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Benefit-Cost Analysis

Cost-benefit analysis of health infrastructure projects

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COPENHAGEN CONSENSUS CENTER

Haïti Priorise
Un plan de développement alternatif

Cost-benefit analysis of health infrastructure projects

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Canada

Academic Summary

This paper presents the economic analysis supported by the investments of two health projects, one of which is to provide the 125 municipal regions with a Community Health Center (CCS) as outlined in the Essential Package of Services and the other that provides an extension of the mobile clinic project in the other five regions or the establishment of clinics in public schools. The main objective of these two projects is to improve access to health care and services for the target audience. These projects aim to achieve this goal through the establishment in the 125 sections that will focus on a primary attention and an attention to schoolchildren in public schools from the ages of 3-14.

A cost-benefit analysis is carried out for the principle expected benefits of these projects, which are:

- Disease prevention
- Reducing disease symptoms
- Reducing chronic diseases
- Reducing the mortality rate

All of these benefits reduce the burden of illness or the DALY-years of life adjusted (DALY) for the population that will be served by the CCS and schoolchildren. Second, these benefits are valued using the GDP per capita for 2016.

The analysis on the ACVI shows that the CCS implementation project is viable for a cost-benefit ratio of 4, with a discount rate of 5%. The same finding for the clinical project at school following the fixed clinic strategy, a ratio of 3.9, for that of mobile clinic on a small scale a ratio of 4.7 to 5.6 for large-scale strategy.

Policy Summary

Improving access to health care is one of the objectives set by the Haitian State through the Strategic Plan for the Development of Haiti (PSDH) in the various programs and subprograms entrusted to the health sector. Of its **11, 078, 033 inhabitants in 2016**, The Ministry of Health does not have an official figure on health coverage in Haiti. Often referring to a 60% coverage.

The different reliefs of the country and the lack of implementation of an urbanization plan make it all the more difficult for this offer whose resources are already very meager. On the other hand, without even mentioning the relief or disposition of habitats, access to care remains a matter of concern for certain segments of society. Aware of this problem and the importance of universal access to health care, the Ministry of Public Health and Population (MSPP) has set the goal of extending the health system network to position a health institution in each communal section of the country, as the gateway into the health system. Thus, the MSPP wants to reach the 125 sections out of the 570 that do not yet have public health institutions.

In addition to the centers, the MSPP also wishes to pay particular attention to children in schools, as a high number of children, despite the presence of health facilities in communities or communal areas, have little access to services because of the lack of resources, as reported in the EMMUS only one third of parents use health services for their children. With this in mind, the MSPP, together with the Ministry of Education, launched a pilot project for mobile clinics in public schools in 2014. This project targeted schoolchildren aged 3-14 years, since care for a teenager over the age of 14 should be done at the institutional level according to one of the managers of the mobile clinic program.

According to the 2013 census of the Ministry of Education, 24% of 1st and 2nd cycle elementary schools (Primary) and 17% of 3rd cycle elementary schools would have an infirmary or a first aid kit. So a percentage of 76% and 83% (1st, 2nd and 3rd cycle elementary schools respectively) of schoolchildren have no first aid in cases of various injuries or illnesses.

The objectives of such interventions are to improve access to health care for the rural population and schoolchildren in public institutions. Two projects that aim to achieve their objectives from the following components:

Mobile clinics at small-scale schools: This intervention includes the passage of a school bus twice a year in each school, with three nurses and one physician as referred to in the pilot phase launched in 2014

Mobile clinics at large-scale schools: Different from the first, this intervention plans monthly visits with the same staff during the ten months that school is in session.

fixed clinics at school: fixed clinics at the schools, which represent the alternative to this pilot phase, will have as staff a doctor who will visit every two weeks and a nurse on-site during school days.

Community health centers: The objective of this component is to improve the provision and quality of services in rural areas and to make the CCS the gateway in the system for these communities. To do this, the CCS will propose promotional, prevention and curative activities, including prenatal and newborn care.

This work, which focuses on health infrastructures, is intended to analyze the implementation of these two health interventions with regard to the establishment of CCSs in the 125 unavailable areas and the extension of the clinic project in public schools.

Factors related to the interventions

In recent years, the construction of a center would cost the Haitian state an average of 20,000,000 Gourdes. The establishment of such health facilities in rural areas would also have an impact on employment within the health sector, particularly among hundreds of community health workers who have been striving to integrate into the system since receiving their training.

On the other hand, through the extension of clinics in schools, the MSPP would like to reach the 100% of public schools in the country. The intervention includes the acquisition of new buses, new

staff training, monitoring and supervision of the program. Other costs of the program include the use of police officer for the safety of the staff when traveling, especially in risk areas.

Justification for the interventions

Just as the CCSs will provide promotional, curative and preventive services, the school clinics project could help:

- Avoid or prevent diseases
- Reduce the severity of symptoms and diseases
- Reduce the duration of acute illness
- Reduce the mortality rate

In addition, the school clinics can help improve school performance, increase class attendance, and as mentioned above, job creation can be counted as a benefit of the implementation of the CCS project.

In addition, the cost-benefit analysis prior to the funding and implementation of these projects will help to determine the expected effects of the project by comparing the situation of the non-institutional areas to the situation with institutions. Similarly, for the situation of schoolchildren without a clinic and with a clinic.

Given the size of the projects where the resources they require are important and the priorities are numerous, an in-depth analysis of these projects should enable the State to see whether these projects are viable or not. In addition, because health benefits are less tangible than in other sectors, the cost-benefit analysis is therefore a powerful tool in this analysis. It could be argued that CCS has greater coverage and should bring greater benefits than clinics in schools that have a smaller audience? In addition, the permanent clinic at the school has a greater presence, but the mobile clinic is less costly due to the nature of the intervention in terms of the use of staff and capital. In this case, what is the best intervention? Such questions may seem simple and yet they require an analysis of the costs and benefits of the interventions.

As summarized in the following table, the implementation of such interventions can have a positive impact on the health of the target groups and the economy in a comprehensive manner. Benefit costs are annual values in gourdes.

1- Table of costs and benefits

Interventions	Benefit	Cost	Benefit-Cost Ratio	Data Quality
Implementation of CCS	3,065,668,058	774,465,407	4	High
Small-scale mobile clinic	403,890,130	85,263,656	4.7	High
Mobile clinic at large scale	2,001,604,697	357,215,348	5.6	High
Permanent clinics at schools	2,001,604,697	516,296,496	3.9	High

Notes: All figures are based on a discount rate of 5%

The benefit-cost ratio, which is the ratio between benefits and costs, designates the benefit for each gourd spent. The discount rate measures the opportunity cost of capital, if this capital has been invested in other sectors and the return rate that should be expected. Thus, following the above interventions, for each gourd spent the company will obtain benefits that vary between 3.9 and 5.6 Gourdes depending on the interventions.

Contents

1-Introduction

The primary objective of the Haitian health system is to ensure universal and equitable access to health services through health promotion, prevention and recovery. Services are delivered through three levels of care, the tertiary level, which includes specialized and university hospitals, the secondary level, which includes departmental hospitals, and the primary level, which includes three levels of community hospitals, health centers in municipalities and community health centers in the communal areas and the complementary participation of the private sector. The Department's senior management is in charge of formulating, regulating and coordinating actions at national level. The health departments that represent the Ministry in the ten departments are responsible for the delivery of services along the lines of the Master Health Plan (PDS).The private sector and sometimes international organizations offer a range of care to overcome the weaknesses of the state.

The main strategy for providing care is given in the Essential Service Package (PES) manual, formerly the Minimum Service Package (PMS) which was introduced in 2006. This model presents a team for the delivery of services at the CCS level, consisting of a nurse, as a key provider, community health workers for promotional activities within the community. Teams are responsible for a population of 5,000-6,000 inhabitants in its serving area and refers to cases that exceed their competencies at higher levels.

Haiti faces a challenge in organizing its health system, the country's relief, the dispersion of households in certain regions where urbanization plans seem to be absent, which complicate the work of setting up the health network whose resources have declined in recent years, from 10% in 2013 to 4% in 2016. Moreover, the presence of departmental hospitals in urban areas creates an imbalance in the provision of health services, pathologies that can be treated at lower levels are found at secondary and sometimes even tertiary levels due to a lack of knowledge of the available services and promotional activities at the community level.

