

MCI SOCIAL SECTOR WORKING PAPER SERIES

N° 8/2009

HEALTH NEEDS ASSESSMENT FOR LOUGA CITY, SENEGAL

Prepared by:

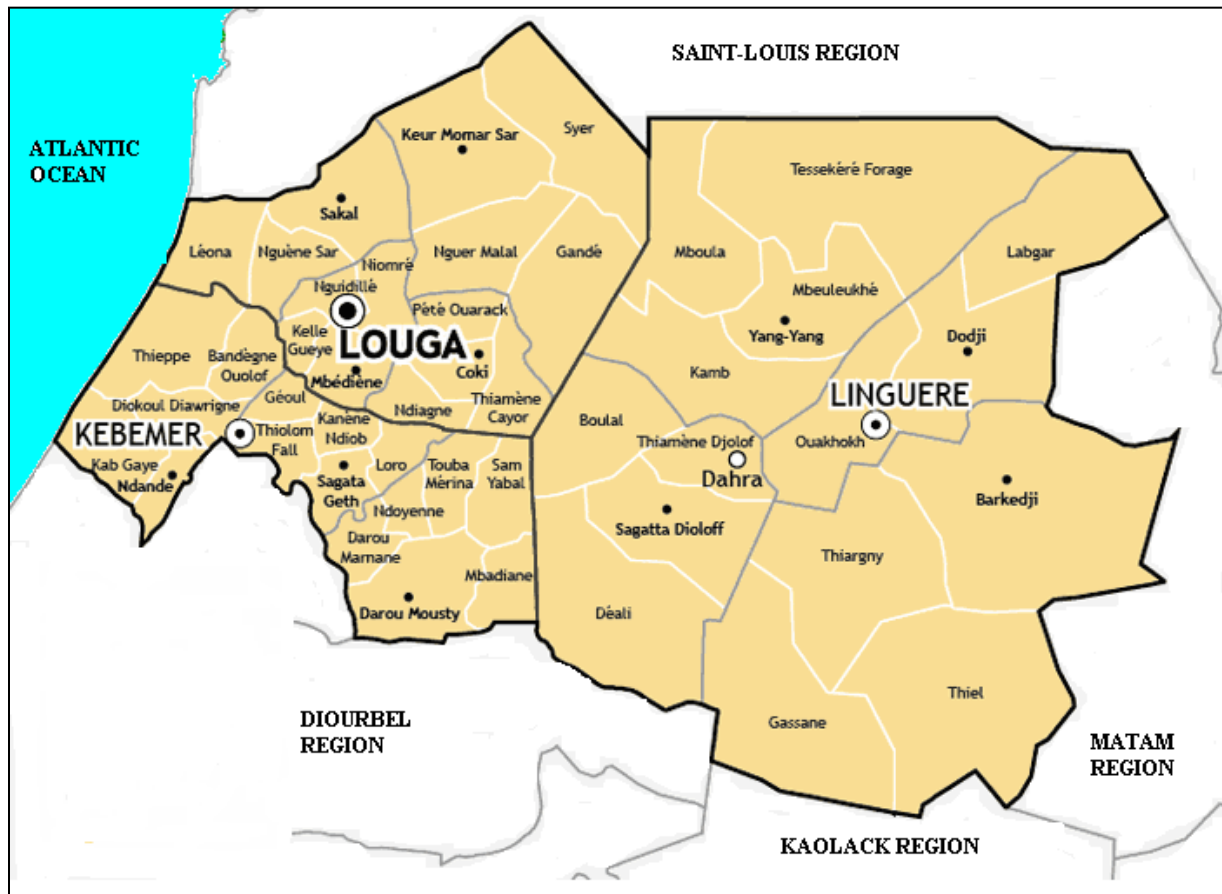
Brian K. Seavey and MCI

December 2009

432 Park Avenue South, 13th Floor, New York, NY, 10016, United States
Phone: +1-646-884-7422/7418; Fax: +1-212-548-5720
Website: www.earth.columbia.edu/mci

NB: This needs assessment was initially researched and prepared by Brian Seavy, who was assisted by Raphael Shaw during the field research. It was reviewed by MCI Social Sector Research Manager Dr. Moumié Maoulidi, together with MCI Co-Director Dr. Susan Blaustein and MCI summer intern, Anna Chang. Jessica Bailly assisted with initial editing.

Figure 1. Map of Louga Region showing Louga City



Source: ANSD, 2007

ACKNOWLEDGEMENTS

This report would not have been possible without the help of many talented people. In Louga, I would like to particularly thank Djibril Samb and his family for their consistent support. Also in Louga, I would like to thank the following individuals for their help: Dr. Mahamadou Traoré, at the Regional Medical Office; Mme. Fall, at the Mayor's Office; Mme. Arame Coumba Fall, at the Prefect's Office; M. Joseph Badji, at the Governor's Office; M. Samba Gueye, Dr. Sarr; Dr. Coulibaly, at the Centre Hospitalier Régional; M. Amadou Sakhir Mbaye; M. Omar N'doye, at *Keur Serigne Louga Est* Health Post, and finally, Mme. Thiayédia Ndiaye, at the Regional Statistic Office. The staff at the Millennium Village Project in Senegal, especially Drs. Diouf and Daff, were also amazing in their support. In New York, I would like to thank the staff at the Millennium Cities Initiative: MCI Co-Director, Dr. Susan Blaustein, Dr. Moumié Maoulidi as well as Janina Franco and Paulo Cunha. A complete list of every individual involved in this project can be found in Appendix II.

Figure 2. Map of Louga City (Commune de Louga)

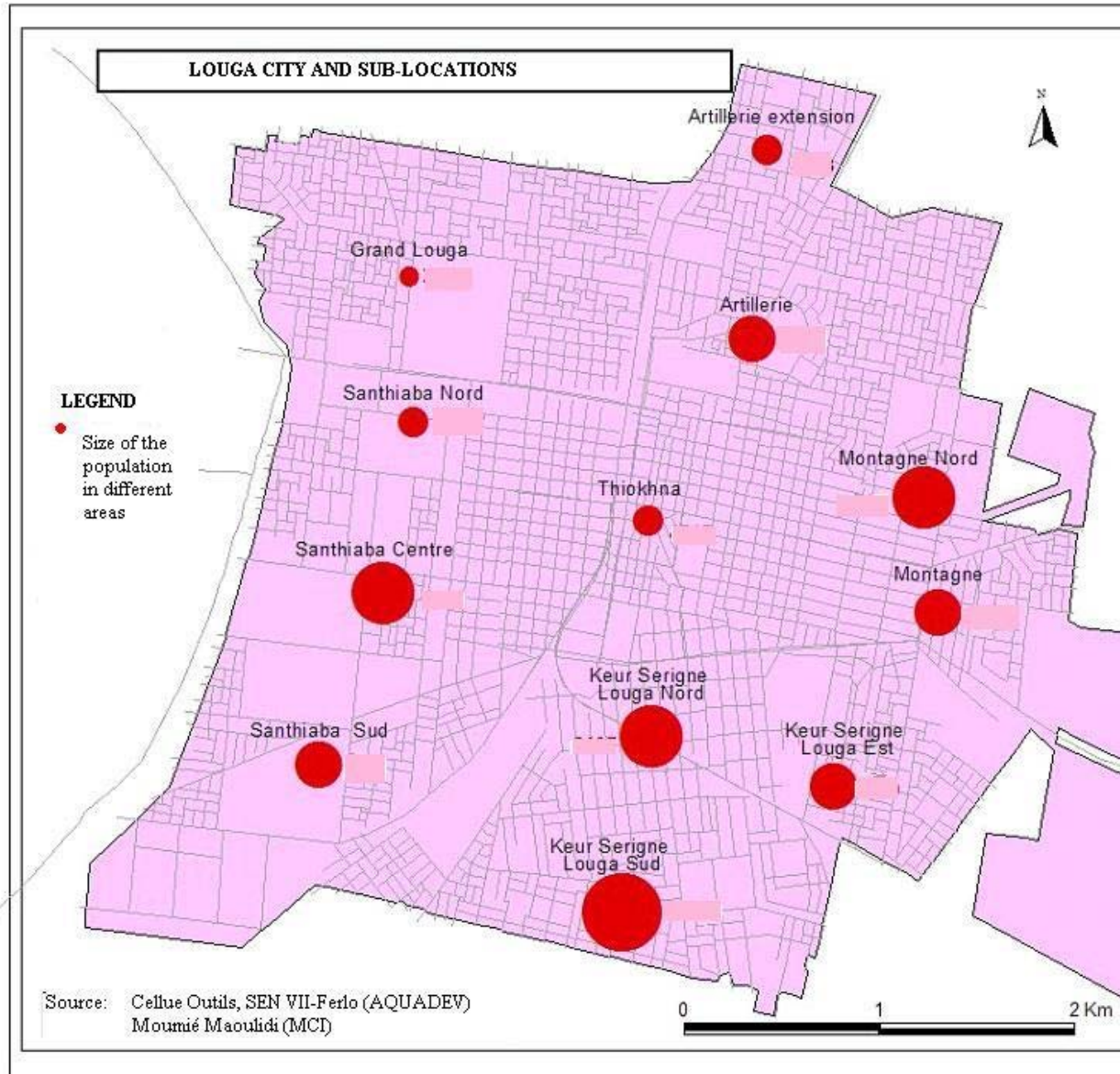


TABLE OF CONTENTS

ACKNOWLEDGEMENTS	3
ACRONYMS	7
EXECUTIVE SUMMARY.....	8
I. INTRODUCTION.....	10
1.1. Objectives	11
1.2. Methodology.....	12
1.3. Decentralization in Senegal	13
1.4. Limitations.....	13
II. DATA ANALYSIS	14
2. Health Services and Facilities	14
2.1. Health Facilities	14
2.2. Health Services	17
2.3. Human Resources.....	18
2.4. Community Health Promotion and Public Health Education.....	19
2.5. Relationship with National Government.....	20
2.6. Access to Care	21
2.7. Estimation of Health System and Human Resource Costs.....	22
3. Child Health.....	22
3.1. Childbirth Outcomes	22
3.2. Infant Mortality	23
3.3. Inoculations	25
3.4. Child Nutrition	26
3.5. Disease Burden, Children 0 – 5.....	27
3.6. Estimation of Child Health Care Costs.....	28
4. Maternal Health.....	29
4.1. Antenatal Care.....	29
4.2. Neonatal Care	30
4.3. Maternal Mortality and Emergency Obstetrical Care	31
4.4. Estimate of Maternal Health Care Costs.....	33
5. HIV/AIDS, Malaria and Other Diseases	33
5.1. HIV/AIDS	33
5.2. Tuberculosis	35
5.3. Malaria.....	36
5.4. Sexually Transmitted Diseases and Contraception Usage.....	38
5.5. Waterborne Diseases	40
5.6. Waterborne and Soil Transmitted Parasitic Infections	40
5.7. Estimation of Disease Care Costs.....	41
6. Summary of Health Care Costs, Louga 2008 – 2015.....	41
7. Note on Government Reform Plans and Future Projects	42
8. Critical Analysis of Needs Assessment at Municipal Level	43
III. CONCLUSIONS AND RECOMMENDATIONS	43
REFERENCES.....	45
Appendix I. Profiles of Senegal & Louga.....	48
Appendix II. Persons Interviewed.....	49

Tables

Table 1: Profile of Louga	11
Table 2. Health-Specific Millennium Development Goals and their Indicators	11
Table 3. Levels of Governance, Louga 2007.....	13
Table 4. Catchment Sizes for All Health Facilities in the City of Louga, 2007	16
Table 5. Comparison of health workforce density '.....	18
Table 6. Ratios of Health Facilities by Population	21
Table 7. Vaccination Program in Louga, 2008	25
Table 8. Vaccination Coverage in Louga and Senegal.....	25
Table 9. HIV Vulnerable Populations in Louga, 2008.....	35
Table 10. Classification of Sexually Transmitted Infections, Louga District.....	39
Table 11. Annual Per Capita Health Costs for Louga, 2010-2015.....	42

Figures

Figure 1. Map of Louga Region showing Louga City.....	2
Figure 2. Map of Louga City (Commune de Louga)	4
Figure 3. Map of Senegal with Louga Indicated	10
Figure 4. Cattle crossing in downtown Louga.....	11
Figure 5. Pyramid Structure of Senegalese Health System, with Louga Equivalent	15
Figure 6. Hospitalization Room at a Health Post in Louga.....	17
Figure 7. Educational Poster promoting infant vaccinations at the Health Center	19
Figure 8. Commodity Supply Chain, Senegal.....	20
Figure 9. Outcome of 5,048 Births in Louga, 2007.....	23
Figure 10. Time Trend Data of Infant Mortality in Senegal.....	24
Figure 11. Comparison of Mortality Rates, Louga Region and Senegal, 2005.....	24
Figure 12. Malnutrition Severity in Louga, 2007	26
Figure 13. Vitamin A Supplementation: Louga and Senegal, 2005	27
Figure 14. Infant Morbidity at Health Post Level: Children < 1 Year Old	27
Figure 15. Infant Morbidity at Health Post Level: Children 1-5 Years Old	28
Figure 16. Antenatal Consultations per Health Post, Louga 2007	29
Figure 17. Results from Antenatal HIV Testing at Louga Health Posts, 2007	30
Figure 18. Distribution of Delivery Complications, Louga 2007.....	32
Figure 19. HIV/AIDS Misconceptions among Louga (Region) Population, 2005.....	34
Figure 20. Malaria Prevention Behavior, Louga and Senegal 2005	36
Figure 21. Characterization of Fever Cases in the District of Louga, 2007	37
Figure 22. Seasonal Effect of Fever Cases in Louga, 2007	38
Figure 23. Female Contraception Usage, Region of Louga, 2005	39
Figure 24. Health care costs for Louga, 2010-2015	41

ACRONYMS

ACT	Artemisinin-based combination therapy
AIDS	Acquired Immunodeficiency Syndrome
AQ	Amodiaquine
AS	Artesunate
ASBEF	Association Sénégalaise pour le Bien-Etre Familial
CHARSM	Centre Hospitalier Régional Amadou Sakhir Mbaye
CNLS	Le Conseil National de Lutte contre le SIDA
DHS	Demographic Health Surveys
DMO	District Medical Officer
DOTS	Directly Observed Therapy
EmOc	Emergency Obstetric Care
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Syndrome
IPT	Intermittent Preventative Treatment
IRS	Indoor Residual Spraying
LLIN	Long Lasting Insecticide-Treated Net
MCI	Millennium Cities Initiative
MDFC	Movement of Democratic Forces of Casamance
MDG	Millennium Development Goals
MMR	Maternal Mortality Ratio
MSM	Men Who Have Sex With Men
MVP	Millennium Villages Project
NGO	Non-governmental Organization
PLHIV	People Living with HIV/AIDS
PMTCT	Prevention of Mother to Child Transmission
PMI	President's Malaria Initiative
PNR	Perinatal Mortality
RDT	Rapid Diagnostic Testing
RMO	Regional Medical Officer
SBR	Stillbirth Mortality Rate
SNIS	Service National de l'Information Sanitaire
STI	Sexually Transmitted Infections
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VSOS	Village d'Enfants SOS
WHO	World Health Organization

EXECUTIVE SUMMARY

The city of Louga, Senegal, represents one of 11 African cities participating in the Earth Institute at Columbia University's Millennium Cities Initiative (MCI). Complementing the already established Millennium Villages Project, the objectives of MCI are to help underserved sub-Saharan cities achieve the Millennium Development Goals (MDGs), attract foreign direct investment and design an urban development strategy that will result in economic growth and social sector improvements. With a population of just under 100,000, Louga is the smallest of the Millennium Cities; however, as a regional capital with strong economic ties to its rural surroundings, Louga epitomizes the situation in many sub-Saharan cities, serving, therefore, as an excellent and extremely telling model for the MCI.

