

Senegal Health System Analysis and Its Implications to Global Health Cooperation

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Abstract

As an active participant of global health cooperation in west Africa, the Republic of Senegal is one of the major recipients of international development assistance. Yet, funding and actions from different donors and implementing organizations are fragmented, which is one of the reasons that Senegal is failing to outstand its health performance disproportionately. This report provides an overview of Senegal's population health status and health system performance and pinpoint areas that should be prioritized for focused global health assistance. Undernutrition and neonatal disorders were found to have posed the highest and most urgent risks on the public health of Senegal. This is intensified by the severe shortage of health human resources, vast disparity of resources between rural and urban areas, and unsatisfactory health financing mechanism. Based on the situation analysis of Senegal's population health and health system, this report recommends (1) the Senegal MSAS to take the lead of integrating and coordinating public, private, and international health programs to reduce fragmentation with a focus on financing rural health human resources; (2) to research the root causes of undernutrition and neonatal disorders in Senegal and construct nutrition and maternal health interventions based on evidence generated; and (3) to conduct continued training of doctors, nurses, midwives, community health workers with strong focus in Kedougou and Kolda.

Background

The Republic of Senegal (hereafter referred to as Senegal), is a west African country with a population of 16.30 million in 2019 according to the World Bank [1]. Senegal has been one of Africa's most stable countries in the past two decades. It is a lower-middle-income country with a gross national income (GNI) per capita and gross domestic product (GDP) slightly lower than Sub-Saharan Africa (SSA) average [2]. Senegal has a very young population and over half of its people live in rural areas [3]. Though basic infrastructure is not robust in Senegal, it outperforms most of the SSA countries in several aspects (Refer to Annex 1 for more political, economic, social and technological analysis of Senegal) [10]. Paralleling with world's trend, Senegal's spectrum of disease burden has shifted from infectious diseases to non-communicable diseases while neonatal disorders and undernutrition posing the heaviest disease burden [4]. The nutrition crisis in Senegal is further intensified by the novel coronavirus 2019 (COVID-19) pandemic though Senegalese's life expectancy is substantially higher than that of other SSA countries [4, 5]. Besides, there are huge gap between rural and urban, higher-income and lower-income populations with regards to their healthcare access and health status [4, 6]. The Healthcare Access and Quality (HAQ) Index of Senegal ranks 175 out of the 195 countries being measured [7].

Senegal is one of the major recipients of international development assistance in west Africa. In 2017, Senegal received \$909.8 million oversea development aid (ODA) in total, ranking 27th among countries receiving any ODA worldwide [8]. Health sector is the second largest ODA beneficiary in Senegal—20.5% of the ODA received by Senegal are for health [9]. The key donor agencies providing funds for health activities are the Japan International Cooperation Agency (JICA), Global Fund to Fight AIDS (USAID), Tuberculosis and Malaria (GFATM), the World Bank, The Global Alliance for Vaccines and Immunisation (Gavi), and the United States Agency for International Development (USAID). China has been sending medical teams to Senegal since 1975. In 2018, China supported the construction of the Maternal and Child Hospital in Senegal and additional donation of 634,000 RMB worth of medicines and medical equipment. In 2013, China's government launched the Belt and Road Initiative (BRI) to strengthen cooperation between countries and international organization along the 21st century Silk Road, with its focus on trade and health assistance. Senegal joined BRI in 2018, becoming the first participating country in western Africa.

With the Forum of China-Africa Cooperation (FOCAC) related preparations taking place in China, the authors conducted a review and analysis of the health situation of Senegal to provide a view on what international

assurances can focus and support the Senegal to meet its Sustainable Development Goals (SDGs) of health-related targets. The authors took the references of the Harvard University Health System assessment criteria from the published papers and structured an assessment tool covering the elements of population health, health service, health human resources, health financing, and global health cooperation [10]. The data on this report was obtained from peer review journals and United Nations (UN) Agencies' websites, as well as interviews of global health experts for this report.

Population Health

Senegalese people's health development outperforms most of the SSA countries and other countries comparable in economic development. Life expectancy at birth is 67.4 year in 2017, which is higher than SSA average [11]. Life expectancy at birth raised by almost 10 years from 2000 to 2017, and under-five and under-one mortality and premature deaths due to infectious diseases such as lower respiratory tract infections, diarrheal diseases, tuberculosis, malaria and HIV/AIDS have all declined considerably [4]. The maternal mortality ratio (MMR), while still high, has steadily declined, from 401 deaths per 100,000 live births in 2005 to 236 in 2017 [12].