The Haitian health system, as advocated, should be able to provide resolute maternal and child health care and services, to prevent and treat communicable diseases, and control chronic diseases such as diabetes and hypertension. The CCS in the health system is the so-called gateway to the system with resources and technology to meet the needs of a specific population.

In addition, the school mobile clinic project is part of the MSPP school health program, which covers interventions related to the health and development of adolescents and young people in schools. It covers, among other things, raising awareness among young people about safe sexual behavior.

This project, which began in 2014, was meant to be a one-off response to the problem of accessibility and availability of care to children in marginalized areas. To launch the project, a USD 600,000 financing was granted by the Inter-American Development Bank (IDB)[1]. With three buses, the project ensured the clinical management of schoolchildren in national schools in the western regions. Subsequently, in 2016, four more buses were delivered to the South, North, North-East and Grande-Anse regions. With two visits per year in each school, the project visited 98 schools and screened 20,474 students.

The current project provides the following services:

- general consultations (clinical examination),
- vision, hearing and back exams,
- height and weight measurements,
- verification of vaccinations and detection of learning disabilities (language, writing...).
- health education
- deworming.

Medicines are also provided free of charge to children, depending on the pathologies diagnosed. And if necessary, the child is referred to other specialists.

[1] http://lenouvelliste.com/lenouvelliste/article/135942/Trois-autobus-pour-des-cliniques-mobiles-scolaires

2-Literature review

In this section we present the methodology that was used for this study and the definition of some key concepts that can help the reader understand.

Methodology

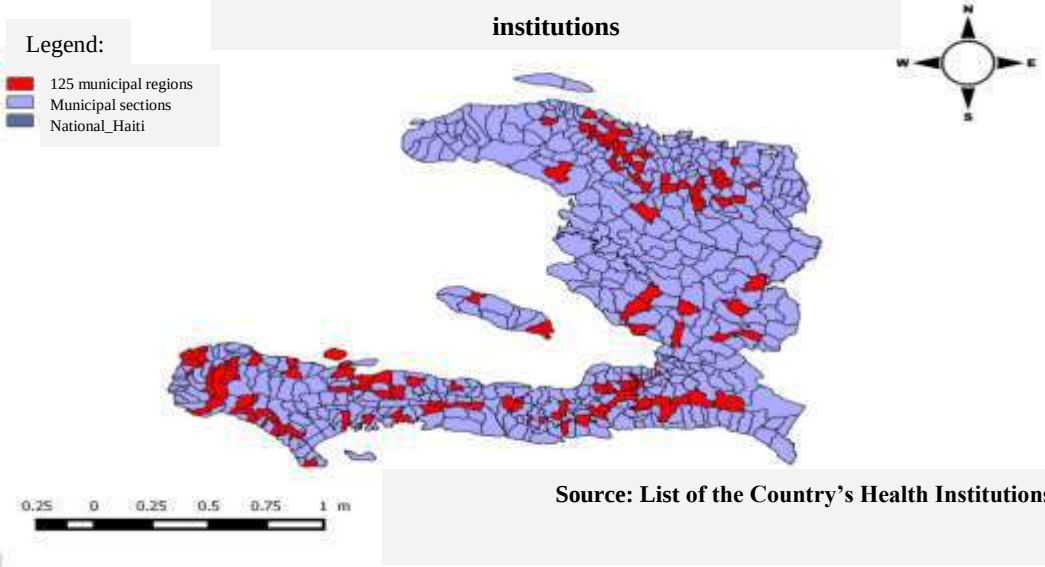
Target population

The target population for the two interventions was determined on the basis of projections, based on the MSPP publication data and the Ministry of National Education and Vocational Training (MENFP). The documents in question are: the list of health institutions published in April 2015 and the school census carried out in 2011 by the MENFP. The unserved population in 2012 was at 958, 614, this population was multiplied by the growth rate between 2012 and 2015, a negative growth rate of -0.36%, adjusted by the growth rate at the national level which means the population in need is at 958,153 inhabitants.

Data from the 2011 and 2013 censuses was used to determine the growth rate of pre-school children at the first and second cycle, as well as the third elementary cycle. Comparing the population with access to the population without any health structure in school, we obtained a population of 635,307 schoolchildren for a total of 1,648 public schools.

Moreover, the intervention on the establishment of the CCSs stems from the national policy of the MSPP, which wants to equip each municipal section with a health institution. Of the 570 sections, there are a total of 125 that are without structure. The location of these is shown in the following map:

The 125 municipal regions unserved by health institutions



Source: List of the Country's Health Institutions

Interventions

The benefits of CCS implementation will be achieved by increasing health coverage and providing access to health services to more people in regions without a health facility and schoolchildren in public schools. In the context of setting up the health network, as a gateway the CCS mainly provides curative, promotional, preventive services including pre / post natal care, immunization and nutrition. The mobile clinic provides education, hygiene and curative services.

The approach of the study was initially to identify the main causes of morbidity and mortality for the target populations, namely the population of[2] impoverished regions and overall in children aged 3-14. To do so, data from the Global Burden of Disease report (2015) was used. Since the mobile clinic project targets schoolchildren in public institutions, the second step was to identify the disease burden for this age group in public schools. On the other hand, no adjustment was necessary for the population of the municipal regions.

The third step was to complete the annual benefits of these interventions. The cost data for the implementation of the CCS comes from the cost study of medical procedures in Haiti[3], a clearly detailed process on the calculation of costs and of the Unit of Studies and Programming for the costs of construction and support to the management of the information. The cost data for the extension of the clinic comes from the pilot project launched in 2014.

In order to measure the impact of the interventions on the target populations, a percentage reduction of the years of life lived with disability (AVI) and years of life lost (AVP) was assigned to each disease as a percentage of expected reduction of the implementation of these projects. These reduction percentages are based on a review of the international literature which can be found in the appendix.

In the extension of the clinic, two cases are to be considered in the benefits calculation, the direct benefits obtained during the years spent in schools and the indirect benefits that will be obtained after the elementary cycle. Because clinics in schools offer the opportunity to educate children

[2] This population was obtained from an adjustment of the unserved population in 2012, according to the list of health institutions, published in 2015 by the MSPP.
[3] Rapport préliminaire, cas du centre de Sante de portail Léogane, p.58

about health problems with benefits that go beyond adolescence. This allows them to occupy a unique position in terms of the benefits they provide beyond those of most other services (hospitals, health centers, community centers). They are accentuated by:

- the promotion and prevention of the disease
- understanding the symptoms and early detection of sicknesses
- properly managing sicknesses

A care package that may include, but is not limited to, hygiene education (regular handwashing), dietary supplements (eg, anemia and iron deficiency), behavioral changes through the prevention and reduction symptoms and proper use of prescriptions for infectious diseases (diarrhea, respiratory infections) and chronic diseases such as asthma, certain skin diseases.

For example, a 50% reduction in the number of pupils who have left the elementary cycle at the age of 15 is the result of these interventions. This reduction was applied to the expected AVIs during the life of schoolchildren after the elementary cycle, in the absence of a school clinic at the 3%, 5% and 12% discount rates.

These reduction percentages were then converted to relative risk. The relative risks, which are the morbidity and mortality risks faced by the populations who do not have access to services compared to those who have access to them. Second, factors related to morbidity and mortality associated with the lack of access to health services are calculated for each disease category, based on the percentage of the population without access to the services. Attributable factors are then multiplied by the nation's burden of illness to obtain an initial estimate of the burden of illness due to a lack of access to health services.

Measurements of the analysis

DALYs: disability-adjusted life years

The *Disability-adjusted life years* or DALYs are a measurements of the disease burden that quantifies not only premature mortality related to various causes of death, but also the gap between the current functional health status of a population and a hypothetical ideal that one

wishes to attain (Lopez et al. 2006). This is a level at which it is generally no longer possible, from the time when it is determined, to achieve a longer life or an improvement in functional health.

DALYs are defined as the loss of one year of healthy life due to disability or death. This indicator is therefore not limited to years of life lost due to mortality; it also includes years of healthy life lost by individuals who end up in poor health or on disability (Murray and Lopez, 1996b). Two components, mortality and functional health, estimated respectively by years of life lost and years lived with disability.

Years of life lost

The *Years of life lost* Or AVP represent years of life lost due to "premature" mortality.

Years living with a disability

Years living with a disability or AVI refer to health years lost due to time spent in a functional health condition that is not optimal due to a particular illness.