The specific goal of this needs assessment was to examine the status of the healthcare system in Louga and to gather the information required to bring about change that will be beneficial to the health of the population. The three health-specific MDGs – to reduce child mortality, improve maternal health and combat HIV/AIDS, malaria and other diseases – acted as the criteria for determining progress. Data collection occurred from May – July 2008 in Louga and, to a much smaller degree, in Dakar. The needs assessment utilized local administrative records where possible, with regional and national data estimations employed only where necessary. The use of the UN-Millennium Project health costing tool allowed for a detailed cost projection, estimating the amount of financial investment required to assist the city of Louga in achieving the health-specific MDGs from 2010 - 2015.¹

Throughout the data collection process, limitations arose that may have affected the accuracy of the final results. Missing data from incomplete administrative records, lost archives and/or unconventional disease classification restricted the accuracy of certain indicators, such as infant mortality and malaria incidence. In these cases, national or regional estimates were incorporated into the analysis to achieve the best estimation of the actual health status in Louga. Data collection limitations may have resulted in overestimation or underestimating both the total burden on the city's health system as well as the costs associated with those interventions required to meet the MDGs by 2015.

¹ The costing instrument utilized in this needs assessment was developed by the UN Millennium Project (UN MP) Task Force on Health for use at the national level, to assist both beneficiary and donor governments in their efforts to assess the investment required to achieve the health-related Millennium Development Goals. Produced by the UN MP, under the direction Dr. Jeffrey D. Sachs, Special Advisor to then-UN Secretary General Kofi Annan and Director of Columbia University's Earth Institute, the MDG-based needs assessments for all relevant sectors are now administered by the MDG Support Team, Poverty Group, UN Development Programme (UNDP). MCI is currently applying four UN MP costing instruments at the municipal level for the first time, with the aim of informing the host and donor governments and interested development partners of the concrete gaps in realizing each Goal and the relative costs of filling these.

The results of this study characterize Louga as a city currently in the process of an epidemiological transition. While none of the health-specific MDGs have been met as of 2008, the current rate of progress suggests that achieving each of the Goals is feasible. MCI estimates that an annual per capita investment of about \$17 during the period between 2010 and 2015 is needed to reduce maternal and infant mortality and the rates of infection for HIV/AIDS, TB and malaria.

The maternal health target -- reducing maternal mortality by three quarters between 1990 and 2015 -- has the highest risk of not being achieved, with an inadequate frequency of antenatal consultations possibly a factor in the consistently high maternal mortality rates. Yet to achieve MDG 5, MCI believes, on the basis of its own costings, will require an investment of only \$0.66 per person per year between 2010 and 2015.

While local infant mortality data were uncertain, regional trends indicate that achieving MDG 4, the two-thirds' reduction in child mortality, will be possible in Louga before the 2015 deadline, given the even more modest investment of \$0.28 per person per year during the next five years.

MDG 6, the goal focused on reducing HIV, malaria and tuberculosis infection rates, can also be achieved, if \$1.74 per capita per year is invested to address these diseases. Given the many needs in the nation's capital and in other impoverished Senegalese regions, it will be a challenge to identify adequate donor support to actually meet these Goals in a short time period; nevertheless, the costs are low, and there is no good reason why the population of Louga should not achieve the health-related MDGs on schedule.

About 84 percent of the total per capita estimate for health (i.e. \$14.49 of the \$17.17 annual per capita cost) will pay for salaries, pre-service and in-service training sessions, facilities, transportation and communication equipment and commodity supply system.²

Organized into five main sections, this report provides a comprehensive assessment of the public health situation in Louga and the costs associated with achieving the MDGs before 2015. The first introductory section reviews necessary background information, methodology and limitations; next, a description of the Senegalese health care system provides a context for the critical elements of this report – the analysis of each health-specific MDG in Louga. Finally, concluding remarks synthesize the researcher's findings and present some final comments and recommendations.

² Note: The exact annual per capita cost is \$17.17. The per capita cost for human resources, facilities and commodity supply system is \$14.49.

I. INTRODUCTION

Senegal

Situated at the far western edge of the African continent, Senegal has historically served as a “gateway” to West Africa. After settlements by Portuguese and Dutch slave traders in the 15th and 16th century, the French had a strong colonial presence in the region until Senegal gained its independence in 1960. A country no bigger than South Dakota, Senegal sits at the confluence of the harsh Sahara desert and the lush tropical forests of Guinea. Advantageously, the Atlantic Ocean enables the existence of a seaport, ample fishing and the hope of offshore oil reserves. At present, the economy is



primarily supported by the agriculture and service industry; however, the country is also heavily reliant on foreign investment.

Unusually, Senegal completely surrounds the country of the Gambia, and the Casamance region of Senegal, just south of the Gambia, has been the site of occasional violent uprisings from members of the Movement of Democratic Forces of Casamance (MDFC), who have claimed their independence since 1990.

Figure 3. Map of Senegal with Louga Indicated

Louga

Despite being the smallest of the Millennium Cities, Louga is representative of many mid-sized African urban centers. The capital of a large agricultural region, Louga is a bastion for youth seeking employment. While the city does offer a small number of jobs in the aquaculture, artisanry and tourism sectors, most people can do little other than find work in the predominant agro-pastoral sector. This could change in the future, as Louga is a mere 35 kilometers from Potou and the Atlantic Ocean and 35 kilometers from the fishing district of Lompoul, both sites of underdeveloped fishing and tourism industries. Even with a significant level of unemployment, the people of Louga remain fiercely proud of their heritage and culture. The city is known throughout Senegal as the birthplace of Abdou Diouf, the second President of Senegal, and Djily M'Baye, who is generally considered one of the first millionaires in the country and also a great philanthropist who financed the construction of the local hospital, high school, market and mosque. Even with these generous donations for infrastructure, however, Louga remains entrenched in poverty. The high poverty index and paltry per capita income, as seen in Table 1, highlight the difficulties faced by the local population. The remainder of Table 1 provides a small selection of recent demographics for the city, with Appendix I providing a more detailed list; Figure 4 presents a common image seen even in the downtown area of Louga.

Table 1: Profile of Louga

Population (2007)	82,375
Population growth rate	2.8%
Percent under 20 years old	56.4%
Religion	Islam (99%), Christian/Other (1%)
Ethnicity	Wolof (72%), Peul (25%), Other (3%)
Poverty index	59%
Income/person (Senegal)	\$670/year ^{3,4,5.}



Figure 4. Cattle crossing in downtown Louga.

1.1. Objectives

The purpose of this project was to assess the state of public health in Louga with respect to the Millennium Development Goals (MDGs). The eight MDGs outline the steps needed to take in order to improve the standard of living among the world's poorest countries. Three of the eight MDGs directly address the health status of the population, particularly analyzing progress in the areas of child mortality, maternal health and the disease burden from HIV/AIDS, malaria, tuberculosis and others. Each MDG relies upon a number of indicators employed to provide a consistent method of measuring progress. Table 2 presents the health-specific MDGs and their relevant indicators.

Table 2. Health-Specific Millennium Development Goals and their Indicators⁶



Goal 4: Reduce Child Mortality

- Under-five mortality rate
- Infant mortality rate
- Proportion of 1-year-old children immunized against measles

³ Administrative records from the *Service Régional de la Statistique à Louga*.

⁴ ANSD (2007)

⁵ USAID Country Health Statistical Report, Senegal 2008.

⁶ <http://www.unmillenniumproject.org>



Goal 5: Improve Maternal Health

- Maternal mortality ratio
- Proportion of births attended by skilled health personnel



Goal 6: Combat HIV/AIDS, Malaria and other diseases

- HIV prevalence among pregnant women aged 15-24
- Condom use rate
- Percentage of population aged 15-24 years with comprehensive correct knowledge of HIV/AIDS
- Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14
- Prevalence and death rates associated with malaria
- Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures
- Prevalence and death rates associated with tuberculosis
- Proportion of tuberculosis cases detected and cured under DOTS

In Senegal, as in all sub-Saharan Africa, there is a large disparity in health between rural and urban communities. While rural communities in Africa are usually worse off when it comes to health outcomes, this is not always the case, particularly with infectious diseases such as HIV. Despite the recent influx of rural populations into regional cities, little attention has been paid to urban health on the continent. This project will analyze the health situation in the city of Louga, in order to assess the progress already realized and to ascertain the unfulfilled goals that must be targeted before the 2015 deadline.

1.2. Methodology

In order to obtain a comprehensive evaluation of the health system in Louga, this study includes the results of many interviews with local officials, stakeholders and experts carried out between May and July 2008. Data collection through direct contact enabled a personal relationship to be established, facilitating future collaborations and bolstering the understanding of MCI's development strategy. Input from national level representatives was minimal; however, two separate visits to Dakar were necessary for administrative protocol and to gather background information on the Senegalese health system.

All data collected in this report is cited, either in the text or in the relevant figure or table. Since local officials report only departmental data to the Ministry of Health, information pertaining specifically to the city of Louga was not easily obtainable (see the following section for a more detailed description of this decentralization). Therefore, most disease incidence and child health data were calculated after a careful aggregation of Louga city public health posts only. Records from the health center and hospital were incomplete and therefore not applied to disease incidence. This is unfortunate, but not

devastating, as most residents visit the health posts for their primary care needs. Maternal health data came from the public maternities located in the city. Any citation of “administrative records” throughout the paper refers to data collected from local authorities and is available upon request. A complete list of contact details corresponding to all of the interviews of Louga officials conducted for this report is provided in Appendix II; all additional citations are found in Appendix III.

1.3. Decentralization in Senegal

Decentralization in Senegal has resulted in a hierarchal system of governance with authority concentrated at the national level, followed by the region, department, and finally the commune (either urban or rural). There are 14 health regions and 65 health districts in Senegal. As MCI’s aim is to “assist mid-size cities across sub-Saharan Africa in their efforts to achieve the Millennium Development Goals,” this project has concentrated on characterizing the public health situation in the city of Louga.⁷ Unfortunately, national standards require all data to be aggregated at either regional or departmental levels; however, neither the region nor the department accurately represents the commune of Louga. Within the department, 73.2 percent of the population lives in rural areas.⁸ Since data for the commune were occasionally unavailable to this researcher, departmental or regional data were applied wherever possible in order to estimate the true value. Table 3 details the differences between the various levels of governance and suggests a level of confidence for the estimations.

Table 3. Levels of Governance, Louga 2007

	Region	Department or District	Commune or City
population	770,657	312,121	82,375
% urban	18.4%	26.8%	~100%
accuracy of estimation			
	low		high

Source: ANSD (2007)

1.4. Limitations

The indisputable and most significant limitation to success in this project was missing data. Nowhere were missing data more prevalent than when looking for old records to be used in time trend analysis. All pre-2007 data at the health center could not be retrieved. The lack of an historical record of health indicators was particularly disappointing, since the health-specific MDGs measure progress as a function of improvements in health since 1990. For example, the MDG target for maternal health is

⁷ <http://www.earth.columbia.edu/mci>

⁸ ANSD (2007)

a three-fourths' reduction in the maternal mortality rate from 1990 to 2015.⁹ Regional or national data obtained from Demographic Health Surveys (DHS), conducted in 1986, 1992, 1997, 1999 and 2005 in Senegal, compensated for missing data when possible.¹⁰

Troubles with missing data were not limited to historic records; even in 2007 there was a serious lack of data available. The 2006 report from Senegal's national health statistic office (*SNIS – Service National de l'Information Sanitaire*) found that reporting levels in the region of Louga were only at 25-49 percent.¹¹ This same behavior was echoed at the district level, with health posts in the city of Louga having only a 76 percent completion rate for health records in 2007.¹² Little effort is made by authorities to follow up on health posts that fail to report their monthly records, and national calculations of health statistics are often performed without taking such lapses and inaccuracies into account.

Other problems with data collection result from the reality that, at the health post level, authority is designated solely to the chief nurse, despite nurses' lack of training in many administrative tasks, including data management. Furthermore, with only one nurse assigned to each health post, any absences from the post often result in a complete breakdown of not only data collection, but also, more importantly, of health service provision.

The effects of under-reporting and poor data collection are, unfortunately, unavoidable in this report. An analysis of Louga's MDG-related health status will be incomplete until the necessary missing data are obtainable. Using regional or national data as a temporary solution fails to accurately illustrate the local conditions, even if these are the best available approximations. Moreover, missing data negatively impact the results of the MDG Health Costing tool, often underestimating the total costs for the city. Therefore, the findings presented in this report should be regarded solely as estimations which, while accurate and based on local public records, would nevertheless benefit from additional research.