However, there are substantial room for further improving Senegalese' health as most of their burdensome health conditions are preventable [4]. In the past 10 years, neonatal disorders have been the most serious killer of Senegalese—accounting for 8.98% of all deaths and 34.9% of under five deaths in 2017 [4]. In addition, dietary iron deficiency has been the number one cause of disability in Senegal since 2007 [4]. The most dramatic health effects of anemia—increased risk of maternal and child mortality due to severe anemia, have been well documented. Vitamin and mineral deficiencies have been associated with pregnancy complications and poor birth and infant outcomes. And studies have indicated that undernutrition particularly iron-deficient anemia drives the most death and disability combined in Senegal [4].

The Ministry of Health and Social Affairs (MSAS) of Senegal recognizes that maternal and child health and nutrition are its priority [13]. The World Health Organization (WHO) also identified the areas of maternal, newborn, child and adolescent health, particularly nutrition, as a priority for Senegal [14]. In a stakeholder meeting organized by WHO, stakeholders agreed that health system financing and Universal Health Coverage (UHC) as well as maternal and child health were among the top priorities of the health care system [14].

Maternal and Child Health

With neonatal disorders and undernutrition found to be the most burdensome health conditions in Senegal, it is imperative to examine the root cause of these disorders. Among 45 out of 1,000 children not able to survive their fifth birthday in Senegal [15], significant geographic variations exist in various regions in country—the south-east region of Kedougou and Kolda have the highest under-five mortality rates in Senegal while Dakar has the lowest, which is in line with the distribution pattern of Senegal's health and other resources [4]. Neonatal disorder—the number one cause of under-five children's deaths in Senegal—accounts for 34.9% of the total under-five deaths. There are three major contributors to deaths (in order of magnitude) of premature birth, birth asphyxia, and neonatal infections [4]. While study specifically on neonatal disorders in Senegal is absent, studies among other populations have shown that high burden of neonatal conditions is associated with the high adolescent birth rate, high prevalence of anemia among women of childbearing age, low proportion of pregnant women have access to antenatal care, low proportion of births attended by skilled professionals, and low rate of postnatal check-up [15]. The statistics on those indicators show that lessening the burden of neonatal conditions and undernutrition need to take an integrated approach to tackle multiple causes in order to reverse the trends in mortality (Table 1) [15].

Table 1
Maternal and Child Health indicators in Senegal, 2018

Indicator name	Statistics
Adolescent birth rate	18%
Proportion of pregnant women have access to antenatal care	47%
Proportion of births attended by skilled professionals	68%
Rate of postnatal check-up	50%
Early initiation of breastfeeding	34%
Exclusive breastfeeding (0–5 months)5 chil	42%
Continued breastfeeding (20–23 months)	40%
Proportion of children under 5 years old anemic	67.9% (2016)
Proportion of pregnant women anemic	58.1% (2016)
Anemia among women of childbearing age	54%
Vitamin A two-dose coverage	58%
Under five children with diarrhea receive oral rehydration salts	32%
Percentage of households consuming iodized salt (> 0 ppm) among all tested households (%)	62%
Data source: UNICEF, 2018, Available from https://data.unicef.org/country/sen/	

In Senegal, nutrition deficiency has caused the most disability among under-five children in Senegal—iron deficiency, Vitamin A deficiency, and neonatal disorders are the top three contributors of under-five children’s year lived with disability (YLD), account for 20.7%, 14.8%, and 13.7% of the total number of under-five children’s YLD respectively [4]. Besides, 18.8% of the children under five years old are stunted; at the same time, 8.8% of the children are suffering from wasting in 2019 [15]. Even though these are lower than SSA averages, the proportion of under five children stunted or wasted have not been decline steadily like most countries do in recent years. Furthermore, almost one fifth of live births in Senegal were born with low birth weight, which jeopardizes critical early childhood development prospects [16]. As poor nutrition has proven to be an important cause of premature death, we believe that undernutrition, as the driver of most death and disability combined, is the most serious health problem in Senegal, especially for children under five years of age. Moreover, the coronavirus disease is exacerbating fragile contexts in West and Central Africa. It was reported by the United Nations Children’s Fund (UNICEF) that Senegal, Burkina Faso, Chad, Mali, Mauritania and Niger are anticipated to suffer from more acute undernutrition in 2020 due the COVID-19 pandemic, with the number of acute undernutrition cases anticipated to jump from 4.5 million to almost 5.4 million [17].