This section contains a description of the major health problems identified for the analysis of the benefits of CCS implementation and the extension of the clinics project in schools. For the CCS, the major problems are chosen according to the different age groups, children aged 0-4, children aged 5-9 and adults aged 20 and over. They are 8-13 for diseases and 5-6 for death.

The main diseases identified in those under 20 are:

- Iron deficiency and anemia
- Asthma
- Respiratory infections
- Diarrhea
- Anxiety disorders
- Depression disorders
- Skin and subcutaneous diseases
- Unintentional injuries
- Migraines
- Epilepsy
- Back and neck pain

- Sensory organ diseases
- Infection of the middle ear

The main diseases identified among those aged 20 and over are:

- Iron deficiency and anemia
- Asthma
- Respiratory infections
- Diarrhea
- Anxiety disorders
- Depression disorders
- Skin and subcutaneous diseases
- Unintentional injuries
- Migraines
- Epilepsy
- Back and neck pain
- Sensory organ diseases

The main causes of mortality identified in children are:

- Low respiratory infections
- Meningitis,
- Diarrhea,
- Unintentional injuries,
- Whooping cough,
- Asthma
- Epilepsy and
- Injuries

For those 20 and older we have:

- Diarrhea
- Tuberculosis
- Respiratory infections
- Injuries
- Diabetes

Benefit calculations

Since there is no specific information in terms of the ACVI for health projects in Haiti, or specifically for projects specifically targeted at children, the estimates available in the international literature are used as a source. A reduction in reduction percentage is assigned to the three age groups, between 2 to 83% for diseases and 22 to 84% for mortality[4]. These percentages are the same for permanent and mobile clinics on a large scale. For further information on the reduction percentages applied to each disease or cause of death see Appendix.

The health benefits of interventions with public schools go beyond providing on-site care and services because raising children's awareness of health issues can have an impact on their future lives. As already mentioned, it is assumed in this study that these interventions could reduce the morbidity by 50% over the life of the beneficiaries after the cycle of the fundamentals.

It should be noted, however, on the side of the community centers that all those who will use the new structures will all be new members of the system, as some already used the private structures and / or centers of the neighboring sections.

For this purpose, it is assumed that 50% of new users did not use any service. The remaining 50% represents resource savings equal to the variable operating costs of private clinics. However, since all former users of private structures are not going to turn to CCSs, the net savings is therefore considered to be half, thus 25% of the variable cost.

The first estimate obtained from the overall burden of illness was then adjusted to reflect the fact that some schoolchildren have access to health care alternatives, which lowers the benefits of clinics in school. The adjustment factors are as follows:

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[4] Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand washing promotion for preventing diarrhoea. Cochrane Database Syst Rev 2015:CD004265.doi:10.1002/14651858.CD004265.pub3.

Salam et al [2016], Interventions to prevent unintentional injuries among adolescents: a systematic review and meta-analysis, Journal of Adolescent Health, 59 (2016) S76-S87

1) For mobile and fixed clinics at school, it is assumed that 33% of schoolchildren will benefit from these clinics[5], as they generally do not use health services within public institutions.
2) For high intensity or fixed clinics, it is assumed that 67% will have partial benefits (ie 50% of the total benefits), as the latter generally use public structures with a preventive and educational orientation but with a lower intensity than on the side of high intensity and fixed clinics.
3) For the low-intensity clinic, 67% of schoolchildren will not benefit, as the benefits they receive from the centers they attend generally have the same scope as the low-intensity clinics provided.

Monetary valuation of health benefits

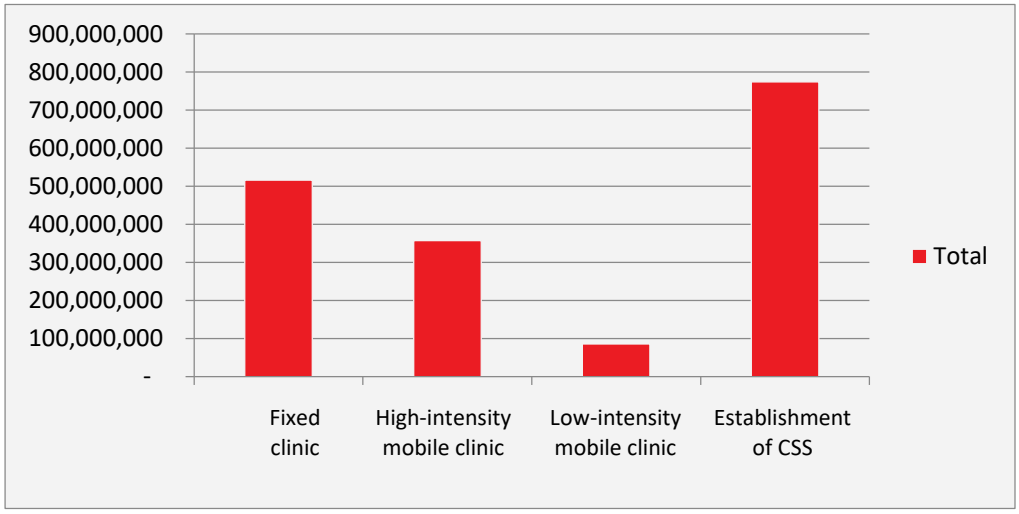
To assign a monetary value to DALYs avoided by implementing these projects, it is assumed that these corrected life years are worth a year of productivity for a person in full use of his or her abilities. Productivity can be valued by GDP per capita for Haiti during 2016, based on projections of GDP on the previous real growth rate of 2.7% from 1975 to 2014.

3-Cost-Benefit Calculations

The cost associated with this investment for setting up the CCSs is equivalent to 774,465,407 of Gourdes. This funding involves public investment funds. In general, the construction of CCS lasts only one year, regardless of disbursement problems. The cost associated with the clinic project in the schools amounts to 85,263,656 for the small-scale strategy, 357,215,348 Gourdes for large-scale strategy and 516,296,496 Gourdes for the fixed clinics in the schools.

[5] Because there is no data on the use of health services by schoolchildren in Haiti, 33% represents the percentage of mothers seeking medical treatment for their children in private facilities, compared to 67% in public or mixed structures according to the EMMUS V.

Graph 1. The annual costs (in gourdes) according to the interventions



The calculations for the establishment of the CCS were obtained on the basis of estimates from the data of the preliminary report from the study on cost of medical procedures in Haiti. The table used for this purpose was the one showing the operational costs for the health center of Portail Léogane. The costs considered in this table are those that relate to the services offered in a CCS and the service staff. These are therefore the costs of expenditure units by the type of expenditure, adult, prenatal, pediatric and vaccination. This cost was then multiplied by the serving population of a CCS which is 6000 inhabitants and divided by that of a health center that is the center of Portail Léogane which has 30,000 inhabitants. Subsequently the cost obtained was adjusted by the rate of inflation between 2014 and 2016.

The cost of pre/post-natal services was estimated separately. Data from the analysis prepared by Ms. F Rozier Balde for the Prioritize Haiti project, which is 31 gourdes in 2014 and 37 gourdes in 2016. Thus, the years of lost lives were multiplied by the expenses of the CCS in vaccination, and then by the number of sections without institutions. This gives an estimate of the years of life that can be saved each year by establishing these centers in the un-provided regions.