II. DATA ANALYSIS

2. Health Services and Facilities

2.1. Health Facilities

Decentralization of the health system in Senegal has resulted in a pyramid structure of authority. The first level of decentralization is the region, with each region in Senegal further divided into districts roughly corresponding to the local departments. The districts receive funding directly from the Ministry of Health, and each is autonomous

⁹ <http://www.unmillenniumproject.org>

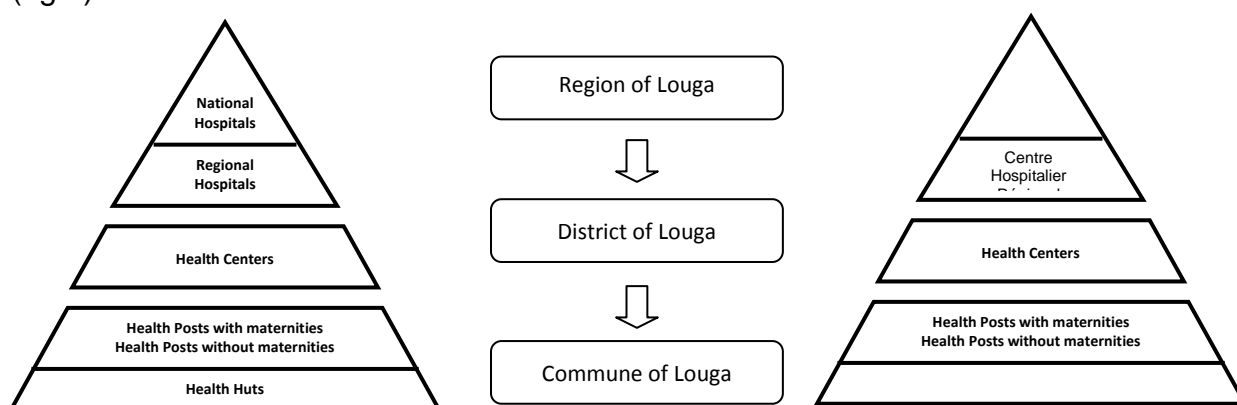
¹⁰ <http://www.measuredhs.com>

¹¹ MSPM (2007)

¹² Administrative records from the health center and health posts.

control over its management.¹³ Each district contains many health posts (*poste de santé*) that serve the primary care needs of the community. In remote rural areas, “health huts” (*cases de santé*) operated by volunteer health workers serve to provide basic primary care. At the heart of each district is the health center (*centre de santé*), which acts as the referral center for the community and a major provider of childbirth services, as not all health posts contain maternity facilities. Each region in Senegal also contains a regional hospital that provides additional referral care but limited primary care services. The Senegalese Ministry of Health displays the national health system as the pyramid structure displayed on the left side of Figure 5.¹⁴ The situation in Louga is displayed on the right side of the figure, to show the existing facilities in the region.

Figure 5. Pyramid Structure of Senegalese Health System, with Louga Equivalent (right)



Source: <http://www.sante.gouv.sn>.

Much the same as in other urban settings in Senegal, the population of Louga city is completely covered by all levels of health care. In 2007 there were eight health posts in the city, four of which were private (*PS VSOS, Mission Catholique, ASBEF, and Yerlandé*). Among the four public health posts, two had operational maternity wards, *PS Keur Serigne Louga Ouest* and *PS Santhiaba*. Between the remaining two public health posts, *PS Croix Rouge* was without a maternity ward, and *PS Keur Serigne Louga Est* had a recently built unit that was not yet operational. In 2008 an additional public health post (without a maternity facility) was constructed, *PS Artillerie*. Future investment in the health facilities of Louga should look at properly equipping the maternity at *Keur Serigne Louga Est*, as well as build maternity wards at both health posts that currently lack them, *PS Croix Rouge* and *PS Artillerie*.

The district of Louga also contains one health center that provides referral care for the entire district of Louga, an area comprised of Louga City and 15 rural communities (pop.

¹³ MSPM (2006b) «Manuel National de Strategies sur la Reference et la Contre Reference».

¹⁴ <http://www.sante.gouv.sn>.

312,121 in 2007), with a total of 165 health structures.¹⁵ The *city* of Louga is comprised of only eight health posts and is therefore a small percentage of the health center's total catchment. The health center is also responsible for sharing some of the primary care burden of the city residents. The complete distribution of primary care catchment is outlined below in Table 4.

Table 4. Catchment Sizes for All Health Facilities in the City of Louga, 2007

Facility Name		Catchment Size
Public	Centre de Santé	6981
	PS Croix Rouge	4343
	PS Keur Serigne Louga EST	6045
	PS Keur Serigne Louga OUEST	18154
	PS Santhiaba	23110
Private	PS VSOS	3811
	Mission Catholique	4818
	ASBEF (Association Sénégalaise pour le Bien-Etre Familial)	4343
	Yermandé	11279
PUBLIC		58633
PRIVATE		24251
TOTAL		82884

Source: Administrative records from the health Center and health posts

From Table 4, we can see that private facilities accounted for 29 percent of all primary care coverage in 2007, a value that has since decreased to 22 percent, with the 2008 construction of *PS Artillerie*, the additional public health post. Whereas public facilities are standardized with regard to the health services they provide, private facilities are autonomous and can specialize the care they offer. For example, ASBEF (*Association Sénégalaise pour le Bien-Etre Familial*) specializes in providing reproductive health care, and PS VSOS concentrates on child health care. With the MCI focusing on public facilities, the remainder of this report will concentrate solely on the public health facilities in the city of Louga.

Referral care is conducted at either the health center or the regional hospital, the *Centre Hospitalier Régional Amadou Sakhir Mbaye (CHRASM) de Louga*, which services the entire region (pop. 770,657 in 2007).¹⁶ Originally built in 1983, the hospital was recently rehabilitated in 2003. Since 1989, the hospital has acted as an autonomous public establishment, meaning that most of its financial and administrative decisions are made independently of the Ministry of Health. Therefore, there is very little collaboration between the district and regional health offices and the hospital.

¹⁵ 1 health center, 28 public health posts, 7 private health posts and 149 health huts.

¹⁶ Administrative records from the *Service Régional de la Statistique à Louga*.

2.2. Health Services

The majority of primary care services are administered at the health posts. General consultations, family planning, malaria treatment, growth monitoring and basic child health care are all available after a nominal consultation fee (200 Fcfa, approximately \$0.50).¹⁷ Antenatal care and child vaccinations are available and provided free of charge. Additional services, such as vitamin A supplementation, STI treatment and tuberculosis treatment (DOTS), are also available at all health posts, but not commonly taken advantage of, with most of the population preferring to visit the health center for those services. Health posts with maternities are staffed by both state-trained and traditional midwives, providing skilled birth attendants and postpartum care for all deliveries. Any cases involving complications at delivery are evacuated to the health center or hospital.

Figure 6. Hospitalization Room at a Health Post in Louga.



Note the lack of window screening, mosquito nets and the overall unsanitary conditions.

Primary care services are also available at the health center in Louga; however, with higher consultation fees (1000 Fcfa, approximately \$2.50), most patients arrive at the health center seeking referral care.¹⁸ Severe diarrhea and complicated acute respiratory conditions, fever and malnutrition are all treated at the health center. With a laboratory on site, multiple tests, such as HIV, tuberculosis, syphilis and malaria, can be performed. The maternity ward provides care for more complicated deliveries than maternities at the health post, such as prolonged labor, hypertensive disorders, postpartum hemorrhage and post-abortion complications. As previously mentioned, the city of Louga only comprises nine of the 164 health structures under the umbrella of the health center; therefore city residents have far greater access to referral care than patients hailing from rural areas.

With high consultation fees in addition to an entrance fee levied at the door, the Amadou Sakhir Mbaye Hospital limits the burden of primary care, specializing instead in referral care. The hospital routinely receives patients with severe conditions from the health center and surrounding health posts. Specialists on site, including a surgeon, gynecologist, orthopedist, dermatologist, urologist, radiologist, ophthalmologist and dental surgeons, distinguish this hospital as the sole public provider of these services in

¹⁷ Interview with nurse at a health post.

¹⁸ Interview with nurse at the health center.

the region. With approximately 130 beds, the hospital is also equipped to service long-term hospitalizations, and the average hospital stay in 2007 was 4.74 days.¹⁹ Unfortunately, national data for the average length of stay at hospitals were not available.

2.3. Human Resources

As in most sub-Saharan countries, Senegal suffers from an inadequate number of health care workers. As a regional capital, Louga benefits from access to both the health center and regional hospital, which greatly increases the density of physicians, nurses and midwives available to the population, especially when compared to the national averages.²⁰ However, as shown in Table 5, the distribution of health care workers in Louga still lags significantly behind WHO standards.

Table 5. Comparison of health workforce density^{21,22}

	WHO Standards	Senegal (2006)	City of Louga (2007)
population per doctor	5,000 - 10,000	19,000	11,802
population per nurse	300	8,000	1,222
WRA per qualified midwife	300	12,000	710
WRA per midwife (including traditional)	355

... : Data not available or not applicable

Source: Manuel National de Strategies sur la Reference et la Contre Reference, 2006 and Administrative records from the health center and hospital.

Every health post in Louga is staffed with one qualified nurse who serves as the technical and administrative supervisor. Working under the head nurse are two primary health care workers, a pharmaceutical technician and one support staff responsible for cleaning and various errands. Furthermore, if the health post contains a maternity ward, it is staffed with one qualified midwife and four traditional midwives, in addition to the core personnel.

Responsible for the entire district of Louga, the health center has a larger staff of approximately 100 employees, including two physicians, nine certified nurses and two laboratory technicians. The maternity ward has eight certified and 15 traditional

¹⁹ Administrative records from the hospital.

²⁰ MSPM (2006b) «Manuel National de Strategies sur la Reference et la Contre Reference»

²¹ Ibid.

²² Administrative records from the health center and hospital.

midwives, and there are an additional 28 primary health care workers at the health center to provide further assistance. The support staff, consisting of 33 persons, is responsible for upkeep of the complex. Despite this large number of personnel, the demand for services is high enough to severely strain the health center. Moreover, physicians in Senegal assume the role of facility administrator and therefore must devote large amounts of time to running the center, in addition to attending to the patients.

Not surprisingly, the hospital contains the largest workforce among the facilities in the city, with over 200 employees. However, only 92 employees are skilled health workers, including at least 14 doctors and over 40 nurses. As an autonomous public establishment, the hospital has a large number of employees devoted to accounting and administrative tasks. The remainder of the workforce is made up of unskilled support staff, such as drivers, cleaners and guardians.

2.4. Community Health Promotion and Public Health Education

The office of public health promotion (Bureau EIPS), located at the health center, coordinates most of the community health promotion programs in the district of Louga. The office uses a diverse selection of interventions to educate the public. For example, in 2007 there were 434 educational discussions, 12 radio emissions, 48 community meetings and five video projections.²³ In addition, the office serves as the focal point for the dissemination of materials provided by foreign organizations, such as the poster seen at a local health post shown in Figure 7. Another important task of the office is the distribution of condoms, and in 2007 alone 67,636 male and 794 female condoms were given out to the community.²⁴

Figure 7. Educational Poster promoting infant vaccinations at the Health Center ²⁵



²³ Interview with director of EIPS Bureau.

²⁴ Administrative records from Bureau EIPS, at the health center.

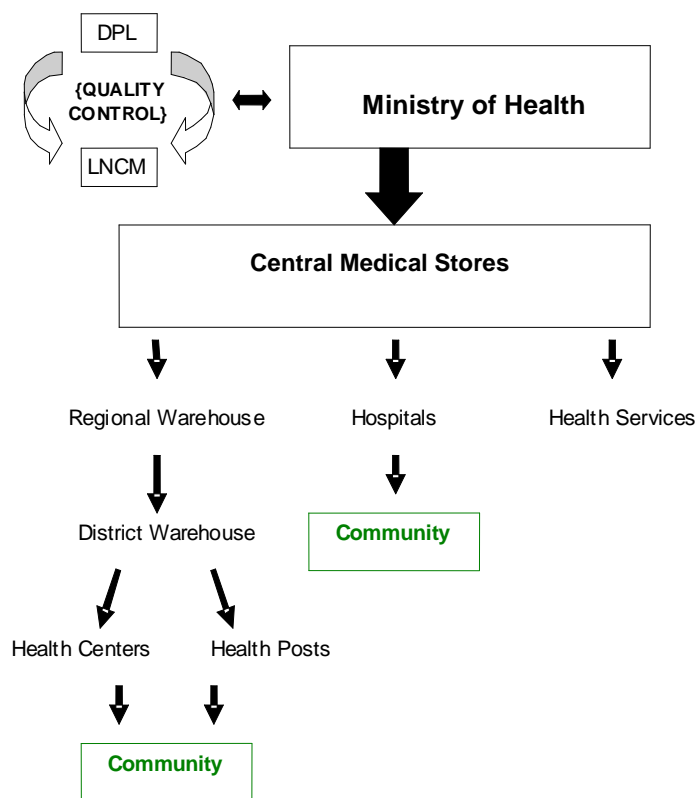
²⁵ Poster at the Health Center in Louga.

Concentrating predominantly on HIV/AIDS prevention, the National Council for the Fight Against AIDS (CNLS) is a very active provider of public health education. A dynamic state-operated organization, CNLS conducts programs to reduce stigmatization toward people living with HIV/AIDS (PLHIVs), raise awareness of HIV and help reinforce the capacity of PLHIV associations. In addition, CNLS partners with the Centre ADOS in Louga, an association of adolescents, to train HIV peer educators who interact with the community and to promote safe-sex practices.

2.5. Relationship with National Government

The primary point of contact between the Ministry of Health and the population of Louga is the regional medical officer (RMO). To transfer information to the health posts in the city, the RMO communicates directly with the district medical officer (DMO) at the health center. This chain of command is identical for all regions in Senegal. Since Louga is the capital of the region, both the RMO and DMO are located in the city, and the dissemination of information is a relatively rapid process.