Studies showed that extending nutrition and growth promotion intervention into rural areas through non-governmental organization (NGO) service providers, and that integrating proven nutrition interventions into health programs at community level improved access to and use of antenatal care, delivery services, and postnatal care by women in Senegal [18, 19]. The WHO performed a Community Nutrition Project (CNP) in Senegal. It provided underweight 6- to 35-month-old children of underweight in urban Senegal with growth monitoring/promotion and food supplementation, and education for mothers for a period of 6 months. However, they did not find no impact was demonstrated in their

intervention zone and they suggested six months of CNP services may not be sufficient for catch-up growth of severely underweight children, indicating longer term programming is needed [20, 21]. Certainly more research on the effective interventions to the high burden of undernutrition and neonatal disorders is needed,

Health service delivery

The health system of Senegal is governed by MSAS, shouldering the responsibilities for national diseases control and prevention, monitoring the national health and social development progress, conducting national health strategic planning with the support from other local government ministries and international partners, regulating health resources together with the Ministry of Community Development and the National Pharmacy Agency, implementing new policies and programs with support from government and non-governmental organizations locally and internationally.

The health service delivery system in Senegal is a four-level pyramid structure with provision of the services by the public, private, and nonprofit entities [22]. The public sector runs mainly facilities at central and regional level [23]. The private service providers are a significant source of health service for the Senegalese, especially in and around Dakar where 72% of private facilities are located [24]. Private facilities are guided by the same policies and regulations as the general health system. The nonprofit sector plays a small but important role in health service provision in Senegal. This is particularly true in rural and peri-urban areas where NGO clinics fill a critical healthcare coverage gap. The way nonprofit organizations operate hospitals, clinics, and medical practices is similar to those described above in the private for-profit sector. However, different from for-profit facilities, nonprofit networks are closely linked with nearby public sector health structures and often act as reference clinics for public sector clients. These close relationships can include invitations to public sector trainings that take place in areas where NGO clinics are located.

As a lower-middle-income country, Senegal has a well-structured health care delivery system [11]. However, it is facing a severe shortage of health workers. WHO estimated that the physician to population ratio was 0.1 per 1000 people and the ratio for nurses and midwives was 0.3 per 1000 people in 2016 [25]. These figures are lower than SSA averages and countries with a similar economic status [26]. The shortage of health workers is even more severe in rural Senegal. The capital Dakar has 70% of all specialist doctors and 39% of all general practitioners serving only 24% of the population while 76% of the population live outside Dakar [27]. Similarly, while the capital has 2 physicians per 10,000 population, Kolda, Fatick, Kaolack, and Matam regions have less than 0.4 per 10,000 [28]. These circumstances combined with the absence of continued training on medical topics after university education have resulted in a very low motivation and effectiveness of their work.

Severe shortage of health professionals and weak performance of health workers make health human resource capacity building one of the top issues to tackle in Senegal. In short term, having specialized organizations with local experience to conduct continuing training of doctors, nurses, midwives, community health workers (CHWs), and relais (outreach person) in rural villages on skill-based training related in compliances to operation guideline, Child delivery technics in low-resource settings, and management of complications around child birth, etc. In the long run, development partners need to assist Senegal in building its health human resources through training and continuous education. WHO and World Bank can help MSAS to design an effective and sustainable mechanism for health human resource financing. Local NGOs and donors can focus on improving compensation to health workers in rural places should also a priority for global health assistance.

Health Financing

Senegal spends 5.5% of its GDP on health, which is higher than both SSA average and lower-middle-income countries' average [3]. And health expenditure takes 6.1% of the total government expenditure, which is also higher than the average of its peer lower-middle-income countries [3]. Total health expenditure is estimated at \$69 per person per year in 2016 [4]. The major sources of health financing are the government, health insurance funds international development assistance for health, and out-of-pocket expenditures. And while overall health expenditure increases in the past 25 years, out-of-pocket expenditures see the greatest increase compared to other sources of expenditure [4]. Recent data indicates \$34 out of the \$69 of health expenditure were estimated to be paid by patients out of their own pockets, which is much higher than SSA average [4, 27]. Health expenditure has put great burden on its people—according to the World Bank, nearly 35% of the population faces impoverishment due to the heavy burden of out-of-pocket payments such as user fees [29].