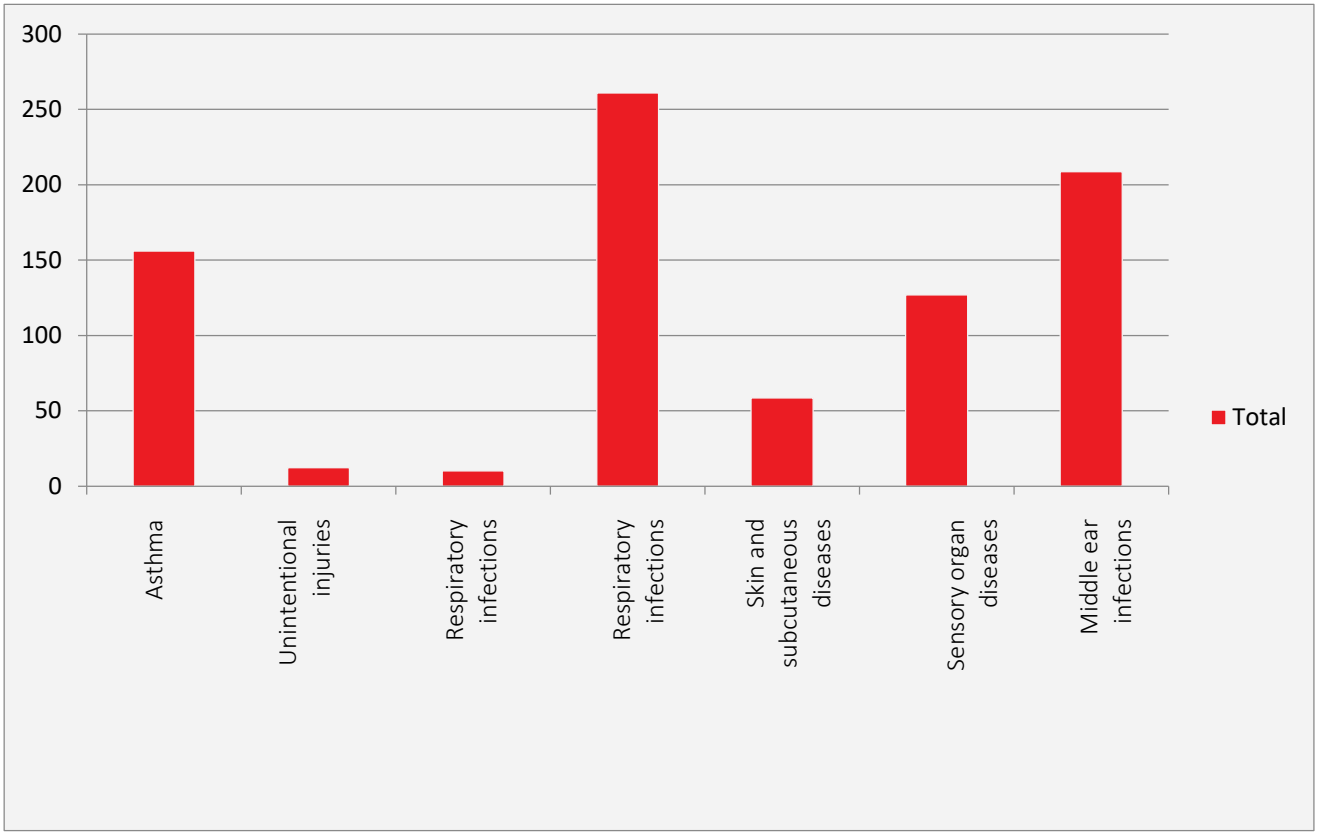
Since permanent and large-scale clinics are expected to bring a greater benefit than the CCS. It is assumed that the cost per pupil for these two interventions is 130 gourdes and half for the small-scale clinics. Expansion costs for mobile clinics are based on pilot phase data, the salaries of staff

on board and maintenance costs for the buses. Based on the number of schools without infrastructure in 1,648 and the number of visits per school for one year (two per year according to the low-intensity clinic and ten per year according to the high-intensity clinic), it was possible to determine the number of days for each strategy. Then by referring to the average number of days of class per year, and by implementing the *Round* function in Excel it was possible to obtain the number of additional buses which is 9 for the low-intensity strategy and 75 for the high-intensity strategy. The unit cost was multiplied by 9 and 75 to find the acquisition values according to the strategies. The annual cost was then determined by adding up the annual cost of the investment (with a discount rate of 3%) and the annual cost of operation.

Permanent clinic implementation costs were based on the area in square meters, ie 12m2 and the price per square meter required by an infirmary multiplied by the number of schools with no structures, the cost for medical personnel was obtained from the current salary scale at the MSPP. For a discount rate of 3% on investment, the sum of the annual cost of the investment and the operating costs gave us the annual operating cost of the permanent school clinics.

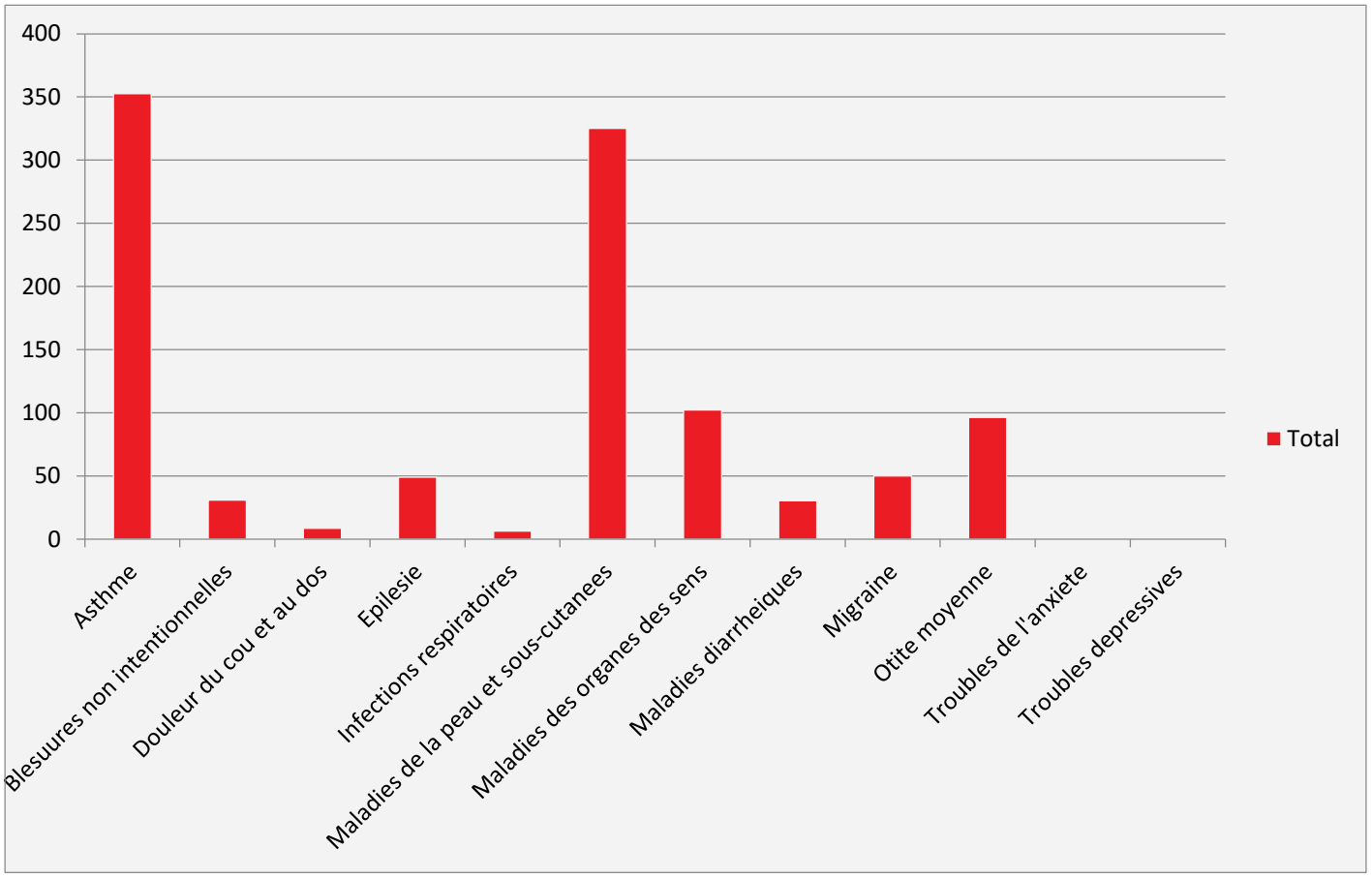
The calculation of the benefits is made from the avoided years of year lived with the disability (AVI) and the Years of life lost (AVP). The benefits are categorized as AVI avoided and AVP avoided per year. The following graphs provide more information by age group and pathology for the intervention on the establishment of the CCS.