Figure 8. Commodity Supply Chain, Senegal²⁶



The distribution of pharmaceuticals from national headquarters to health centers and health posts in the city of Louga follows the commodity supply chain diagram presented

²⁶ President's Malaria Initiative, Malaria Operational Plan FY07: Senegal.

in Figure 8, which was adapted from a USAID report on the President’s Malaria Initiative in Senegal.²⁷ The Ministry of Finance first allocates resources to the Ministry of Health for the purchase of pharmaceuticals. After undergoing a quality control check from national laboratories and review boards, the drugs are then distributed to the central medical stores, which are responsible for the delivery of drugs to the regional level. Officials from the district level approach the regional warehouses and purchase pharmaceuticals for their district, keeping them stored at a district warehouse. Once at the district level, the individual health posts and health centers are responsible for purchasing their respective pharmaceuticals on an as-needed basis, directly from the district warehouse. This system does not apply to hospitals, such as *Amadou Sakhir Mbaye* of Louga, which follow a separate supply chain, purchasing their required pharmaceuticals directly from central storage facilities in Dakar.

2.6. Access to Care

The conventional problems involving access to care in Senegal are not as prevalent in the urban setting of Louga. As seen in Table 6, due to Louga’s status as regional capital, the entire population is located near both a health center and hospital. According to 2008 data, the city fell in line with national standards for health facility densities, developed by the *Programme de Développement Intégré de la Santé* (PDIS), and easily performed better than the national average. Be that as it may, the city of Louga still falls short of WHO standards with respect to the number of health centers per population.

Table 6. Ratios of Health Facilities by Population

	WHO Standards	PDIS Guidelines	Senegal (2006)	Louga* (2007)	Louga* (2008)
people per health post	10,000	10,000	11,992	10,327	9,392
people per health center	50,000	150,000	167,361	82,613	84,529
people per hospital	150,000	one per region	517,297	82,613	84,529

*Including public and private facilities.

Source: MSPM (2007), *Annuaire Statistique 2006*

Although the residents of Louga live in close proximity to health facilities, they still face many difficulties in accessing health care. The health post *Keur Serigne Louga Ouest* contains a functioning and well-staffed maternity ward; however, the midwife does not have lodging at the facility and must return to her residence each evening.²⁸ Therefore, the population serviced by the health post is aware that the maternity ward is not open

²⁷ Ibid.

²⁸ Interview with midwife at *KSL Ouest* health post.

at all hours, and as a result, women do not use any of its services, leading to the overcrowding of the surrounding health posts. One other health post, *Keur Serigne Louga Est*, recently benefited from international funding and has a newly built maternity unit on site. However, the facility was not adequately equipped and currently lies inoperative while authorities feud over who bears responsibility for procuring future funding.²⁹

There are additional systematic concerns that hinder the population's access to care. There is only one qualified nurse per health post, which presents a problem to the care-seeking population whenever he/she is unavailable. In addition to sickness, in-service trainings and personal leave, it is not uncommon for the chief nurse to take a month of vacation throughout the year, rendering the health post incapacitated for that time. These conditions serve only to exacerbate the population's (already existing) distrust of the local health care workforce, leaving them to seek referral care for primary care needs at the hospital, or even as far as Dakar, if financially possible.

2.7. Estimation of Health System and Human Resource Costs

Using the MDG Health Costing Tool, health system and human resource costs for the city of Louga were obtained for 2010 – 2015. Per capita cost for human resources, facilities and commodity supply for the period 2010-2015 were on average \$14.49 per year.³⁰ Costs for human resources and health facilities are responsible for the majority of the total fiscal burden. While health facility costs represent less than a fourth of the total health system costs, essential gaps in the data collection likely resulted in an underestimation of their true costs. For example, the costs of building, rehabilitating and upgrading a health center were not found, and, as fairly large facilities, would likely represent a significant portion of the total health facility costs. However, it is also true that, on the human resources side, no pre-service training was included in the overall cost estimation, so it is conceivable that the distribution of health system costs might not change appreciably from the initial cost estimates.

3. Child Health

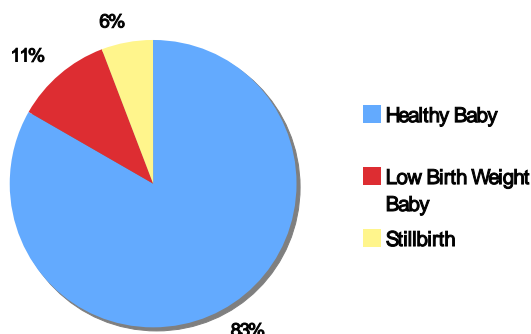
3.1. Childbirth Outcomes

An aggregation of maternity data from hospital, health center and health post records yielded the following analysis of the birth outcomes in Louga.

²⁹ Interview with nurse at *KSL Est* health post.

³⁰ MDG Health Costing Tool.

Figure 9. Outcome of 5,048 Births in Louga, 2007



Source: Administrative records from health center, hospital and health posts

From the data presented in Figure 9, we can calculate that the stillbirth rate (SBR) is 58.8 deaths per 1,000 live births, which is more than double the estimated 2006 SBR by the WHO.³¹ With an additional six child deaths recorded in the first seven days after birth, the prenatal mortality rate (PNR) is estimated at 60 deaths per 1,000 live births, which is still higher than the 2006 WHO estimate of 49 deaths per 1,000 live births.³² Since SBR and PNR values are often elevated in rural areas in comparison to urban settings, it is disconcerting to observe a PNR in an urban enclave such as Louga easily surpassing the national average.

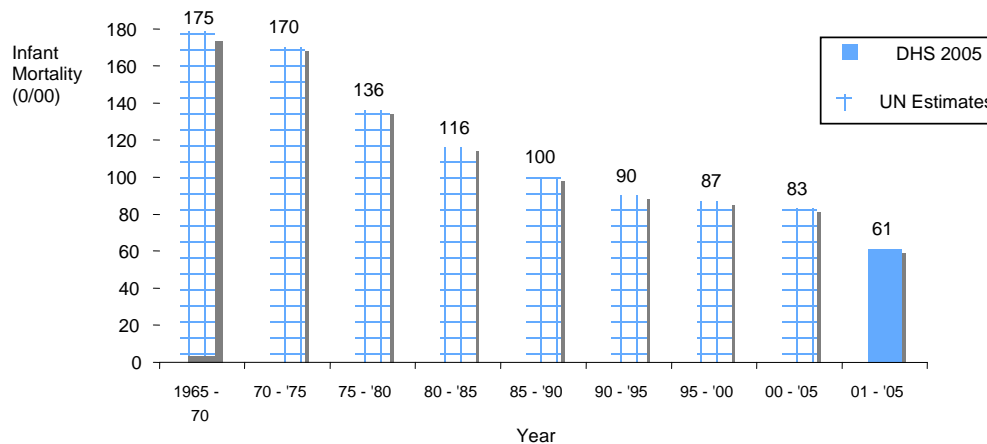
3.2. Infant Mortality

Infant mortality data for the city of Louga are exceedingly difficult to obtain. Local officials reported zero deaths for the entire district of Louga in 2007 among children ages seven days to five years; however, with an estimated 11,236 children under a year living in the district, this figure must be questioned. An estimation of the infant mortality rate (IMR) can be achieved after looking at the national data, shown in Figure 10.

³¹ Neonatal and Perinatal Mortality: Country, Regional and Global Estimates. WHO, 2006.

³² Ibid.

Figure 10. Time Trend Data of Infant Mortality in Senegal³³

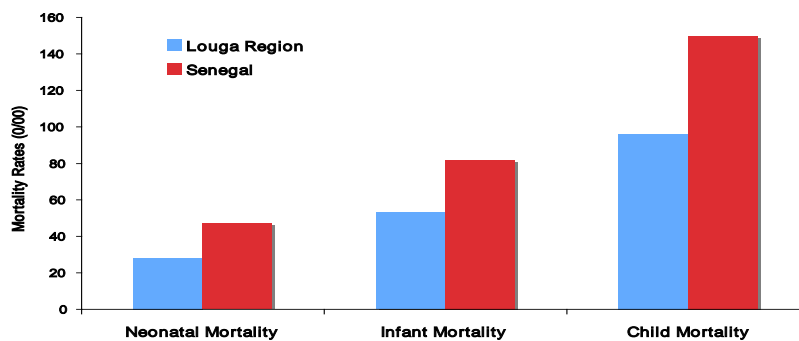


Source: The Population Council, Inc. (2007)

The figure displays an encouraging sign: infant mortality rates have steadily declined over the past 40 years. The one-third decrease since 1990 is in harmony with the necessary two-thirds decrease by 2015 required to meet the Millennium Development Goals. However, the national data presented in Figure 10 may not be indicative of the situation in Louga. With a calculated PNR of 60, common sense suggests that an IMR of 61, the latest national estimate, would be extraordinarily difficult to obtain.

While time trend data are not available for Louga, DHS provides neonatal, infant and child mortality rates for the region of Louga. Presented in Figure 11, the data correspond to mortality rates over the 10 years leading up to the 2005 survey. From this figure we can see that the region of Louga outperforms the national average in each mortality indicator. Such improvements over the national average should not be overstated, however, as the northern regions in Senegal typically have much better mortality outcomes than the southern regions, which can sometimes have twice the incidence of IMRs (DHS, 2005).

Figure 11. Comparison of Mortality Rates, Louga Region and Senegal, 2005



Source: Senegal DHS (2005)

³³ Senegal: *Enquête Démographique et de Santé, 2005.*

3.3. Inoculations

An effective vaccination program is essential in Louga to curtail the high rates of infant mortality. Currently, all children born in Senegal follow the same vaccination schedule, as detailed in Table 7.

Table 7. Vaccination Program in Louga, 2008

	Birth	6 weeks	10 weeks	14 weeks	9 months
Shot	Polio-0	Polio-1	Polio-2	Polio-3	VAR
	BCG	Penta-1	Penta -2	Penta-3	VAA
Diseases Covered	Poliomyelitis	Poliomyelitis	Poliomyelitis	Poliomyelitis	Measles
	Tuberculosis	Diphtheria	Diphtheria	Diphtheria	Yellow Fever
		Tetanus	Tetanus	Tetanus	
		Whooping Cough	Whooping Cough	Whooping Cough	
		Hepatitis B	Hepatitis B	Hepatitis B	
		HIB Infections	HIB Infections	HIB Infections	

Source: Interview with the director of vaccination at the health center.

It is difficult to accurately calculate vaccination coverage for the city of Louga. Inoculations are available at health posts and the health center; however, patients at the health center routinely come from the surrounding villages. Therefore, estimations of the vaccination coverage in the city are inflated, as seen in Table 8, with the true value more likely to resemble the vaccination coverage for the district.

Table 8. Vaccination Coverage in Louga and Senegal

Vaccine	City of Louga (2007)	District of Louga (2007)	Senegal (2004)	Senegal (2000)	Senegal (1990)
DPT 1-3	120%	82%	87%	52%	51%
Polio 1-3	120%	82%	87%	49%	53%
HepB 1-3	120%	82%	0%	0%	0%
Measles	109%	78%	57%	48%	51%
BCG	141%	92%	95%	89%	90%
Yellow Fever	105%	73%	78%	34%	0%

Source: Administrative records from the health post; WHO Immunization Summary (2007); WHO (2005)

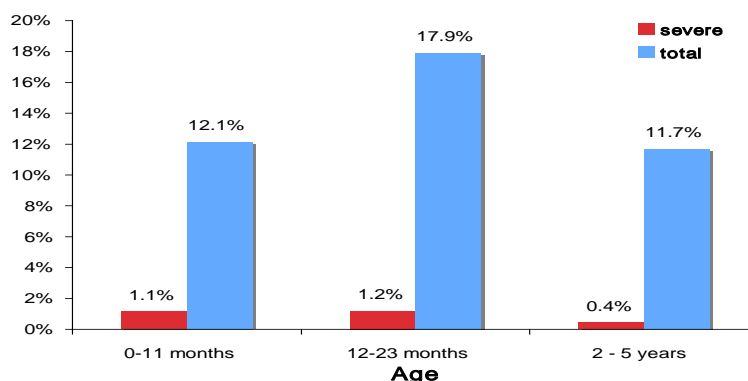
Less than satisfactory vaccination coverage rates in the district of Louga are not likely to be due to problems of access, as all residents are in close proximity to a service providing health facility. More probable limiting factors include 1) the continued lack of understanding among the populace of the necessity of vaccines, and/or, in a more likely scenario, 2) the populace does not prioritize inoculations due to competing stressors. Fortunately, as confirmed by the time trend data in Table 8, public education programs

have been effective, with vaccination rates having climbed tremendously over the past 20 years. However, there remains a small percentage of the population that does not seek vaccination.

3.4. Child Nutrition

Responsible for 5-10 percent of all infant cases seen at urban health posts, malnutrition represents a serious problem for children living in Louga.³⁴ An examination of administrative records, displayed here in Figure 12, reveals that severe malnutrition only affects a small percentage (~1 percent) of the child population. However, as also exemplified in the figure, there is a much larger problem of simple chronic malnutrition in the district, with close to 20 percent of the 1-2 year olds affected. This number is arguably an underestimate, moreover, as only children receiving routine check-ups were examined. While not confirmed, it may be assumed that many of the children not receiving routine check-ups come from low-income families that do not seek out health care services, and therefore, are more likely to be malnourished. With nutrition so intimately associated with health outcomes, simple malnutrition that can be easily treated should be targeted for public health interventions.

Figure 12. Malnutrition Severity in Louga, 2007



Source: Administrative records from the health center.

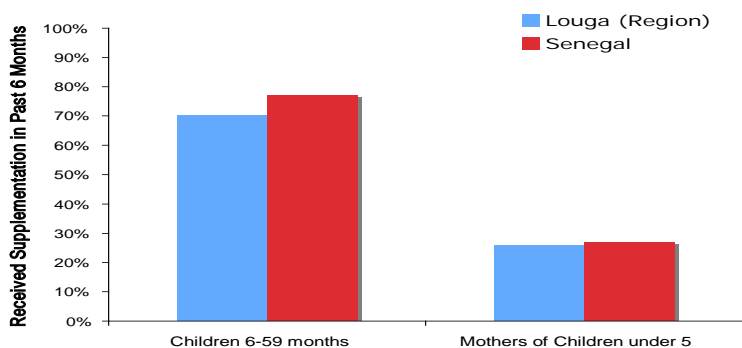
One intervention currently employed to combat severe malnutrition is vitamin A supplementation. While data reporting vitamin A supplementation coverage rates in the city of Louga are unreliable due to significant under-reporting at the health post level, DHS data from 2005 show the region of Louga at about 70 percent for children aged six months to five years.³⁵ As shown in Figure 13, this coverage rate lags slightly behind the national average of 77 percent. Vitamin A supplementation coverage rates for mothers of children are poor, albeit consistent with national averages, at 25 percent. Recognized by the WHO as an invaluable method of reducing infant mortality and

³⁴ Administrative records from health posts.