Public healthcare providers are paid on a fee-for-service basis, with the total amount of reimbursement payment dependent on an annual global budget that set by the government. The aim for global budget is to contain the cost of health providers, where healthcare fee exceeding the budget will not be reimbursed by the government.

Recognizing the financial constrains in accessing healthcare services and in order to reduce out-of-pocket expenditure, Senegal launched its UHC program in 2013. The UHC Strategic Plan is funded through a combination of government subsidies, household contributions, and external funding from development partners. In 2016, after the roll-out of the reform, domestic general government health expenditure increased from 27–35% compared to 2013, and the out-of-pocket expenditure decreased from 55–51% [30]. However, despite the efforts from the government to reforming compulsory health insurance, the social health insurance and voluntary health insurance still only accounts for 4% and 5% respectively [31].

Healthcare Access and Equity

Due to long distance to health facilities, limited transportation means, and environmental conditions (sandy or muddy roads), it was reported that only 32% of rural households have regular access to healthcare facilities [32]. Half of the rural residents indicated that health services are too far from their residency or not even exist [33]. Senegal is the same as in most SSA countries, the health resources are concentrated in the capital. As a result, there are vast variations in health care provision and health outcomes between rural and urban residences and between low-income and high-income patient groups. Furthermore, population whose income fall into the lowest 20% of the income distribution, which represents 68% of the population, cannot use maternal and child health services for economic reasons [6]. Studies have indicated that geographic disparity in maternal and child health outcomes are also consistent with the geographic distribution of wealth [33].

Despite that the Government of Senegal has launched initiative to provide free health care services for pregnant women and under-five children, they still have limited access to antenatal and postnatal care due to lack of health facilities, skilled medical personnel, and nutritional resources within reachable distance. Mladovsky indicated that Senegal's UHC system is fragmented and may have contributed to the inefficiency, inequity and ineffectiveness of its ability to reduce poverty and promote health, and interventions to reduce fragmentation of UHC may be missing [34]. By experimenting interventions on both supply- and demand-sides of Senegal's health systems to examine effectiveness of interventions to reduce inequity, Parmar et al.. found that the rich benefit more from the supply-side intervention (improving the availability of maternal health services) while those living in poverty benefit more from the demand-side intervention (abolished user fees for facility deliveries) [35].

Rural and poorer communities are in dire need of more accessible, equitable, and quality health care, the development research is needed in new models of financial models and tools beyond to make further improvements in access and

quality care services for poor.

Global Health Cooperation

The key global players in the field of health assistance in Senegal include UNICEF, WHO, World Bank, Gavi, JICA, GFATM, and USAID. The health assistance approaches adopted by key donor countries or organizations to work with Senegal MSAS can be summarized as: (1) direct budgeted support, (2) direct technical support, and (3) specific strategies and projects implementation by donors.

Yet in practice, the lack of government resources to implement some of the policies and strategies jointly developed poses a risk to the sustainability of results achieved. There are needs to anticipate alternative sources for resource mobilization and the support of partners for the implementation and uptake of these important results of its joint work with local governmental agencies and other partners. In addition, many stakeholders considered that the national context and priorities continued to evolve and advocated for a revitalized strategic planning process marked by more dynamic cycles, incorporating systematic evaluations and increased flexibility to adjust to country needs in a more focused manner. Finally, coordination mechanisms are limited and aid at the regional level is fragmented while external funds finance a substantial share of total health expenditures in Senegal (21%). On the one hand, donors complement each other by supporting different regions, but this contributes to fragmentation, with several systems being used, increasing inefficiencies in uptake by the national government. Furthermore, only 45% of participating development partners have communicated their resources for the next three years to the MSAS, it poses challenges to the MSAS's own planning and budgeting [36].

In order to achieve more effective use of health resources, it is imperative to build capacity to the local government agencies to take a more active and stronger role in coordinating the distribution of development assistances to their own regions. Another aspect can be considered is incorporating a theory of change that can better frame the pathway for change, including a clear priority-setting process and targets with indicators for both the expected outcome and output levels, and clarify the expected contribution from all levels of the organization in a measurable manner, allowing the monitoring of performance and target achievement.