Graph 2. AVIs avoided according to the causes of morbidity in children under the age of 5



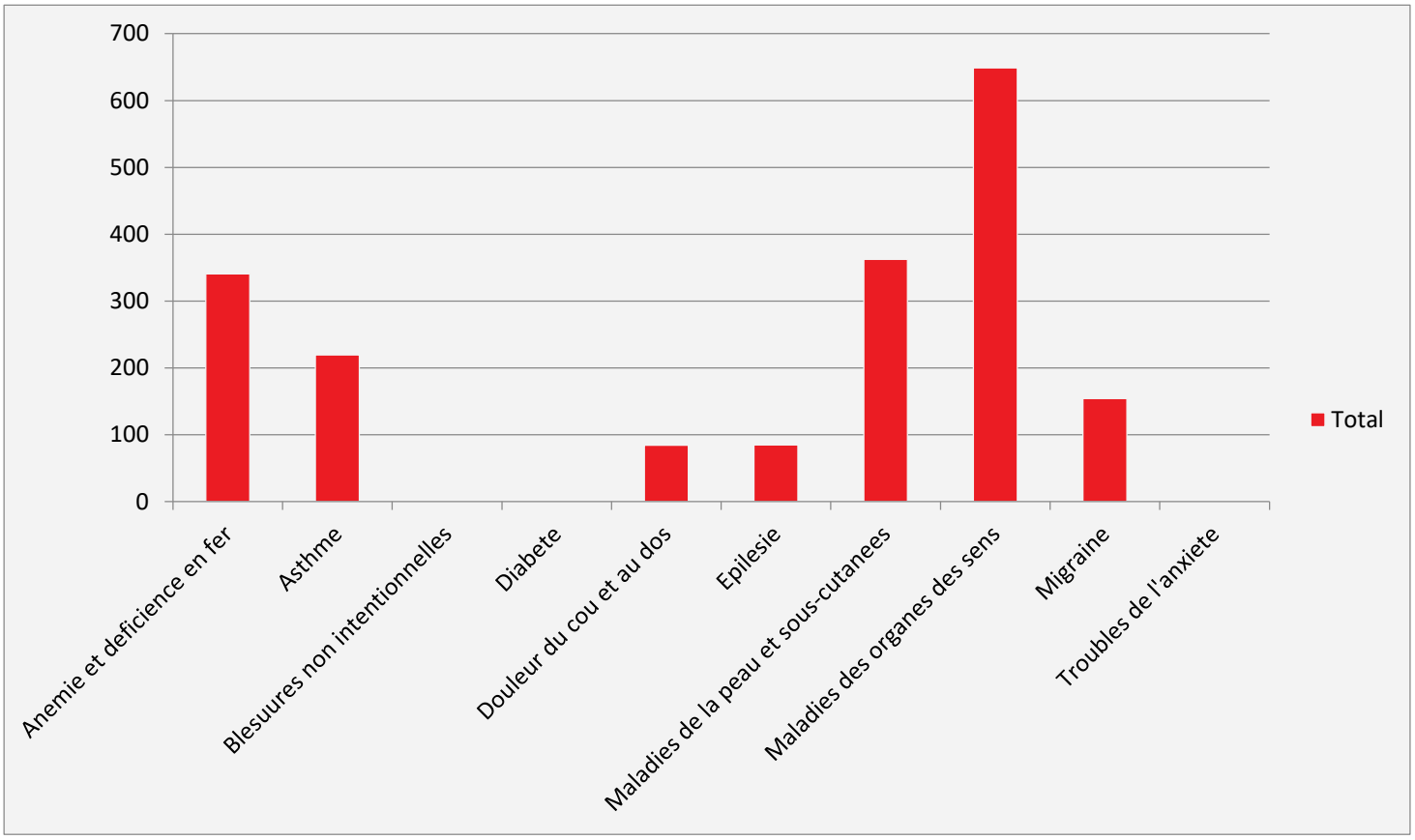
Right to Left: Asthma, non-intentional injuries, respiratory infections, skin and sub-cutaneous diseases, sensory organ diseases, diarrhea-related illnesses, ear infections.

Graph 3.AVIs avoided according to the causes of morbidity among 5-19 year olds



Right to Left: Asthma, non-intentional injuries, Back and neck pain, Epilepsy, Respiratory infections, Skin and sub-cutaneous diseases, Sensory organ diseases, Diarrhea-related illnesses, Migraines, Ear infections, Anxiety-related issues, Depression-related issues

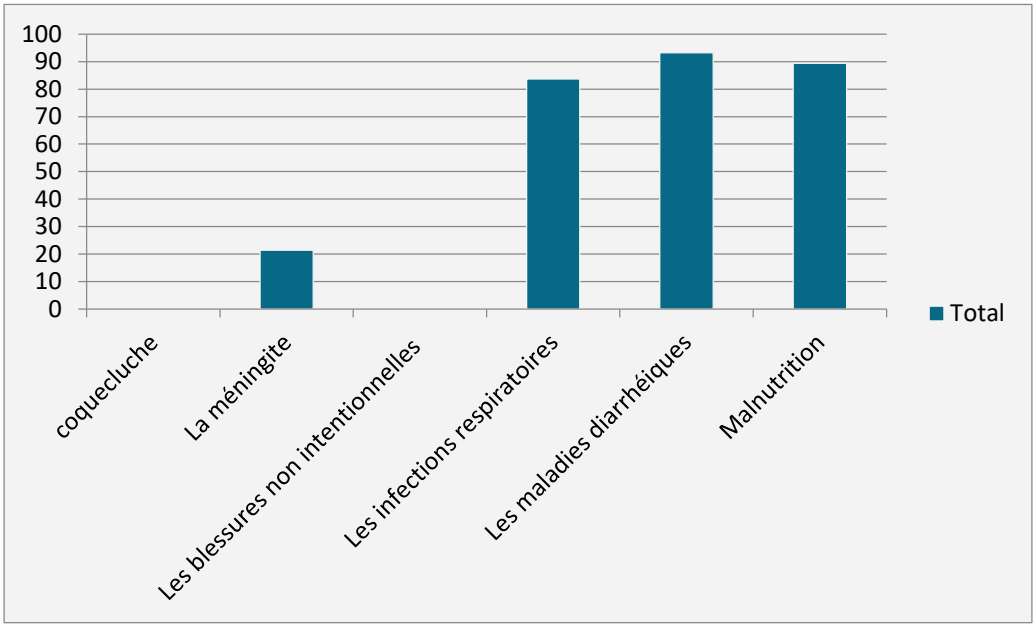
Graph 4.AVIs avoided according to the causes of morbidity among those aged 20 and over



Right to Left: Anemia and iron deficiencies, Asthma, non-intentional injuries, Diabetes, Back and neck pain, Epilepsy, Skin and sub-cutaneous diseases, Sensory organ diseases, Migraines, Anxiety-related issues,

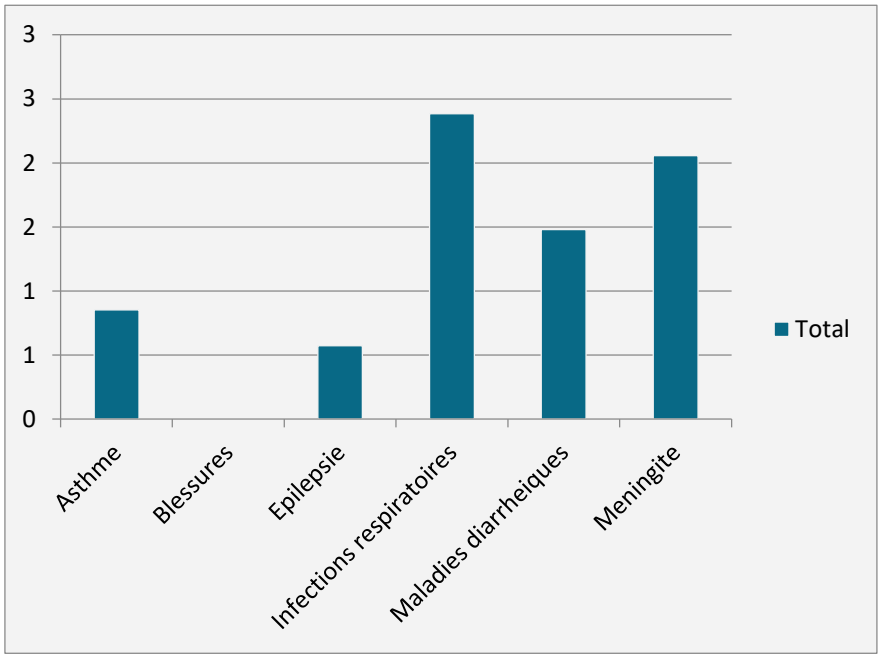
Moreover, the AVP avoided per year due to the establishment of the CCS in the 125 regions are presented for the causes of mortality identified by age.