³⁵ Senegal: *Enquête Démographique et de Santé, 2005*.

fortifying the quality of breast milk, vitamin A supplementation coverage rates should be increased in Louga.³⁶

Figure 13. Vitamin A Supplementation: Louga and Senegal, 2005

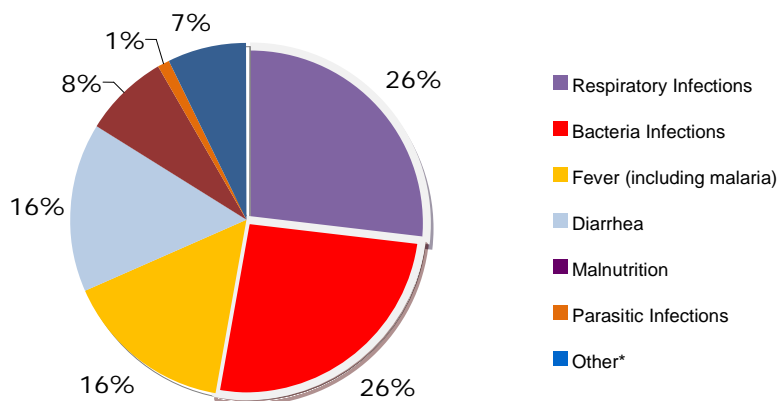


Source: Senegal DHS (2005)

3.5. Disease Burden, Children 0 – 5

The four principal health problems affecting children and diagnosed at health posts in the city of Louga are respiratory infections, bacteria infections, fever and diarrhea.³⁷ These four maladies alone represent over 80 percent of Louga’s total child disease burden at the health post level, as seen in Figure 14. It is important to note that in this diagram, the designation, “*respiratory infections*” includes influenza; “*diarrhea*” includes dysentery; “*fever*” includes malaria, and “*bacteria infections*” include oral, ear and skin infections. The category denoted as “*other*” includes anemia, angina, asthma, sexually transmitted diseases, chickenpox, dental, heart and unknown conditions.

Figure 14. Infant Morbidity at Health Post Level: Children < 1 Year Old



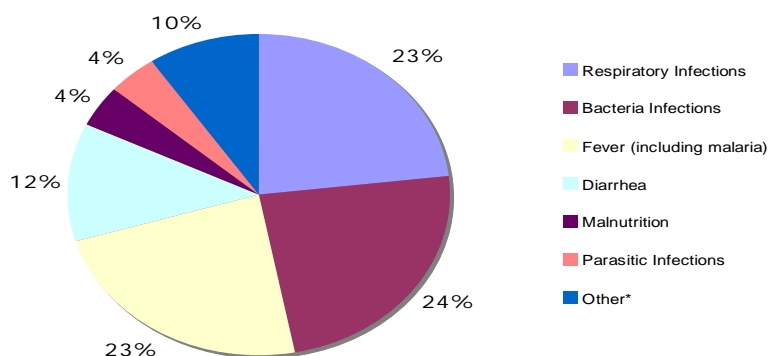
*Includes: anemia, angina, asthma, STIs, varicella, dental, heart and unknown conditions

Source: Administrative records from health posts.

³⁶ Vitamin A Supplementation, WHO Immunizations, Vaccines, and Biologicals, 2003.

³⁷ Administrative records from health posts.

Figure 15. Infant Morbidity at Health Post Level: Children 1-5 Years Old



*Includes: anemia, angina, asthma, STIs, varicella, dental, heart and unknown conditions

Source: Administrative records from health posts.

As evidenced from the data presented in Figures 14 and 15, the shift in disease burden among children as they age is subtle. Noticeable in the two pie charts are the significant decrease in diarrhea cases, and increase in fever cases in the Louga children over time. Moreover, parasitic infections increase fourfold as the children age. As explained in section 5.6, most of these parasitic infections are due to Helminthiasis originating in the soil and could be explained simply by the increase in mobility among children without shoes whose skin is exposed to the soil.

3.6. Estimation of Child Health Care Costs

Child health care costs were calculated using the MDG Health Costing Tool.³⁸ To meet child health targets during the period between 2009 and 2015, Louga will need an average per capita cost of \$0.28 per annum. By far the largest share of costs for children under one year can be attributed to bacterial infections, with 94 percent of those costs coming from referral care. Referral costs for diarrhea care were minimal, even though primary care diarrhea costs exceeded those associated with all other diseases.

The estimated cost of child health care may be an underestimate of the true costs associated with treating Louga's child population, for the reason that only data from public institutions were incorporated in the costing model, even though private institutions do account for a significant percentage of care in Louga. To the extent that development and capacity-building in public institutions succeed in reducing demand at private institutions, the increased demand for services from public institutions will likely trigger further increases in public costs.

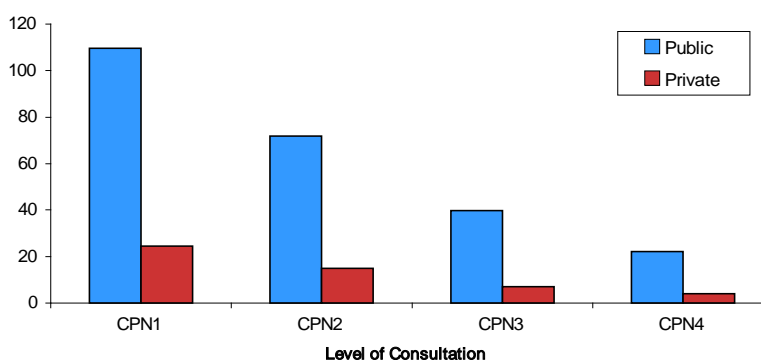
³⁸ MDG Health Costing Tool.

4. Maternal Health

4.1. Antenatal Care

Expectant mothers in the city of Louga are fortunate to be in close proximity to health facilities providing prenatal services, thus eliminating one of the major barriers of maternal care in Senegal. However, even with health facilities at their disposal, a large percentage of expectant mothers do not seek care. From Figure 16, we can see that the majority of mothers go to public health posts for their prenatal consultations (ANC); it may be, however, that an absence of data from ASBEF, a private health post, has resulted in an underestimation of the number of consultations at private institutions.

Figure 16. Antenatal Consultations per Health Post, Louga 2007



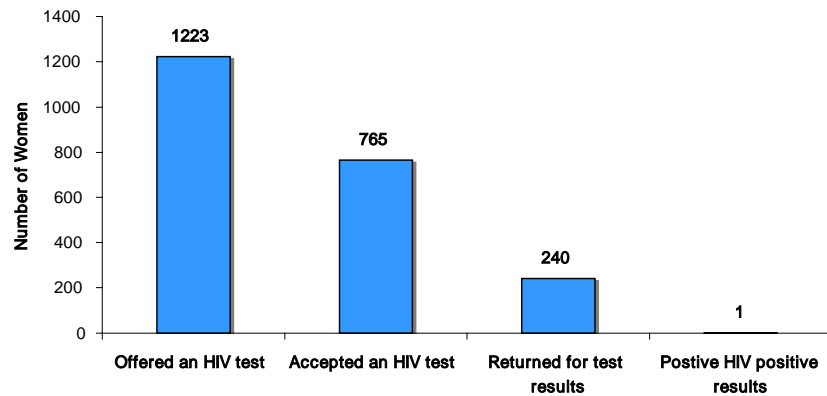
Source: Administrative records from health posts.

Also evident from Figure 18 is the remarkable ANC drop-out rate of expectant mothers. Only 19 percent of the pregnant women in Louga who receive one ANC follow through with all four recommended consultations, a surprising discovery, since all ANCs are provided free of charge. With blood work and intermittent preventive treatment (IPT) against malaria provided at each ANC, the ramifications of poor attendance could be disastrous for the mother. Among expectant mothers receiving antenatal care, data from the health center indicate that only 43.4 percent undergo IPT for malaria.³⁹ Further research could investigate the motivation behind the surprising under-utilization of such an important no-cost service.

An HIV test is one of the additional services provided at health posts for expectant mothers. With antiretroviral drugs (ARVs) provided free of charge by the state to all HIV-positive individuals, antenatal HIV tests are essential to prevent mother-to-child transmission of the disease. Regrettably, as noted in reference to the ANC participation rates, many expectant mothers refuse to undergo this test. Figure 17 displays 2007 data on antenatal HIV testing at health posts in Louga.

³⁹ Administrative records from the health center.

Figure 17. Results from Antenatal HIV Testing at Louga Health Posts, 2007



Source: Administrative records from health posts.

While it is disappointing to see only a 63 percent participation of HIV testing among expectant mothers, it is more dispiriting to discover that only 31 percent of those actually taking the test return to learn the results. Although HIV prevalence in Louga is currently very low, strategies to amend this behavior should be explored in order to prevent unnecessary transmission of HIV to newborns.

4.2. Neonatal Care

Expectant mothers in the city of Louga have many options when seeking a location to give birth, including health posts with maternity facilities, the health center and the hospital. The majority of mothers select either the health center or the hospital, which are known to provide better services in case of emergency. Some more affluent members of the community may even choose to travel to Dakar for their deliveries, particularly if they mistrust the abilities of the local health care providers. As 2007 data from the health center indicate, only 5.8 percent of births occurred at home.⁴⁰

The health center estimates that a skilled birth attendant assisted 98.4 percent of all births in Louga in the second half of 2007 (data from the first half of 2007 were unavailable).⁴¹ This value is nearly twice the most recent WHO estimates for Senegal, of 51.9 percent.⁴² Given the relative easy access to health care in Louga, a greater percentage of births assisted by skilled attendants should not come as a surprise. However, if there was significant under-reporting of unassisted home births, the 98.4 percent estimate for assisted births would be too high.

While most official accounts maintain that most births are aided by a trained health professional, it is necessary to qualify this observation with a cautionary reference to a 2008 report on maternal health care in Dakar, which found that even births reported as having a “skilled birth attendant” might not satisfy WHO requirements. The author of the

⁴⁰ Administrative records from the health center.

⁴¹ Ibid.

⁴² WHO (2008)

report, Mayumi Shimizu, recounts seeing, “a janitor enlisted to provide fundal pressure...; a woman reporting to give birth at a health center without assistance...; some health care workers scolded women when they cried out because of labor pain, and some of the women were even slapped by health care workers.”⁴³ While direct observation of maternity wards at health facilities in Louga did not find the same kinds of behavior among local health care workers, there was an evident shortage of skilled personnel, and this deficiency could easily exacerbate conditions in a maternity setting.

4.3. Maternal Mortality and Emergency Obstetrical Care

Maternal mortality data were difficult to obtain in Louga. Under-reporting was again an issue, with the health center reporting zero maternal deaths in 2007, and the hospital reported 24.^{44,45} It is conceivable that the true number of maternal deaths at the health center was zero, and that all complicated pregnancies were evacuated to the hospital. Given this situation, the maternal mortality ratio (MMR) for Louga would be 472.1 deaths per 100,000 live births per year. If, as suspected, maternal deaths did occur at the health center and were not recorded, it would be more accurate to estimate MMR from solely the hospital data, leading to an MMR of 1,004.6 deaths per 100,000 live births per year. Such a large discrepancy in MMRs serves as a reminder of the general difficulty in calculating maternal mortality in developing countries. As explained by Kodio et al, “Correctly measuring maternal mortality not only requires complete registration of deaths in women of reproductive age, which in many countries may be lacking, but also the recognition that the woman was pregnant or recently delivered at the time of her death...In settings where vital registration is weak, special studies are needed to correctly measure the levels and causes of maternal death.”⁴⁶ For this report, a special study is not available, and we must manage with the unhelpfully broad range of 472 – 1,004 deaths per 100,000 live births per year. With 1990 data also unavailable, it is difficult to determine MDG 5 progress in Louga; however, the high maternal mortality ratio suggests that important work remains to be done in this sector.

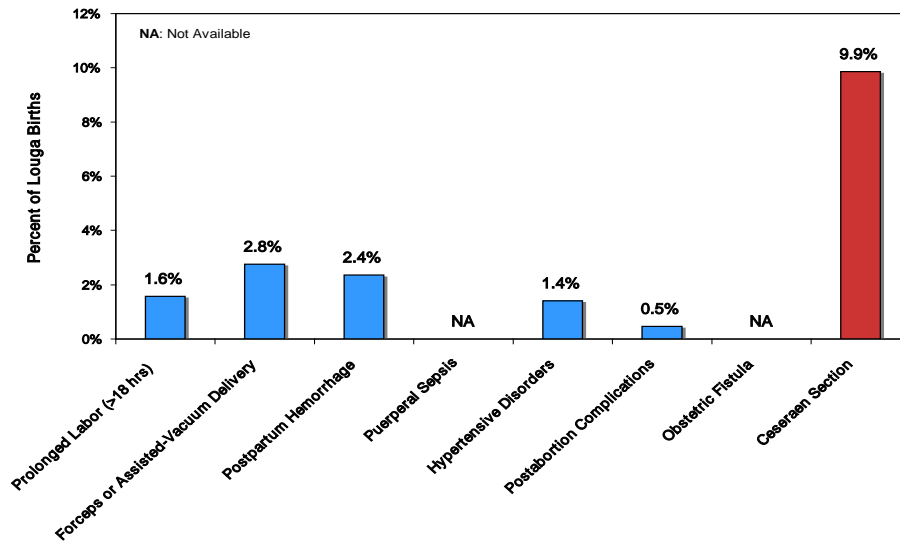
⁴³ Shimizu (2008).

⁴⁴ Administrative records for the health post.

⁴⁵ Administrative records for the hospital.

⁴⁶ Kodio et al (2002).

Figure 18. Distribution of Delivery Complications, Louga 2007



Source: Administrative records for the health center; Administrative records for the hospital.

