascular lesions that impact the kidneys. According to a 2003 study, one third of diabetic patients develop a renal insufficiency ten years after diabetes first appears. Six percent of these cases are at an advanced stage.

Worldwide Scientific Advances – According to a press release from the World Kidney Day, published on March 8th, 2017, one in in ten adults (so close to 600 million people) suffers from some form of kidney related illness. The WHO predicts a 17% increase in the rate of chronic kidney disease in the next ten years. Every year, because of a late diagnosis, millions of people die prematurely from CKD and from associated cardiovascular complications.

La piste de solution – In response to the prevalence of kidney disease in the world, World Kidney Day (on the second Thursday of March) was started in 2006 as a way to raise awareness about the disease. Of the eleven topics retained, references to diabetes and cardio-vascular diseases appeared four times. The focus is thus on the need to combat high blood pressure and diabetes which, along with obesity, constitute the three major causes of kidney disease. The neglect of these causative diseases thwarts the possibility of detecting kidney disease early on and stopping or slowing its (often silent) progression. If the opposite is done, dialysis (and its extremely high price tag) can be avoided with medication and proper hygiene and nutrition measures.

Estimate of the cost of dialysis care – According to the Court of Auditors in France, annuals costs for dialysis care are: €53 028 (euros) for non assisted peritoneal dialysis, and €87 036 for hospital hemodialysis. Kidney transplants cost €53 273 the first year, then just €13 536 thereafter [3]. The total cost for health insurance in France was at to 2.1 billion euros in 2005. According to the French National Authority for Health (HAS), that number was at 4 billion euros in 2007, covered by healthcare. The cost varies depending on age and comorbidities.

The situation in Haiti – As of 2017, Haiti has 8 nephrologists for approximately 11 million inhabitants. There are four dialysis centers, one of which is a public center established in 2001, and all in Port-au-Prince. The minimum wage average, depending on the category of workers, varies from 175 HTG (Haitian gourdes) to 340 HTG per day for eight hours of work [5].

In 1997, the first set of data on visits from kidney disease patients to the Internal Medicine Clinic of the Hospital of the State University of Haiti (HUEH) revealed that there were between 4 and 6 new cases of ESRD per month [6]. The main cause is high blood pressure (57%). A 2006 study on the prevalence of diabetes and hypertension in Haiti (PREDIAH) conducted by the Haitian foundation for diabetes and cardiovascular disease (FHADIMAC)[7], claimed that in the Port-au-Prince metropolitan area, the prevalence of diabetes, adjusted for age, is 4.8% for men and 8.9% for women. High blood pressure is found in 48.7% of men and 46.5 % of women, and its frequency in the population aged 40 and up is 69.1% for men, and 67.2% for women.

In 2013, a Haitian nephrologist at a conference of the Haitian College of Internal Medicine (CHAMI) presented a care model for CKD adapted to Haiti. It is a variation of current models of CKD care that takes into account the realities of Haiti. It resembles the care model by Bourquin

and Martin, from the university hospitals of Geneva [8]. In Haiti, general practitioners and internists are very involved in early care of kidney disease patients (Table 1).

Table 1- From diagnosis to care for kidney disease in Haiti in 2013

General Practitioner	Internist
Diagnose	Diagnose Monitor
Nephrologist	
Diagnose Monitor (more specialized monitoring) Treat	

Source- http://www.chamihaiti.org

All in all, care for end stage chronic kidney disease patients represent a major medical and financial challenge in a society. Dialysis is a costly treatment (approximately €80,000 per year for each patient in France). Whether covered or not by health insurance, the care must take into account associated costs: medical treatment, food, transportation etc. Dialysis, according to many, can impoverish someone. Hence the need for the players in a health system to conduct regular economic evaluations about care for this group of non-communicable diseases.

Methodology

We are addressing kidney disease, two of its major determinants, and the direct cost of optimal care at the terminal stage in Haiti. To that end, three factors are considered:

1- Goals of care
2- Tools for providing care
3- Financing care

1- The objectives of care for terminal chronic kidney disease (Tab.2) are based on the technical considerations that guide medical decisions and actions

Table 2. Goals of care for terminal chronic kidney disease

Diagnosis	Monitoring	Treatment
Search for aggravating factors Evaluation of progression Control of complications	Specialized monitoring Follow-up Rate of progression	Hygiene and nutrition measures Specific therapeutics Hemodialysis

2- The tools or elements of care are investigations and therapeutic methods used to prevent or control ailments caused by the disease. These are:

- Medical consultation,
- Counseling
- Medical visits of dialysis patients during sessions
- Para-clinical checkups
- Medicine
- Hygiene and nutrition measures
- Dialysis sessions

3- Financing for care includes the amount, in the local currency, spent to reach the goals of diagnosing, monitoring, and administering hemodialysis. They can be divided into two categories:

Mandatory financing needed to provide optimal care :

a- Monthly reports for diagnoses (complete blood count, blood chemistry and ionogram, lipid and calcium test)
b- Annual report for monitoring (electrocardiogram, uricemia et protein test)
c- Dialysis sessions (transportation, costs of the session and food) and antianemic drugs (erythropoietin, iron, folic acid) to compensate for the kidney deficit and treat.