Graph 5.AVPs avoided according to the causes of mortality of under 5 years of age



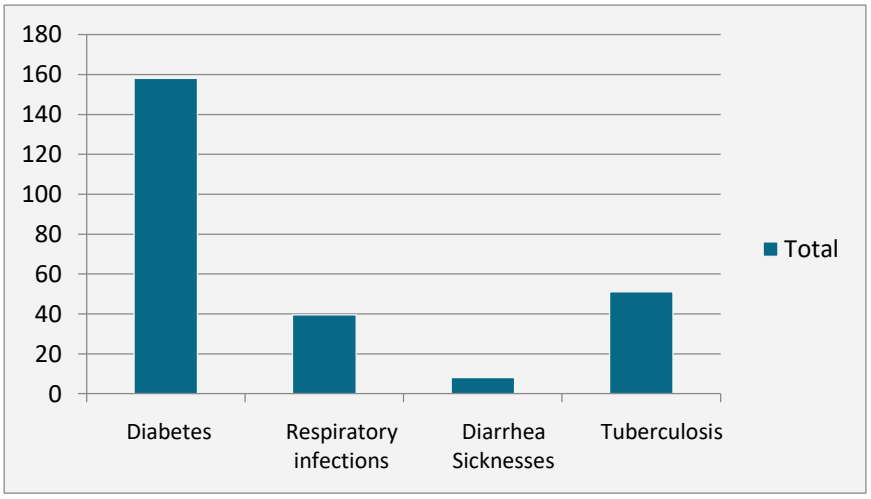
Right to Left: Unvaccinated, Meningitis, Unintentional injuries, Respiratory infections, Diarrhea-related illnesses, Malnutrition

Graph 6. AVPs avoided according to the causes of mortality in 5-19 year olds



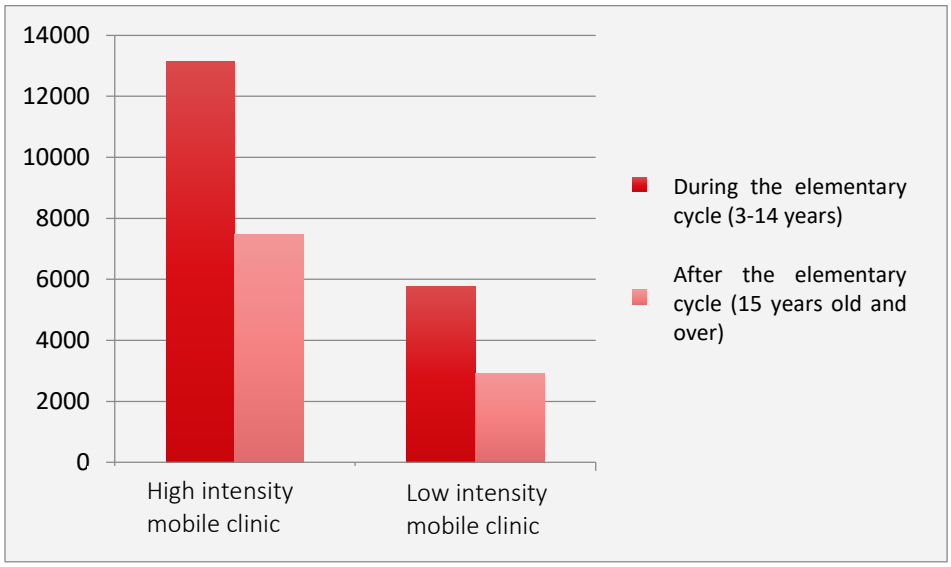
Right to Left: Asthma, Injuries, Epilepsy, Respiratory infections, Diarrhea-related illnesses, Meningitis

Graph 7. AVPs avoided according to the causes of mortality in those aged 20 and over

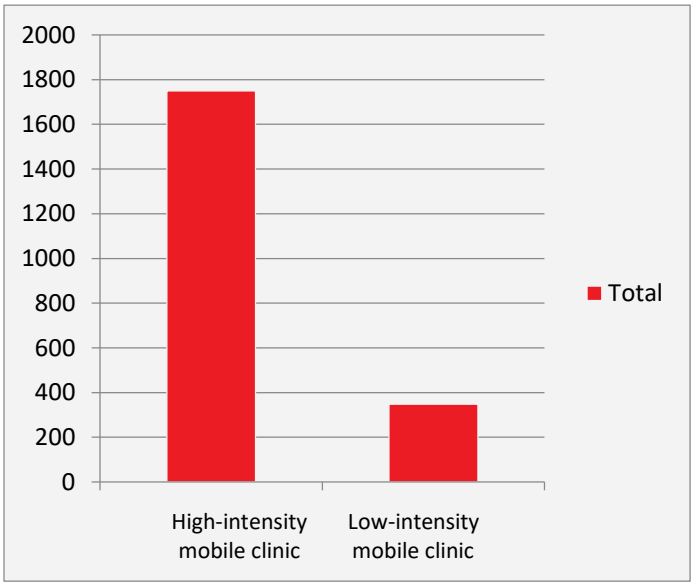


This is why through the extension of mobile clinics, the AVIs and AVPs avoided per year are presented for the low intensity clinics and the high intensity clinics and the fixed clinics combined because the same percentages of reduction are applied for these two strategies.

Graph 8.The years of life lived with disability (AVI) avoided according to the three strategies