The causes of maternal deaths in Louga are numerous and systemic. Expectant mothers with difficult pregnancies in Senegal are at risk for dangerous, life-threatening complications when delivering their babies. Any expectant mother with complications during pregnancy must be relocated to either the health center or the hospital, as health posts have neither the equipment nor staff to appropriately provide emergency obstetric care (EmOC). The health center can provide EmOC in cases of prolonged labor (defined as greater than 18 hours), forceps or vacuum-assisted delivery, postpartum hemorrhaging, hypertensive disorders and post-abortion procedures. The hospital, in turn, can provide all of the aforementioned services, in addition to providing cesarean section (c-section) deliveries. Unfortunately, neither obstetric fistula (OF) nor puerperal sepsis data were available at either the health center or the hospital.

Although OF and puerperal sepsis data were not available, the maternity wards at both the health center and hospital have kept records of any complications during delivery. Figure 18 presents the distribution of EmOC, relative to the number of live births in Louga during 2007. At first glance, it appears that the prevalence of c-sections was several orders of magnitude higher than other EmOC interventions; however, this may not be the case. Unfortunately, c-section data was the only information available from the hospital, so the remaining percentages were calculated solely on the basis of health center data. Since patients travel from around the region to use the hospital, the suggested 9.9 percent proportion of c-sections likely overestimates the true frequency of c-sections in the city. Similarly, the relative rates for other triggers for EmOC are likely underestimating their true values, as the underlying numbers also do not include hospital data.

4.4. Estimate of Maternal Health Care Costs

Using the MDG Health Costing Tool, maternal health care costs were calculated. From 2010-2015, average maternal health costs per capita are estimated at approximately \$0.66. It is important to note that due to inaccurate reporting of STI incidence, those costs were not included in the estimate of total maternal costs; therefore the current figure underestimates the actual total cost.

When analyzing maternal health costs in Louga, there is an uncertainty associated with the calculation of absolute values, due to the utilization of maternal health services by individuals living outside the city. With the hospital seeing patients from the entire region, and the health center also visited by patients from nearby rural communities, it is difficult to calculate the true municipal burden on maternal services. The propensity of individuals from outside Louga to visit urban health facilities adds further emphasis to the question of whether a cost estimate should examine solely the costs associated with services for those residing within said municipality, or the total financial burden faced by municipal health facilities.

5. HIV/AIDS, Malaria and Other Diseases

5.1. HIV/AIDS

With only 0.7 percent of all 15-49 year olds testing positive for HIV, Senegal has one of the lowest HIV prevalence rates in Sub-Saharan Africa.⁴⁷ However, there is a great disparity in the disease burden among certain populations. In 2004, an estimated 15-30 percent of sex workers were HIV-positive, while a USAID-funded project in 2005 found 33 percent of a “men who have sex with men (MSM)” cohort who demanded HIV tests to be positive.^{48, 49} Geographically, the regions in the south, near the Guinea-Bissau border, have prevalence rates more than three times the northern regions.⁵⁰ Therefore while the overall population has as yet successfully avoided the HIV epidemic, the pockets of high HIV prevalence put the rest of the country at risk of infection.

Much the same as other cities in the north of Senegal, Louga has a very low HIV prevalence rate. Unfortunately, HIV data for the city are limited; however, the 2005 EDS-IV survey found a 0.5 percent prevalence rate among 15-49-year-olds in the region. Surprisingly, the rate among men was found to be 0.0 percent, whereas the rate among females was 0.7 percent; however, the small sample size (375) probably affected the accuracy of the results.⁵¹ Andandoo Sigg, the Louga association for people living with HIV/AIDS (PLHIVs), estimates that there are over 500 PLHIVs in the

⁴⁷ Senegal DHS (2005).

⁴⁸ Ibid.

⁴⁹ *Implementing STI/HIV Prevention and Care Interventions for Men Who Have Sex with Men in Dakar, Senegal*, USAID.

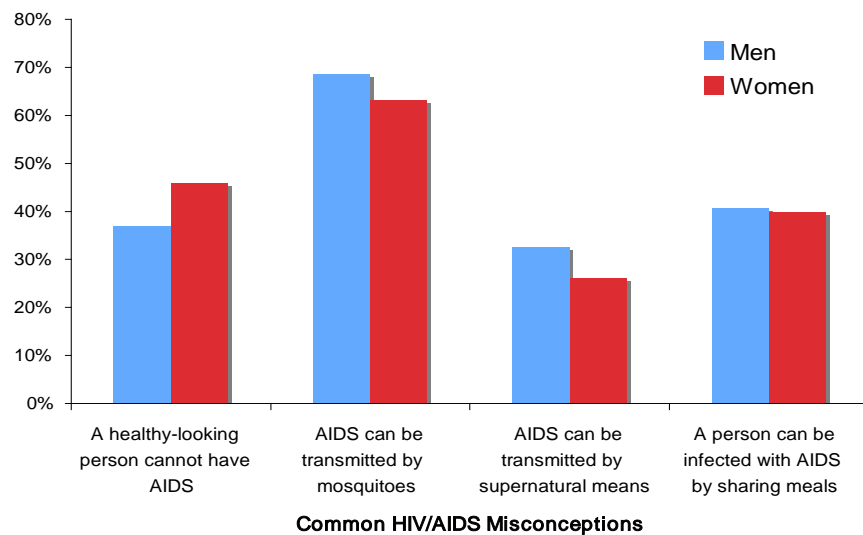
⁵⁰ Senegal DHS (2005)

⁵¹ Ibid.

city.⁵² According to an unpublished study performed by a physician at the hospital, the average age of PLHIVs is 37.4 years, and 61 percent are married. The same study found that 90 percent of the PLHIVs in Louga are currently undergoing ARV therapy.⁵³

Although the prevalence of HIV is low in Louga, HIV prevention efforts should be continued there, given the low level of public comprehension of the disease and the presence of vulnerable populations with the potential to transmit the infection to others. Figure 19 presents some of the misconceptions concerning AIDS among the people in the region of Louga.

Figure 19. HIV/AIDS Misconceptions among Louga (Region) Population, 2005



Source: Senegal DHS (2005)

The most common misconception among Louga residents, perceived by almost 70 percent of the population, is the thought that mosquitoes are capable of transmitting AIDS. Approximately a third of the population also believes a host of other common misconceptions present in sub-Saharan Africa: for example, that healthy looking people are incapable of having AIDS; that supernatural causes can transmit the disease, and that a person can be infected with AIDS simply by sharing a meal with an infected individual. Unfortunately, despite recent public health outreach programs, MCI is not in position to analyze their success, as time trend data are not available.

The low HIV prevalence rate in Louga could be compromised if education programs targeting vulnerable populations are not conducted. Table 9 outlines the principal vulnerable populations in the city of Louga and their estimated population and growth rate.

⁵² Interview with president of Andandoo Siggj.

⁵³ Interview with infectious disease physician at the hospital.

Table 9. HIV Vulnerable Populations in Louga, 2008

Vulnerable Population	Pop. Estimate	Pop. Growth
Migrant Workers ⁵⁴	1,833	3%
Truck/Taxi Drivers ⁵⁵	1,005	5%
Prisoners ⁵⁶	207	2%
Sex Workers ⁵⁷	200	10%
Men who have sex with men (MSM) ⁵⁸	150	2%
Returned Emigrants ⁵⁹	114	NA
Injection Drug Users (IDU) ⁶⁰	NA	NA

Joseph Badji, *Le Conseil National de Lutte contre le SIDA* (CNLS) director for Louga, is coordinating HIV interventions for a number of vulnerable populations in the region, including truck/taxi drivers, sex workers and MSM, in addition to the many other programs his CNLS branch organizes. However, despite the efforts of the CNLS, there is still a need for more interventions, specifically ones that target migrant workers, prisoners and returned emigrants. Moreover, there are very few data available on the injection drug user (IDU) population in Louga, with many officials regarding the local IDU population as insignificant, even while acknowledging the existence of a sizable community in Dakar. Interviews with Mr. Badji made clear, though, that such deficiencies have been acknowledged by the agency, which has begun to formulate future interventions to fill these gaps.

5.2. Tuberculosis

Heavily stigmatized in the community, it is difficult to accurately characterize the prevalence of tuberculosis. An examination of the 2007 health center records yielded an estimated 312 cases per 100,000 people, slightly higher than the 2006 USAID estimated national average of 245.^{61, 62} Among the 2007 tuberculosis cases in Louga, 93 percent represented new cases, and 16 percent represented extra pulmonary cases requiring special care. All tuberculosis cases in Louga follow Directly Observed Therapy (DOTS) procedure, and local officials were proud of their reported 97 percent success rate with treatment.⁶³ However, further research is needed in this area, as there is some concern as to how the local communities define the successful completion of DOTS treatment.

⁵⁴ Estimation from adapting RGPH-3 values to the city of Louga.

⁵⁵ Estimation from president of truck/taxi association.

⁵⁶ ANSD (2007)

⁵⁷ Estimation from a focus group of sex-workers, overseen by Association AWA.

⁵⁸ Estimation from a nurse at Santhiaba health post.

⁵⁹ Estimation from the *Service Régional de la Statistique à Louga*.

⁶⁰ CNLS estimates suggest minimal IDUs in Louga.

⁶¹ Administrative records from the health center.

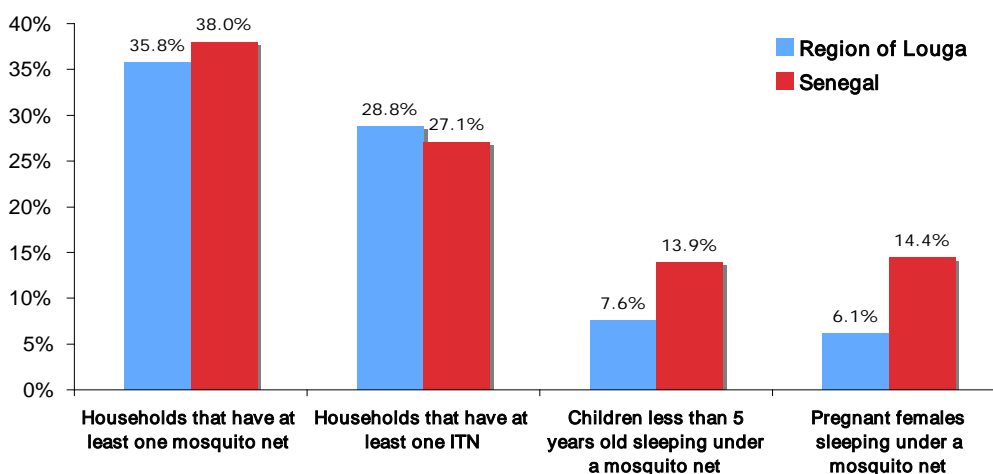
⁶² Tuberculosis Profile: USAID Senegal, September 2006.

⁶³ Administrative records from the health center.

5.3. Malaria

With 100 percent of the population in Senegal at risk for malaria, the population of Louga needs to take heavy precautions to avoid infection.⁶⁴ Unfortunately, no data exist regarding residents' behavior; however, data from the *region* of Louga suggest that the population could be doing more to prevent infection. Despite government subsidies reducing the price of the long-lasting insecticide impregnated mosquito nets (LLINs) by 63.5 percent, Figure 20 reveals how few people in the region actually take preventive measures against malaria.⁶⁵

Figure 20. Malaria Prevention Behavior, Louga and Senegal 2005



Source: Senegal DHS (2005)

While malaria is undeniably a major public health problem in Louga, there is some question as to the extent of its impact. While local officials report that 26 percent of outpatient cases in the district of Louga are attributable to malaria, it is important to note that no distinction is made between malaria and fever, and therefore, all cases of fever are registered as malaria cases.⁶⁶ The district of Louga began the use of rapid diagnostic testing of all fever cases in 2007; however, widespread use of the technology has been slow to arrive. At the health center in Louga, only 3.3 percent of the 591 blood tests performed in 2007 came back positive for malaria.⁶⁷ An analysis of all fever cases in the entire district reveals a similar outcome, as displayed in Figure 24.

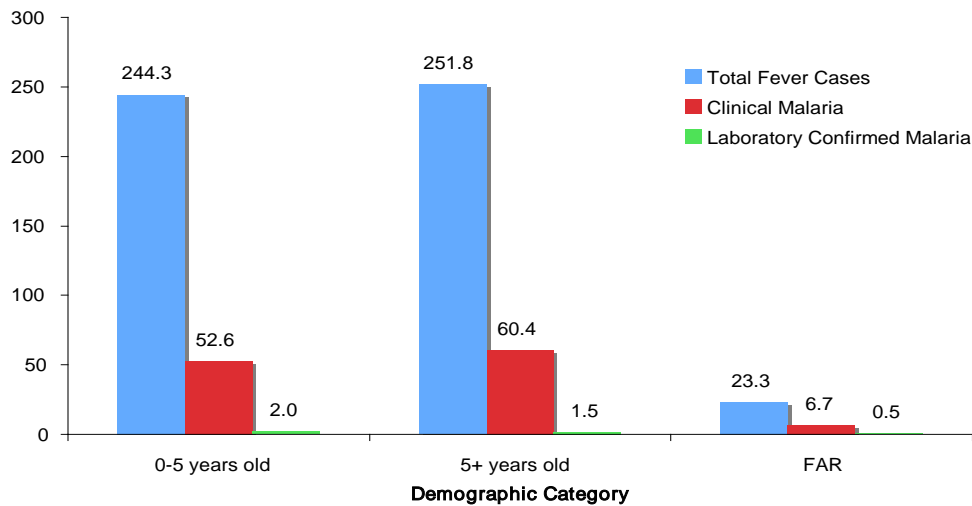
⁶⁴ Roll Back Malaria 2005 World Malaria Report.

⁶⁵ Interview with health center pharmacist.

⁶⁶ Administrative records from health posts.

⁶⁷ Interview with a lab technician at the health center.