Conclusion

Senegal has stable political environment and outperforms SSA average in terms of economic and social infrastructure development. These make Senegal a welcoming place for global health collaboration. However, there are still several aspects waiting for substantial improvements in order to achieve better population health, where focused research, undernutrition, maternal health, and health human capacity building should be given priorities. Successful roll-out of nutrition and maternal health interventions needs local government, experienced technical and operation partners, and private sector to work together closely. Even though health-focused NGOs and multilateral organizations are active in Senegal, coordination mechanisms are limited and fragmented, which may have contributed to the inefficient and non-cost-effective health care system. Thus, Senegal MSAS should be the leading institute in coordinating focused and across-the-board interventions. A good implementation partner is essential in the successful roll-out. Implementation partners are responsible of proposing and managing program activities, tracking and reporting program progress, and coordinating among partners and outreach sites. UNICEF Senegal has abundance of experience in on-the-ground operation of health programs and has close relationship with MSAS, thus is a good implementation and coordination candidate. Besides, health interventions need better and clearer priority-setting process, longer project cycle, and systematic data collection of indicators that measure inputs, expected outcome and output are needed to enable sustainable and efficient effect. Global health donors should also adjust their funding

allocation based on new evidence and priorities. Finally, relevant technical multilateral organizations such as WHO and World Bank can help MSAS to design an effective and sustainable mechanism for health human resource financing, while local NGOs and donors can be the implementer of the renewed health human resource financing scheme.

Declarations

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Authors' contributions

YZ wrote the manuscript and contributed to gathering information and synthesizing evidence. LC contributed to report structure and analysis. JC and CZ contributed to gathering information. All authors read and approved the final manuscript.

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Consent for publication

All authors consented to have the paper published.

Competing interests

The authors declare there are no competing interests.

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Annex

Annex 1: Political, economic, social and technological analysis of Senegal

Political, economic, social, and technological background

Political

Senegal was colonized by France in the middle of the 19th century. After experiencing as a member of *Union française* (A special combination of countries formed by the relationship between France and former French colonial countries in Africa) and *the Fédération du Mali* (A federal state of west Africa that existed during 1959-1960, the other member is Sudan), it declared independence as a republic in 1960.

Senegal has been among Africa's most stable countries in the past two decades. It is a semi-presidential republic, with a parliament elected by popular vote every five years. The president of Senegal is the head of state and head of government of Senegal. In accordance with the constitutional reform of 2001, and since a referendum that took place on 20 March 2016, the president is elected for a 5-year term, and limited to two consecutive terms. President Macky Sall is the current President and has been the President since 2012. In April this year, President Sall announced a plan to abolish the position of the Prime Minister. In May 2019, Senegal's parliament approved the constitutional reform to permanently abolish the Prime Minister, and the President will take a more hands-on approach to governing, this marks an era of more power to the President [41].

Economic

According to the World Bank's classification, Senegal is a lower-middle-income country with a Gross National Income (GNI) per capita of \$1,410 in 2018—this is \$97 lower than SSA average [10]. Its gross domestic product (GDP) in 2018 was US\$ 24.1 billion and GDP per capita was \$1,522, also slightly lower than SSA average [10]. However, Senegal is growing rapidly and has made great progress in economic growth. The growth rates of GDP and GDP per capita have been increasing at higher rates than SSA average. In 2018, Senegal's growth rates of GDP and GDP per capita are 6.77% and 3.84%, respectively, compared with SSA average of 2.37% and -0.30% [10].

Senegal is an agricultural country, with added value of agriculture accounting for 16.56% of GDP and over half (58.2%) of the employments in Senegal agriculture-related [10, 36]. Added value of industry accounts for 22.73% of GDP and service industry takes a dominant role [42]. This is a result of prospering tourism industry and tourism-related industries such as catering business and airline business. World Bank has an optimistic forecast of Senegal's economy, particularly with oil and gas production expected in 2022 [3].

Senegal's national poverty head count ratio has been declining. Nation poverty was last measured in 2011 at 46.7% measured by the national poverty line and 38% using the international poverty line (US\$1.9 PPP) [10]. Senegal's GINI index was estimated at 40.3 in 2011, which ranks 14th among SSA countries that have GINI estimates available, indicating that Senegal's income distribution is more equal than most of SSA countries [10]. World Bank commented that *"Poverty should begin to fall faster—from 34% in 2017 to 31.2% in 2020 (IPL)—and by 2020, the decline in the number of poor that started in 2016 should accelerate due to agricultural growth. Under this scenario, poverty reduction in urban areas would be driven by services, remittances, and public construction."* [3]

Social and demographic

Senegal has a population of 15.72 million, of which 8.37 million live in rural areas, accounting for 52.80% of the population, lower than the sub-Saharan African (SSA) average of approximately 62% [3]. The growth rate of total population is 2.78% in 2018, with 3.74% urban growth rate and 1.92% for rural [3]. The urban population is growing at almost twice the rate of the rural population, which is a sign for higher urbanization level in the future. It was estimated in 2016 that up to half of its population is concentrated around Dakar and other urban areas in 2020 [43].