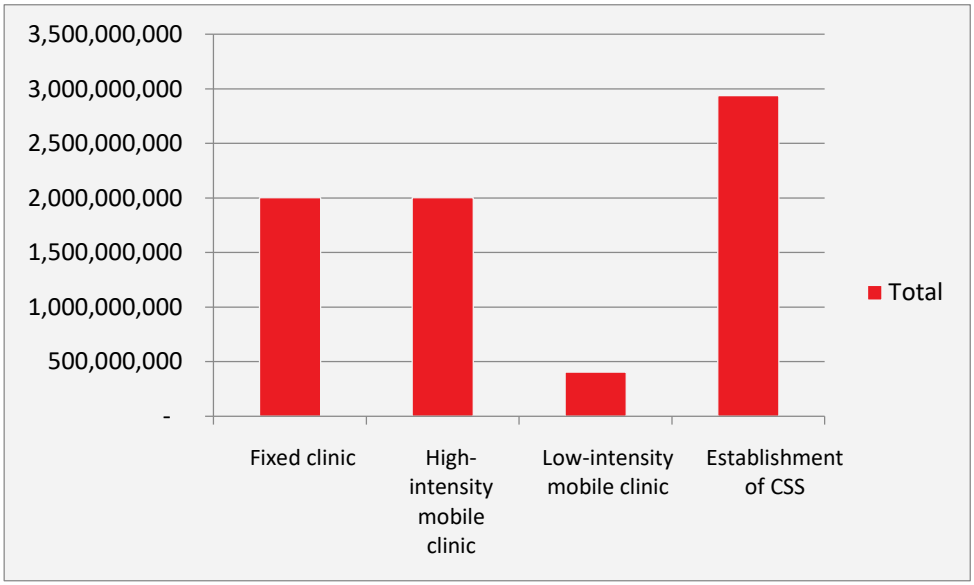


Graph 9. The years of life lost (AVP) avoided according to the three strategies



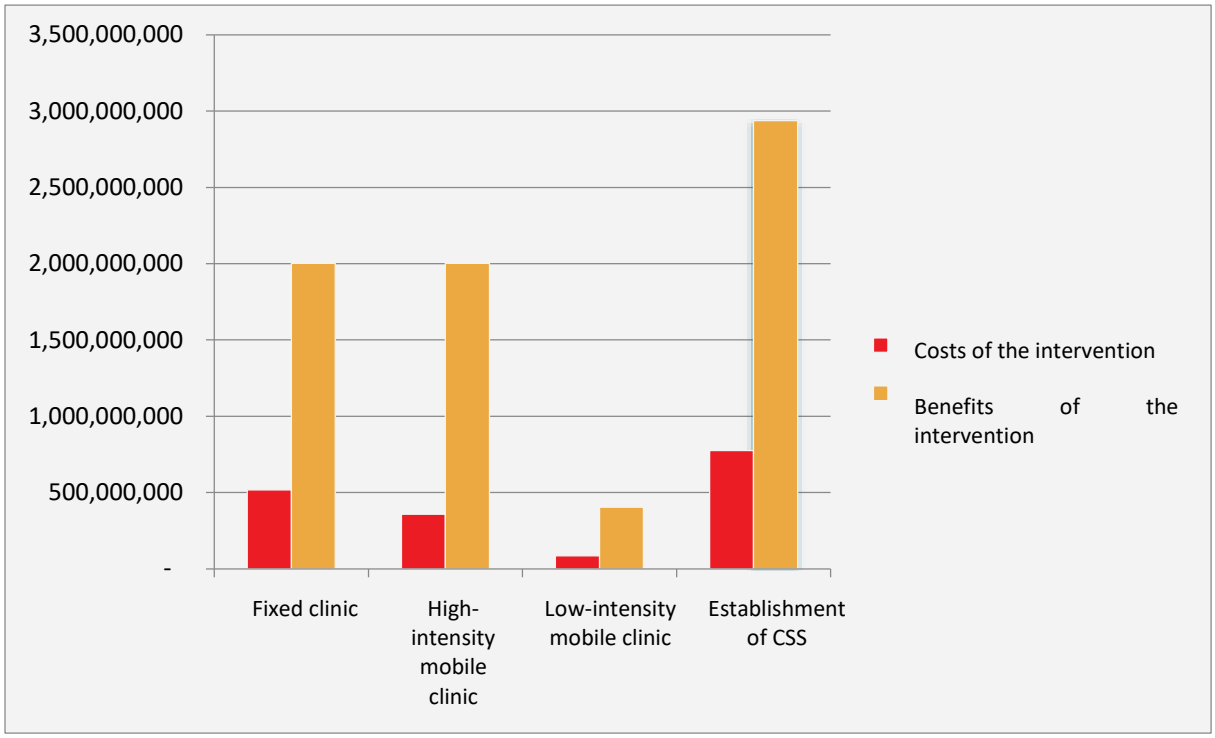
The total number of DALYs avoided for the different interventions were then multiplied by the GDP / capita to obtain benefits in monetary values. However, it should be noted that the benefits for the CCSs are the sum of health benefits and resource savings generated by the intervention, which is 25% of the variable operating cost of the 125 CCSs.

Graph 10.Advantages in monetary values (gourdes) per year according to the intervention



A comparison of costs and benefits (in gourds) of interventions allows us to obtain the cost-benefit ratios associated with each intervention. For the fixed clinics, a ratio of 3.9 was obtained, compared to a ratio of 4.7 to 5.6 for the low and high intensity strategies, respectively. And finally a cost-benefit ratio of 4 for setting up clinics.

Graph 11. Comparison of annual costs and benefits in gourdes



4-Conclusion

As an entity responsible for ensuring care and health services to the Haitian population, the MSPP has focused on universal access to health care for a few years. Dozens of projects to build a health center, community hospitals, and the establishment of an ambulance network have been implemented in this direction. The establishment of the CCS in the regions and the extension of the mobile clinical project are thus part of this framework. However, since such projects are national in scope, an economic analysis makes it possible to assess the contribution of such investments to the target public.

Through identification, quantification of costs, benefits and decision indicators. The analysis made it possible to decide that the amounts envisaged for such projects are worth investing in and will have a positive impact on the population.

Since in the domain of cost-benefit analysis, the methodologies vary according to the specificities of the countries. This analysis will lay the foundation for a cost-benefit analysis for the health sector and this methodology could serve as inspiration for further analysis of the same type.

Although the analysis can be carried out on the basis of the international literature, it is important to note the importance of a health information system and the production of reliable data in order to obtain results that reflect the reality of the country as closely as possible.

In addition, the results of this study can help curb the implementation of fanciful, impact-free projects and lead to a culture of project analysis in order to make public investment more efficient.

As mentioned above, the discount rate used for the results obtained is 5%, with a GDP / capita multiplied by 3. However, this table presents the various discount rates generally used in the evaluation of health projects that would have benefits at 3% and 12% discount rates. The costs presented in this table are annual operating costs, taking into account the lifetime of investments, 25 years for fixed clinics, 20 years for the CCS and 10 years for mobile clinics.

2-Summary table

Interventions	Discount rate	Benefit	Cost	Benefit-Cost Ratio	Data Quality
Establishment of CCS	3%	4,133,543,950	730,993,910	5.7	High
	5%	3,065,668,058	774,465,406	4.0	
	12%	1,772,089,364	953,452,677	1.9	
Small-scale mobile clinic	3%	469,077,335	83,807,706	5.6	High
	5%	403,890,130	85,263,656	4.7	
	12%	322,574,844	90,895,685	3.5	
Mobile clinic at large scale	3%	2,371,512,277	345,082,431	6.9	High
	5%	2,001,604,697	357,215,348	5.6	
	12%	1,542,515,386	404,148,922	3.8	
Permanent clinics at schools	3%	2,371,512,277	507,603,974	4.7	High
	5%	2,001,604,697	516,296,496	3.9	
	12%	1,542,515,386	552,640,713	2.8	

Appendix

Relative Risk Reduction Estimates – School Clinics

This section outlines the relative risk reduction assumptions for various diseases due to the presence of low-scale mobile clinic, high-intensity mobile clinics and fixed clinics in schools. These should be interpreted as risk reduction in the given disease relative to *having no other health facilities* either at school or in the community. This may make some relative risk reductions seem high on face value. However, the analysis contains further adjustments after these risk reductions to account for existing coverage from alternative health facilities as described in the methods section of this paper.

Morbidity tables

	Low intensity Mobile clinics	Description	High Intensity Mobile Clinics / Fixed clinics	Description
Diarrheal diseases	17%	Mobile clinics are able to educate children on hand-washing and encourage school administrators to provide soap and continue promotion within school. Assume 50% effectiveness of high-intensity mobile / fixed clinic due to lower reinforcement of message.	34% reduction in cases due to hand-washing promotion and soap provision as observed in Ejemot-Nwadiaro et al (2015)	The relative risk reduction is based on a school based hand-washing promotion in Africa with soap provision. It is assumed that clinic staff can work with school administration and teachers to reinforce behaviors and provide soap.
Lower respiratory infections	7%	Assume 50% as effective as high-intensity mobile / fixed clinics in promoting hand washing with soap	14% reduction in cases as observed in Aiello et al (2008)	This is another benefit of hand-washing promotion and hygiene education.
Iron-deficiency anemia	15%	The report on pilot study of mobile clinics (MSPP 2015) shows that 1,203 out of 20,472 children or 5.9% were diagnosed and treated with anemia. This compares to a baseline prevalence of 39% according to GBD. This suggests mobile clinics are	30%	It is assumed that high intensity mobile clinics / fixed clinics are twice as effective as low-intensity mobile clinics in treating iron-deficiency anemia.

	Low intensity Mobile clinics	Description	High Intensity Mobile Clinics / Fixed clinics	Description
		effective in identifying and treating 15% of cases of anemia from one visit. For two visits this would be 30% effectiveness. However not all anemia is from iron-deficiency, so rate is reduced by half.		
Asthma	20%	For low-intensity mobile clinics we assume that teachers are able to play a role in highlighting children with asthmatic symptoms. This parameter is set at 50% effectiveness of fixed clinics.	40%	The Wheezy child program in Brazil was able to reduce hospitalizations by 79% (Lasmar et al, 2009). However, this was in a different resource setting. We estimate the effectiveness of clinics in diagnosing and treating asthma at 50%.
Epilepsy	9%	Again we assume that teachers are able to highlight children with epileptic symptoms and make arrangements with mobile clinics for appropriate testing and treatment. Scenario assumed for low-intensity mobile clinics: 25% coverage rate of AEDs, 60% adherence which according to Chisholm (2005) leads to 9% reduction in disability.	38%	The use of older AEDs (especially phenobarbitone) delivered by health care workers, often non-physician health care workers, at the primary care level. Scenario assumed for fixed clinics / high-intensity mobile clinics: 80% coverage with 80% adherence has 38% improvement in remission according to Chisholm (2005)
Migraine	0.2%	This is the probability that a mobile clinic visit coincides with a migraine (2/365) multiplied by effectiveness of ibuprofen and triptans (32%) as per Richer et al, (2016).	18%	Ibuprofen and triptans provide improved chance of pain freedom in children - 1.32 times more likely to be pain free at 2 hours (Richer et al, 2016). This is multiplied by 200/365 where 200 is the number of days of schooling.
Depressive disorders	No evidence of effectiveness of interventions in adolescents	Das et al (2016) show that the only evidence for school based interventions that can impact depression involve cognitive behavioural therapy which should be delivered by a qualified, speclalized mental health practitioner. This is not part of mobile clinics program,	No evidence of effectiveness of interventions in adolescents	Das et al (2016) show that the only evidence for school based interventions that can impact depression involve cognitive behavioural therapy which should be delivered by a qualified, speclalized mental health practitioner. Not part of fixed or mobile clinics staffing.