Figure 21. Characterization of Fever Cases in the District of Louga, 2007⁶⁸



Given the data from the health center and the results presented in Figure 24, it is reasonable to question the magnitude of Louga's malaria burden. However, fever remains a significant cause of morbidity in the city, and an examination of the number of cases on a month-by-month basis, as in Figure 22, indicates a seasonal effect. The seasonality of fever cases in Louga demonstrates that malaria may well be responsible for the infections. Indeed, the data in Figure 22, obtained from Louga health posts, correspond well to MARA/ARMA's (Mapping Malaria Risk in Africa/Atlas du Risque de la Malaria en Afrique) predicted malaria season of July – October for the region of Louga, indicating that many of the fever cases may in fact be malarious.^{69,70,71}

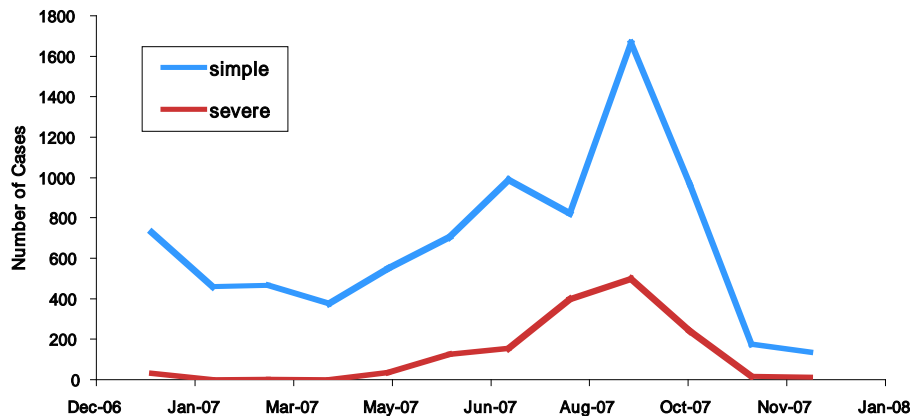
⁶⁸ Administrative records from the health center.

⁶⁹ MARA/AMRA (2002)

⁷⁰ Senegal: First Month of Malaria Transmission Season.

⁷¹ Senegal: Last Month of Malaria Transmission Season.

Figure 22. Seasonal Effect of Fever Cases in Louga, 2007⁷²



Furthermore, indirect evidence of malaria in Louga could be seen from the results depicted in Figure 21. While the incidence of laboratory-confirmed malaria cases is minimal, there is a significant decrease in the incidence of all fever cases among pregnant women. Given the significant rate of pregnant women’s participation in intermittent preventative treatment programs (IPT), as detailed in section 4.1, the reduced incidence may signal the effect of IPT in an environment of high malaria prevalence. If this is the case, further research should be conducted, to understand why so few malaria cases are detected in the laboratory.

There are additional reasons that supplemental research should be performed to accurately characterize the malaria burden in Louga. As Senegal has moved completely to ACT-based therapy (AS-AQ, artesunate-amodiaquine) for treating malaria, there is an economic motivation to diagnose all cases accurately. Moreover, the correct diagnosis of all fever cases will avoid the unnecessary use of ACT drugs, thereby inhibiting the development of drug resistance.

5.4. Sexually Transmitted Diseases and Contraception Usage

As recommended by the WHO, the health care providers in Louga use alternative methods to identify and treat sexually transmitted infections (STI).⁷³ While the laboratory in the health center has the capability to test for syphilis (and in 2007 there were 31 positive cases from 1,069 blood samples), other STIs are identified through a case management system that looks at symptoms and risk factors.⁷⁴ Since chlamydia and gonorrhea require similar treatment, research has shown that expensive tests to accurately diagnose each case are not cost-effective.⁷⁵ The symptoms used to classify patients for treatment of STIs are given in Table 10, along with data corresponding to incidence figures for the district of Louga.

⁷² Administrative records from the health posts.

⁷³ “Prevention and management of sexually transmitted and reproductive tract infections,” WHO (2006).

⁷⁴ Interview with lab technician at the health center.

⁷⁵ Sloan et al. (2000).

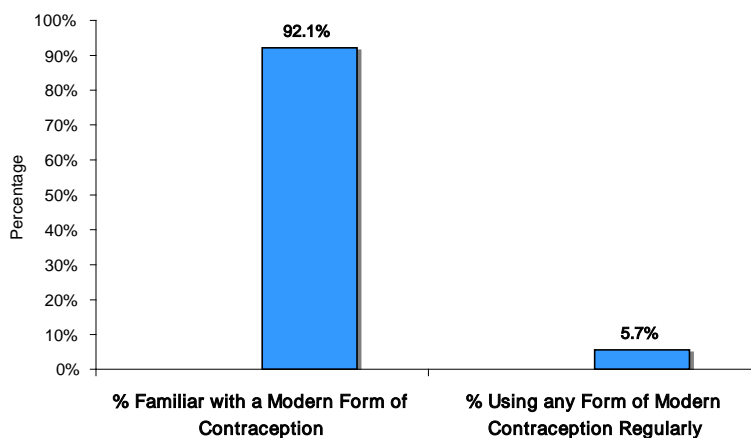
Table 10. Classification of Sexually Transmitted Infections, Louga District

	Genital Discharge		Genital Ulcerations		Lower Abdominal Pain		Other STI symptoms	
	m	f	m	f	m	f	m	f
2003	53	927	26	43	0	434	197	376
2004	101	1132	68	41	0	376	106	368
2005	97	1822	5	6	0	238	36	149
2006	63	1428	19	26	0	589	30	111
2007	47	1897	10	44	0	457	41	695

Source: Administrative records from the health center.

Prevention of sexually transmitted infections is a top priority for health care workers in Senegal. The use of contraception offers one effective method of impeding STI transmission; however, data suggest that the population of Louga could be doing more in this realm. Figure 23 exhibits the startling revelation that even though over 90 percent of the female population in the region of Louga is aware of a modern form of contraception, only 5.7 percent currently use one.

Figure 23. Female Contraception Usage, Region of Louga, 2005



Source: Senegal DHS (2005)

As shocking as these data appear, there is suspicion that condom usage is underestimated (the survey estimates it at 0.1 percent), thus leading to an underestimation of the true contraception use. Officials in Louga estimate that 2.6 – 7.0 percent of women of reproductive age currently use contraception in the district; however, these data correspond primarily to those women using regular contraception, such as oral contraceptives, injectables, intrauterine devices, implants and

sterilization.⁷⁶ Country estimates from the same 2005 demographic and health survey (DHS) found that 37.5 percent of females and 61.9 percent of males in Senegal used condoms during their last sexual encounter with a “non-regular partner.”⁷⁷ With over 67,000 male condoms distributed by the health center in 2007 alone, these findings would appear to be justified; however, more research should examine the prevalence of regular condom users in Louga.⁷⁸

5.5. Waterborne Diseases

The burden of waterborne diseases on the population of Louga is difficult to quantify. An absence of clinical tests for even the most prevalent of these, such as Amoebiasis and Giardiasis, limits the ability to characterize the many cases of diarrhea in the community. In 2007, the public health posts in Louga reported a diarrhea incidence of 18.67 cases per 100 people, of which they determined from clinical symptoms that 11.9 percent had dysentery.⁷⁹ Cholera was reported in rural areas of the region in 2007; however, all clinical tests for the bacteria came back negative.⁸⁰ Overall, the city of Louga has made great strides to reduce the incidence of waterborne diseases. In 2007 approximately 99 percent of residents had access to potable water, presenting a much-improved situation in relation to that of rural Senegal.⁸¹

5.6. Waterborne and Soil Transmitted Parasitic Infections

Due to the semi-arid climate and lack of rivers or lakes, waterborne parasitic infections are not one of the leading health concerns for the population of Louga. In 2007, public health post facilities reported an incidence of Schistosomiasis (bilharzias) in Louga of only 7.41 cases per 10,000 people.⁸² There were no reports of Onchocerciasis (river blindness) or Lymphatic filariasis (elephantiasis) in the city; however, incidence data for all parasitic infections may be underestimated due to under-reporting.

The prevalence of soil-transmitted parasitic infections appears to be a much greater problem in Louga. In 2007, an incidence rate of 5.67 cases per 100 people of Helminthiasis was reported by public health post facilities in Louga, representing a much greater disease burden than Schistosomiasis.⁸³ Unfortunately, a more detailed diagnosis of the parasitic infections is not available, since Helminthiasis does not specify the worm responsible for the infection (e.g., roundworm, tapeworm, pinworm, hookworm). Over 90 percent of the Helminthiasis cases in Louga occurred in children aged 0-14, signifying a serious health concern for that demographic.⁸⁴

⁷⁶ Interview with officials at the health center.

⁷⁷ Senegal DHS (2005).

⁷⁸ Interview with Bureau EIPS at the health center.

⁷⁹ Administrative records from the health posts.

⁸⁰ Administrative records from the health center.

⁸¹ N. Sobhani, from research for the MCI water & sanitation needs assessment for Louga.

⁸² Administrative records from the health posts.

⁸³ Ibid.

⁸⁴ Ibid.

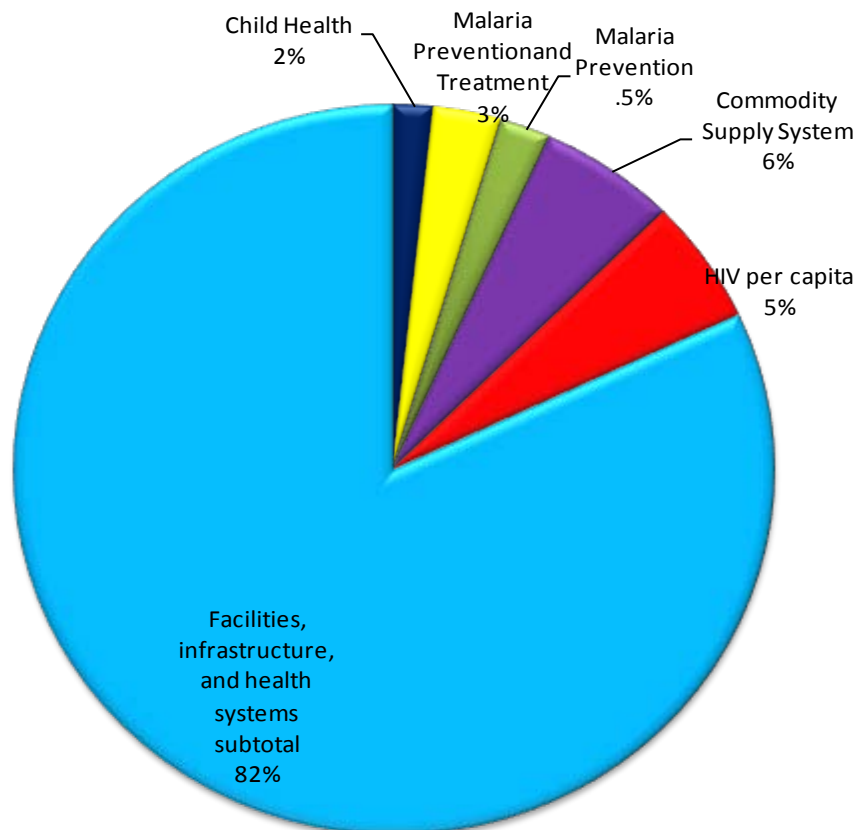
5.7. Estimation of Disease Care Costs

The average per capita cost associated with addressing malaria, tuberculosis and HIV in Louga from 2010-2015, as calculated by the MDG Health Costing Tool, is \$1.74. As previously mentioned, this estimate does not take into consideration the costs associated with many relevant diseases, such as waterborne diseases and parasitic infections, and therefore, the total cost is greater than presented.

6. Summary of Health Care Costs, Louga 2010 – 2015

Based on the analysis of the available data presented above, Louga City needs between \$1.55 and \$1.59 million each year between 2010 and 2015.⁸⁵ These values were calculated using the MDG Health Costing Tool and are susceptible to the previously mentioned limitations. The average per capita cost is \$17 each year between 2010 and 2015. Figure 24 provides a categorical breakdown for the 2010-2015 period, while.

Figure 24. Health care costs for Louga, 2010-2015



Source: MDG Health Costing Tool

⁸⁵ MDG Health Costing Tool.

Table 11 presents an estimate of costs for 2010 – 2015. Increases in costs follow a steady trend. The data presented in Table 11 do not account for immediate improvements in health that might reduce long-term needs. (A more detailed account of the costs can be found in the MDG Health Costing Tool, which is available on the MCI website and on request.)

Table 11. Annual Per Capita Health Costs for Louga, 2010-2015

	2010	2011	2012	2013	2014	2015	Average
MDG 4 - Child Health	0.30	0.29	0.28	0.27	0.26	0.25	0.28
MDG 5 - Maternal & Reproductive Health	0.69	0.68	0.66	0.65	0.64	0.62	0.66
MDG 6 - HIV/AIDS, Malaria and Other Diseases	1.49	1.66	1.65	1.76	1.86	2.04	1.74
Malaria Prevention	0.06	0.15	0.06	0.05	0.05	0.13	0.08
Malaria Treatment	0.28	0.33	0.38	0.42	0.46	0.49	0.39
Tuberculosis	0.38	0.37	0.36	0.35	0.34	0.33	0.35
HIV/AIDS	0.77	0.81	0.86	0.93	1.00	1.09	0.91
Facilities, HR, Health Systems	14.52	14.12	13.72	13.33	12.95	12.54	13.53
Commodity Supply System	1.03	1.00	0.97	0.95	0.92	0.89	0.96
Sub - Total	15.55	15.12	14.70	14.27	13.87	13.43	14.49
Cost per Capita	18.04	17.74	17.29	16.96	16.63	16.35	17.17

Source: UNDP Health Costing Tool

For the same period it will take \$0.28 per capita per annum to achieve MDG 4, \$0.66 per capita per annum to achieve MDG 5, and \$1.74 per capita per annum to achieve MDG 6. Hence, only a small percentage of the total cost is associated with infant and maternal services, while most of the total cost will be for combating malaria, tuberculosis and HIV. Most of annual per capita cost (\$14.49) will pay for salaries, pre-service and in-service training sessions, facilities, transportation and communication equipment and supplies. Overall health care costs in Louga will steadily increase each year to accommodate a population that is growing at over 2.8 percent annually.

7. Note on Government Reform Plans and Future Projects

The number of government reform plans and projects targeting the city of Louga is limited, with respect to other regions of Senegal. Despite the relative abundance of non-governmental organizations (NGOs) with their headquarters located within city lines, including Plan International, AQUADEV and Hunger Project, none of these organizations operates in the city. Instead, these NGOs limit their projects to the rural communities, notwithstanding the fact that many rural inhabitants are migrating to the cities and stretching, if not exhausting, municipal capacities. Therefore, even in a city of almost 100,000 people, there is relatively little private development work, particularly in the health system, where the agencies' influence is restricted to the four private health clinics. Given the importance of the private sector in the financing of health systems in developing and transitional countries, more effort might be made to coordinate the various NGO community's health programs in Louga.