Financing of adjuvants surrounding dialysis sessions

d- Other treatment medicines (angitensin, Furosemide, Statin, Calcium carbonate)
e- Monthly consultation and medical visits for monitoring dialysis
f- Monthly counseling to raise awareness on hygiene and nutrition measures

A matrix is developed depending on care objectives to determine prices of tools and elements of care used according to a standard progression. The prices used by this study for a, b, and c are those covered in the public centers unless the service is only available or only reliable in the private sector. Adding up the different prices determines the cost of the dialysis session, from which we then get the annual direct cost of care of terminal kidney disease. Adding d, e and f gives us the minimum cost of care for terminal kidney disease.

The elements not included in the cost of care are:

- Comorbidities
- Infrastructure and equipment needed for diagnosis and treatment
- Service costs for medical personnel and nurses
- Additional examinations and medicine not particular to dialysis

Results

Components to calculating the direct cost of care for ESRD:

1. Consultation + Counseling + Monthly report
2. Dialysis + Medical visit during the session
3. Annual report
4. Medicine

The exchange rate is calculated at 68,35 Gourdes for 1 USD and 1.0737 USD for 1 Euro. Results of our calculations are presented in Table 3.

Table 3. Direct cost of care of ESRD with dialysis

#	Tools for care	Monthly costs			Annual cost		
		GDES	USD	EURO	GDES	USD	EURO
1.	Consultations…	4075	59.61	55.51	48900	715.43	666.32
2.	Dialysis Sessions	29280	428.38	398.97	351360	5140.60	4787.74
3.	Annual Report	0	0.00	0.00	2750	40.23	37.46
4.	Medicine	8215	120.20	111.94	98580	1442.28	1343.28
Total		41570	608.19	566.44	501590	7338.54	6834.81

The direct costs of care for an end-stage kidney disease patient are 41.570,00 Gourdes monthly and 501.590,00 Gourdes annually. These amounts represent the expenses paid for by the dialysis patient in in the only public dialysis center, or 25% of the cost of private treatment.

As a comparison, the average monthly and annual costs are respectively 2400 USD and 28800 USD when care is administered in a private center.

Discussion

This study is a part of the work by the « Research Laboratory on Non-Communicable Diseases » on chronic kidney disease. This being the cause and consequence of other illnesses, like high blood pressure and diabetes, the study groups together these categories of non-communicable diseases and analyzes their impact on health and the economy. By specifically addressing the direct cost of care for chronic kidney disease in Haiti, our work touches upon the problem of financing these diseases in a country with limited resources.

Along with infectious diseases in Haiti, and in light of what the current medical literature tells us on non-communicable diseases, high blood pressure, diabetes, and kidney diseases are becoming very serious public health issues. At the Hospital of the State University of Haiti (HUEH) alone, the prevalence of terminal chronic kidney disease is high. The results from the PREDIAH study points to the high prevalence of diabetes and high blood pressure in the population, while any form of neglect in the care of high blood pressure and diabetes can lead, after ten years, to terminal kidney disease needing hemodialysis. Noting that the latter, the most costly of all treatment methods, is the only one available in Haiti, and that the average minimum salary in Haiti is low, there is a need for increased focus on non-communicable diseases.

Furthermore, the health system is faced with a deficit in terms of specialized professional caregivers, as well a lack of infrastructure and adequate equipment. Haitian nephrologists circumvent these issues by involving general practitioners in the early care of these diseases considered, for the most part, to be silent killers.

This is clearly explained by the methodology of this work, which gives a strategic place to the objectives and has chosen a minimal but efficient plan to be achieved in the public structures chosen by the patient.

The results of this work demonstrate the significant costs incurred by dialysis patients, whose income is low. They also indicate that, given the cost of private care, the Haitian government, even if faced with a lack of financial resources and a multitude of other priorities, must find a way to subsidize the public center by 75% of the amount spent for private care. It should also be noted that the included costs (which represent the minimum needed to provide optimal care) do

not take into account comorbidities or additional consultations or hospitalizations. Hence the necessity to think of appropriate financing methods for preventative measures.

Conclusion

The management of kidney disease in Haiti includes managing its major determinants, diabetes and high blood pressure. This study does not completely discern the problems of financing care for this group of non-communicable diseases in a country with limited resources. Nevertheless, it opens the door for further examination of the problem, reinforces existing studies on the subject, and raises awareness about the most accessible solution, which is prevention. The Haitian health care system must continuously consult the data available on diseases in general. It must pay attention to the changes that undoubtedly occur continuously in health indicators in order to update its priorities.

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Haiti faces some of the most acute social and economic development challenges in the world. Despite an influx of aid in the aftermath of the 2010 earthquake, growth and progress continue to be minimal, at best. With so many actors and the wide breadth of challenges from food security and clean water access to health, education, environmental degradation, and infrastructure, what should the top priorities be for policy makers, international donors, NGOs and businesses? With limited resources and time, it is crucial that focus is informed by what will do the most good for each gourde spent. The Haïti Priorise project will work with stakeholders across the country to find, analyze, rank and disseminate the best solutions for the country. We engage Haitans from all parts of society, through readers of newspapers, along with NGOs, decision makers, sector experts and businesses to propose the best solutions. We have commissioned some of the best economists from Haiti and the world to calculate the social, environmental and economic costs and benefits of these proposals. This research will help set priorities for the country through a nationwide conversation about what the smart - and not-so-smart - solutions are for Haiti's future.

For more information visit www.HaitiPriorise.com

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