	Low intensity Mobile clinics	Description	High Intensity Mobile Clinics / Fixed clinics	Description
		and in any case requires greater intensity of treatment than twice per year.		
Anxiety disorders	No evidence of effectiveness of interventions in adolescents	Das et al (2016) show that the only evidence for school based interventions that can impact depression involve cognitive behavioural therapy which should be delivered by a qualified, speclalised mental health practitioner. Unlikely to be part of mobile clinics program, and in any case requires greater intensity of treatment.	No evidence of effectiveness of interventions in adolescents	Das et al (2016) show that the only evidence for school based interventions that can impact depression involve cognitive behavioural therapy which should be delivered by a qualified, speclalised mental health practitioner. Not part of clinics staffing.
Low back and neck pain	1%	50% effectiveness of fixed clinics setting assuming teacher support in on-going education.	2%	Calvo-Munoz et al. (2012) show that education can reduce back pain outcomes by 4.2%. This comes from HICs however and it is uncertain what extent they are applicable to LMICs. Reduced by 50% to account for uncertainty.
Skin and subcutaneous diseases	20%	For mobile clinics, handwashing promotion was assumed to be 50% as effective as fixed clinics	40%	According to Luby et al (2005), handwashing promotion can reduce impetigo by 34%. We then assume treatment is able to reduce severity somewhat more, hence 40%.
Unintentional injuries	Limited evidence in LMIC setting	Salam et al [2016] show that the interventions with the strongest evidence to prevent unintentional and road injuries are not part of clinic-based care. They are graduated licence arrangements and sports-based injury prevention interventions. There is limited evidence in LMIC setting.	Limited evidence in LMIC setting	Salam et al [2016] show that the interventions with the strongest evidence to prevent unintentional and road injuries are not part of clinic-based care. They are graduated licence arrangements and sports-based injury prevention interventions. There is limited evidence in LMIC setting.

Mortality tables

	Mobile clinics		Fixed clinics	
Diarrheal diseases	17%	Assumes a 17% reduction in cases from handwashing promotion will lead to a 17% reduction in deaths.	46%	Assumes 34% reduction in cases will lead to a 34% reduction in deaths. For the remaining 66% of cases we assume a 36% reduction in deaths from ORS provision as per Edejer (2005)
Lower respiratory infections	7%	Assumes a 7% reduction in cases from handwashing promotion will lead to a 7% reduction in deaths.	42.5%	42.5% reduction from Edejer (2005)
Meningitis	0%	Detection and treatment (unlikely to detect significant number of cases in mobile clinic only visiting twice a year)	0%	Treatment for meningitis is done in the hospital setting. Fixed clinics could help in early detection but there is no evidence of this we could find.
Asthma	20%	Assumed to be the same as morbidity risk reduction	40%	Assumed to be the same as morbidity risk reduction
Epilepsy	9%	Assumed to be the same as morbidity risk reduction	38%	Assumed to be the same as morbidity risk reduction
Road injuries	0%	Salam et al [2016] show that the interventions with the strongest evidence to prevent unintentional and road injuries are not part of clinic-based care. They are graduated licence arrangements and sports-based injury prevention interventions. There is limited evidence in LMIC setting.	0%	Salam et al [2016] show that the interventions with the strongest evidence to prevent unintentional and road injuries are not part of clinic-based care. They are graduated licence arrangements and sports-based injury prevention interventions. There is limited evidence in LMIC setting.
Unintentional injuries	0%	Salam et al [2016] show that the interventions with the strongest evidence to prevent unintentional and road injuries are not part of clinic-based care. They are graduated licence arrangements and sports-based injury prevention interventions. There is limited evidence in LMIC setting.	0%	Salam et al [2016] show that the interventions with the strongest evidence to prevent unintentional and road injuries are not part of clinic-based care. They are graduated licence arrangements and sports-based injury prevention interventions. There is limited evidence in LMIC setting.

Relative Risk Reduction Estimates – Community Clinics

Relative risk reduction estimates for community clinics are broken down into three age group categories: i) children 0-4 year olds ii) children 5-19 year olds and iii) adults 20+ years. As with the school clinics analysis these should be interpreted as risk reduction in the given disease relative to *having no other health facilities*.

We assume that community clinics focus on young children (0-4 years old) through a combination of maternal support during pregnancy and community health programs, and are able to achieve relative risk reductions that are equivalent to fixed school clinics for this age group. For 5-19 year olds and adults 20+ years relative risk reductions are half that of the same diseases in school fixed clinics. There are two high burden adult diseases not examined in school clinics: diabetes mellitus and tuberculosis. For diabetes we assume a relative risk reduction due to receiving diabetes treatment (insulin) as 80% and that the presence of a clinic allows 2/3 of individuals to be reached for a relative risk reduction of 53%. For tuberculosis we note that in Haiti there is a 79% detection rate and a 78% treatment effectiveness rate (World Bank database). Multiplying these numbers together assumes a relative risk reduction of 62%.

5-References

Ejemot-Nwadiaro RI, Ehiri JE, Arikpo D, Meremikwu MM, Critchley JA. Hand washing promotion for preventing diarrhoea. Cochrane Database Syst Rev 2015:CD004265. doi:10.1002/14651858.CD004265.pub3.

Edejer TT, Aikins M, Black R, Wolfson L, Hutubessy R, Evans DB. Cost effectiveness analysis of strategies for child health in developing countries. BMJ 2005;331:1177. doi:bmj.38652.550278.7C [pii]\r10.1136/bmj.38652.550278.7C.

Aiello AE, Coulborn RM, Perez V, Larson EL. Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis. Am J Public Health 2008;98:1372–81. doi:10.2105/AJPH.2007.124610.

Lasmar L, Fontes MJ, Mohallen MT, Fonseca AC, Camargos P. Wheezy Child Program. World Allergy Organ J 2009;2:289–95. doi:10.1097/WOX.0b013e3181c6c8cb.

Chisholm D. Cost-effectiveness of First-line Antiepileptic Drug Treatments in the Developing World: A Population-level Analysis. Epilepsia 2005;46:751–9. doi:10.1111/j.1528-1167.2005.52704.x.

Iannotti L, Dulience SJ-L, Joseph S, Cooley C, Tufte T, Cox K, et al. Fortified Snack Reduced Anemia in Rural School-Aged Children of Haiti: A Cluster-Randomized, Controlled Trial. PLoS One 2016;11:e0168121. doi:10.1371/journal.pone.0168121.

Richer L, Billinghurst L, Linsdell MA, Russell K, Vandermeer B, Crumley ET, et al. Drugs for the acute treatment of migraine in children and adolescents. In: Richer L, editor. Cochrane Database Syst. Rev., vol. 4, Chichester, UK: John Wiley & Sons, Ltd; 2016, p. CD005220. doi:10.1002/14651858.CD005220.pub2.

Luby SP, Agboatwalla M, Feikin DR, Painter J, Billhimer W, Altaf A, et al. Effect of handwashing on child health: a randomised controlled trial. Lancet 2005;366:225–33. doi:10.1016/S0140-6736(05)66912-7.

Das et al (2016), Interventions for adolescent mental health: An overview of systematic reviews, Journal of Adolescent Health, 59 (2016) S49-S60

Salam et al [2016], Interventions to prevent unintentional injuries among adolescents: a systematic review and meta-analysis, Journal of Adolescent Health, 59 (2016) S76-S87

Ministère de la Santé Publique et de la Population (2105),Paquet Essentiel de Services

Ministère del'Education Nationale et de la Formation professionnelle(2011),Annuaire Fondamentale 1_et 2 et du 3^{ieme}du secondaire

Unité de Santé Internationale/MSPP (Octobre 2014), Etude des coûts des actes médicaux en Haiti, rapport préliminaire

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.

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