8. Critical Analysis of Needs Assessment at Municipal Level

Household Survey Necessity

The city of Louga could benefit immensely from an effective household survey. With over 1,000 fever cases reported each year, it is imperative to understand just how many of those cases are malaria. For reasons unknown, current laboratory methods are ineffective at accurately diagnosing cases, and a household survey with blood sampling could prove more successful. In addition, a greater understanding of bed net usage behavior, also obtained via a household survey, could be correlated with the results from the malaria profile to generate an improved strategy for combating malaria and preventing unnecessary deaths.

Using a household survey to examine contraception usage, and in particular male condom usage, would also be very beneficial. Over 67,000 male condoms are distributed in the district each year, but there is little data to indicate whether or not they are being effectively used by the population.⁸⁶ Of equal importance would be data showing how condom usage differs across sex, age groups and marital status. Results from such a household study could be incorporated into revised interventions targeting a reduction in STI transmission and improved family planning.

Examining the prevalence of tuberculosis by means of a household survey would also be very useful. According to several local officials, tuberculosis is a stigmatized disease in the region, and many people who suspect they are infected avoid seeking care for fear of being ostracized. As a result, many cases go untreated, and transmission is amplified. An effective household survey could analyze the true prevalence of the disease and form the basis for future interventions targeting undiagnosed tuberculosis infections.

III. CONCLUSIONS AND RECOMMENDATIONS

The results of the needs assessment conducted in Louga reveal a city in the process of an economic and epidemiological transition. At the time of this study, none of the health-specific Millennium Development Goals had been achieved; however, reaching each health MDG target is feasible. For example, if the improvements seen in child health over the past 15 years continue, MDG 4 is within reach. The outlook for such progress in the area of maternal health is not as promising: Louga needs increased attention to MMR reduction interventions if it is to overcome the gulf in development so as to achieve MDG 5. With regard to MDG 6, malaria remains a significant health burden in the Louga community, and success in fighting this disease will rely upon further promotion of preventive measures, accurate methods of diagnosis and the rapid dissemination of effective treatment. Data from this study indicate that HIV is not an

⁸⁶ Interview with Bureau EIPS at the health center.

urgent health concern among Louga's public; however, inadequate knowledge and stigmatization of the disease must be addressed to avoid increased transmission and future outbreaks. While tuberculosis represents a more serious challenge at present, the high success rate of treatment indicates that Louga officials are effectively confronting this disease. Overall, at the present rate of progress, MDG 6 -- reversing the trends in incidence of these three diseases -- is a reasonable target.

To meet MDG targets related to health, Louga will need an average of \$17 per capita each year between 2010 and 2015.

The main impediment to research in Louga was the high level of incomplete data in every health sector. The problem ranged from under-reporting, as seen in the estimations of infant mortality, to difficulties in the diagnosis of key diseases such as malaria and sexually transmitted infections. As evidenced throughout this report, difficulties in data collection led directly to a level of imprecision in assessing the city's progress toward the MDGs in health. Nevertheless, despite the meager amount of quality data regarding the city itself, a thorough review of all available data, also for the regional and national levels, was sufficient to complete a health needs assessment that represents relatively accurately the current state of health in this Millennium City.

At this moment, the city of Louga is ripe for investment in health. While none of the health-specific MDGs has been achieved, the targets are in sight, and recent progress reveals their proximity. Hopefully, the current assessment can play a role in enabling government, the development partners and the relevant health officials to work together in an informed way to bring about an appreciable leap in health care service delivery for Louga's people.

REFERENCES

- Agence Nationale de la Statistique et de la Démographie [ANSD] (2006). "Résultats du Troisième Recensement Général de la Population et de l'Habitat – 2002," (Dakar: Agence Nationale de la Statistique de la Démographie). (http://www.ansd.sn/publications_demographiques.html, accessed August 6, 2008).
- Agence Nationale de la Statistique et de la Démographie [ANSD] (2007). "Situation économique et sociale de la région de Louga: Année 2006," (Dakar: Service Régional de la Statistique et de la Démographie de Louga). (http://www.ansd.sn/publications_demographiques.html, accessed August 6, 2008).
- Cheikh, I. N. (2004). "Formative research on peri/neonatal health in Kebemer Health District (Senegal): Final Report," (Arlington, Virginia: Basic Support for Institutionalizing Child Survival Project [BASICS II] and USAID).
- Kodio, B., de Bernis, L., Ba, M., Ronsmans, C., Pison, G. and Etard, J-F. (2002). "Levels and causes of maternal mortality in Senegal," *Tropical Medicine and International Health* 7(6): 499-505.
- MARA/ARMA (2002). "Malaria Prevalence Model: Senegal," (Durban, South Africa: Medical Research Council). (<http://www.mara.org.za/pdfmaps/SenPrevModel.PDF>, accessed September 30, 2008).
- MARA/ARMA (2001). "Senegal: First month of malaria transmission season," (Durban, South Africa: Medical Research Council). (<http://www.mara.org.za/pdfmaps/SenFirstMonth.PDF>, accessed August 3, 2008).
- MARA/ARMA (2001). "Senegal: Last month of malaria transmission season." (Durban, South Africa: Medical Research Council). (<http://www.mara.org.za/pdfmaps/SenLastMonth.PDF>, accessed August 3, 2008).
- Ministère de la Santé et de la Prévention Médicale [MSPM] and ORC Macro, (2006). "Senegal: Enquête Démographique et de Santé (DHS), 2005," (Calverton, MD: Measure DHS). (http://www.measuredhs.com/pubs/pub_details.cfm?ID=583&srchTp=advanced, accessed August 5, 2008).
- Ministère de la Santé et de la Prévention Médicale [MSPM] (2006b). "Manuel national de stratégies sur la référence et la contre référence," (Dakar: Service National de l'Information Sanitaire). (<http://www.sante.gouv.sn>, accessed August 3, 2008)

- Ministère de la Santé et de la Prévention Médicale [MSPM] (2007). *Annuaire statistique 2006*, (Dakar: Service National de l'Information Sanitaire). (<http://www.sante.gouv.sn/>, accessed August 6, 2008).
- Moreau, A., Placide T., Abdoulaye L., Cheikh I. N., and Abdou K. D. (2007). "Implementing STI/HIV prevention and care interventions for men who have sex with men in Senegal," *Horizons Research Summary*. (Washington, DC: Population Council). (http://pdf.usaid.gov/pdf_docs/PNADL437.pdf, accessed September 8, 2008).
- Shimuzi, M. (2008) "Preliminary Findings: Problems and further improvement of maternal care in Senegal," *Japan Medical Association Journal (JMAJ)*, 51(2): 128-130.
- Sloan, N.L., Winikoff, B., Haberland, N., Coggins, C., and Elias, C. (2000) "Screening and syndromic approaches to identify gonorrhea and chlamydial infections among women," *Studies in Family Planning* 31(1): 55-68.
- UNDP (2008). "UNDP Poverty Reduction: MDG Data and Tools." (New York: United Nations Development Program). (<http://www.undp.org/poverty/tools.htm>, accessed September 9, 2008).
- USAID (2006). "Tuberculosis Profile: Senegal," (Washington, DC: U.S. Agency for International Development). (http://pdf.usaid.gov/pdf_docs/PDACL550.pdf, accessed August 6, 2008).
- USAID (2008). "Country health statistical report: Senegal," (Washington, DC: U.S. Agency for International Development) (http://pdf.usaid.gov/pdf_docs/PNADM412.pdf, accessed September 11, 2008).
- USAID (2007). "President's Malaria Initiative, Malaria Operational Plan FY07: Senegal. Malaria Program," (Washington, DC: U.S. Agency for International Development). (http://pdf.usaid.gov/pdf_docs/PDACL791.pdf, accessed August 6, 2008).
- WHO (2003). "Vitamin A Supplementation, WHO Immunizations, Vaccines, and Biologicals," (Geneva: Immunizations, Vaccines, and other Biologicals Department). (<http://www.who.int/vaccines/en/vitamina.shtml>, accessed August 4, 2008).
- WHO (2005) "Yellow Fever in Senegal (French) – Senegal Country Profile," (Geneva: WHO Epidemic and Pandemic Alert and Response). (http://www.who.int/entity/csr/disease/yellowfev/Senegal_Fr.pdf, accessed August 3, 2008).

- WHO (2006). "Neonatal and perinatal mortality: country, regional and global estimates. (http://www.who.int/reproductive-health/docs/neonatal_perinatal_mortality/index.html), accessed September 11, 2008).
- WHO (2006). "Prevention and management of sexually transmitted and reproductive tract infections. standards for maternal and neonatal care," (Geneva: Department of Making Pregnancy Safer). (http://who.int/reproductive-health/publications/standards/prevention_mngt_stis.pdf), accessed August 5, 2008).
- WHO (2008). "Proportion of births attended by skilled health worker, 2008 updates," (Geneva: WHO Department of Reproductive Health and Research). (http://www.who.int/reproductive-health/global_monitoring/skilled_attendant_at_birth2008.pdf), accessed August 21, 2008).
- WHO and UNICEF (2005). "2005 World Malaria Report," (Geneva and New York: World Health Organization and United Nations Children's Fund). (<http://www.rbm.who.int/wmr2005/>), accessed August 3, 2008).
- WHO and UNICEF (2007). "Immunization Summary: The 2007 Edition: A statistical reference containing data through 2005," (New York: United Nations Children's Fund)(http://www.unicef.org/publications/files/Immunization_Summary_2007.pdf), accessed August 2, 2008).

Appendix I. Profiles of Senegal & Louga

Indicators	Senegal	Source	Louga	Source
Population (2007)	11,519,226	ANSD (2008)	82 375	ANSD (2007)
Population growth rate (2006/2007)	2.7%	USAID (2007)	2.8%	USAID (2007)
Life expectancy (2007)	55.8 years	ANSD (2008)		
Ethnicity			Wolof (72%), Peul (25%)	ANSD (2006a)
Religion	Islam (99%), Christian /Other (1%)	ANSD (2007)	Islam (99%), Christian /Other (1%)	ANSD (2006a)
Adult HIV/AIDS Prevalence	0.7%	ANSD (2007)	0.8%	UNHABITAT (2006)
Access to potable water	Urb: 93% Rur: 65%	ANSD (2006b)	Urb: 84% Rur: 39.7%	ANSD (2006b)
Gross Enrollment Ratio	86%	ANSD (2008)		
Girls-to-Boys Ratio in primary school	1	ANSD (2008)	0.99	ANSD (2008)
Under-five mortality rate (for 100,000 live births)	121	ANSD (2008)		
Maternal mortality rate (for 100,000 live births)*	401	ANSD (2008)		

Appendix II. Persons Interviewed

	Organization	Name	Position	Location
1	MCI	Djibril Samb	MCI Social Sector Specialist	Louga
2	Mayor's Office	Mme. Fall	Secretary General	"
3	Prefect	Mame Gor Diop	Prefect	"
4	Prefect	Mme. Arame Coumba Fall	Head of Community Development	"
5	National Government	Joseph Badji	Regional Leader in the Fight against HIV/AIDS	"
6	National Government	Lamine Ndiaye	Fishing Service	"
7	Hospital (CHRASM)	Pape Ndiaye	Administrative and Financial Director	"
8	Hospital (CHRASM)	Samba Gueye	Head of Management	"
9	Hospital (CHRASM)	Dr. Coulibaly	Head of Infectious Diseases	"
10	Hospital (CHRASM)	Mr El Hadj Sene	Head Nurse (Pediatrics)	"
11	Hospital (CHRASM)	Mamadou Aissata Ly	Hospital Statistician	"
12	Hospital (CHRASM)	Dr. Abdou Sarr	Chief of Medicine	"
13	Health Center	Dr. Mahamadou Traoré	Regional Chief of Medicine	"
14	Health Center	Dr. Mamadou Diop	District Chief of Medicine	"
15	Health Center	Nafi Ndiaye	Head Midwife / Deputy	"
16	Health Center	Abdoul Aziz Sylla	Health District Statistician	"
17	Health Center	Bassine Ka	Laboratory Technician	"
18	Health Center	Alioune Sall	Health Agent – Tuberculosis	"
19	Health Center	Mme. Faye	Midwife	"
20	Health Center	Sidé Wade	Director of Health Education	"
21	Health Center	Abdoulaye Ndiaye	Director of Vaccination Program	"
22	Health Post – Keur Serigne Louga Est	Omar N'doye	Head Nurse	"
23	Health Post – Keur Serigne Louga Ouest	Roseline Diop	Midwife	"
24	Health Post – Artillerie	Opa Diallo	Head Nurse	"
25	Health Post – Croix Rouge	Awa Diakite	Head Nurse	"
26	Health Post – Santhiaba	Biriame Sene	Head Nurse	"
27	Andandoo Sigg	Sidi Fall	President of	"
28	Regional Statistic Service	Thiayédia Ndiaye	Statistician	"
29	Regional Statistic Service	Alioune Cissé	Head Statistician	"
30	Association for the Development of the Entrepreneurial Women	Abdoulaye Sylla		"
31	Center ADOS	Demba Badji	Director	"
32	Center ADOS	Papa Mademba Ly	Coordinator of Peer Educators	"
33	Academic Inspection	Doudou Ngom	Statistic Director	"
34	NGO – Hunger Project	Idrissa Bah	Trainer	"
35	NGO – Hunger Project	Khary Cissé	Trainer	"
36	NGO – Aquadev	Oumou Khayry Sy Dia		"
37	NGO – CISV	Edouard Ndeye		"
38	NGO – Self-Help	Chiekh Lô	Coordinator	"
39	NGO – Plan International	Lamine Bob	Coordinator	"
40	Regional Medical Store	Oumar Cissé	Director	"
41*	Louga Bus Station	Ousmane Sall Ndiaye	President of Taxi Drivers	"
42	Louga Bus Station	Pape Ali	Bus Station Controller	"
43	Cheikh Anta Diop University	Mbathio Samb	Doctoral Student	Dakar
44	Ministry of Health	Cheikh Issa Sall	Director of the Cabinet	"
45	Ministry of the Family	Mahamadou Traoré	Director of the Cabinet	"
46	Ministry of Education	M. Sagna	Director of General Administration	"