The median age in Senegal is 18.2 years old, and almost one fifths of the population are under five years old (17.5%), over half of the Senegalese aged between 15 and 64 (54.25%) [36]. Fertility rate in Senegal was 4.7 in 2017, close to the SSA average of 4.8, meaning that women in Senegal will have 4 to 5 children on average in their life time [36]. Senegal's death rate is at a low rate of 5.8 per 1,000 population, which is 22.7% lower the world average [10]. With Senegal's high fertility rate low death rate, its population will likely maintain young and grow quickly. This, on the other hand, has also resulted in a high dependency rate with children. Senegal has a high dependency ratio of 84.32%, but a high percentage are with children (78.75%) and only 5.57% are with elderly [44]. Thus, to benefit from a demographic dividend, Senegal needs to accelerate its fertility decrease.

Notwithstanding Senegal's progress and great potential in economic development, it is classified as a country with low human development by the United Nations Development Programme (UNDP)—its Human Development Index (HDI) ranks 166 out of the 189 countries that were evaluated [46]. HDI, created by UNDP, is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. Senegal's HDI ranking is 12 lower than its GNI per capita ranking, meaning its human development does not catch up with its economic development [45].

Education situation in Senegal is worrisome—almost half (48.1%) of the people over 15 years old are not literate, and current primary education completion rate is only 53%, much lower than lower-middle-income countries average of 90.2% and even lower than SSA average of 68.5% [46]. Furthermore, despite the encouraging intergenerational progress, adult women are systematically less educated than men—about 46% of women aged 15–49 years old received no education which, together with their lower access to productive inputs and discrimination, weighs heavily on their agency and access to opportunities [46].

While basic infrastructure is not robust in Senegal, it outperforms most of the SSA countries (Table 2). Reliable electricity is accessible to 62% of the population, but with a huge gap between rural and urban areas [10]. As for the communication sector, 46% of the people have used internet in the past 3 months, which is almost twice as much as SSA average; and there are 104.5 mobile cellular subscriptions per 100 people, also well above SSA average of 77.4 subscriptions per 100 people [37]. Besides, over 80% of the population have access to basic drinking water sources, and over half of the population are using basic sanitation facilities [36].

Table 2.

Basic infrastructure coverage, Senegal and SSA average

	Senegal	SSA average
Assess to reliable electricity (overall)	61.7% (2017)	44.6% (2017)
Assess to reliable electricity (urban)	91.7% (2017)	79.0% (2017)
Assess to reliable electricity (rural)	35.4% (2017)	22.6% (2017)
Individual using the internet (overall)	46.0% (2017)	25.4% (2017)
Mobile cellular subscription (per 100 people)	104.5 (2018)	77.4 (2018)
People using at least basic drinking water services (overall)	80.7% (2017)	61.0% (2017)
People using at least basic drinking water services (urban)	92.3% (2017)	84.1% (2017)
People using at least basic drinking water services (rural)	70.5% (2017)	45.7% (2017)
People using safely managed sanitation services (overall)	51.5% (2017)	30.9% (2017)
People using at least basic sanitation services (urban)	65.0% (2017)	44.9% (2017)
People using at least basic sanitation services (rural)	39.6% (2017)	21.7% (2017)

Source: World Bank, 2019.

Technological

The African Regional Center for Technology, with 30 member states, has its headquarters in Dakar, Senegal. Most research facilities in Senegal deal with agricultural subjects. Dakar has centers for mining and medical research and a research institute on African food and nutrition problems. The University Cheikh Anta Diop de Dakar, founded in 1949, has faculties of medicine and pharmacy and of sciences, and research institutes in psychopathology, leprosy, pediatrics, renewable energy, applied tropical medicine, applied mathematics, health and development, environmental science, adontology and stomatology, applied nuclear technology, and the teaching of mathematics, physics, and technology [46].

Figures

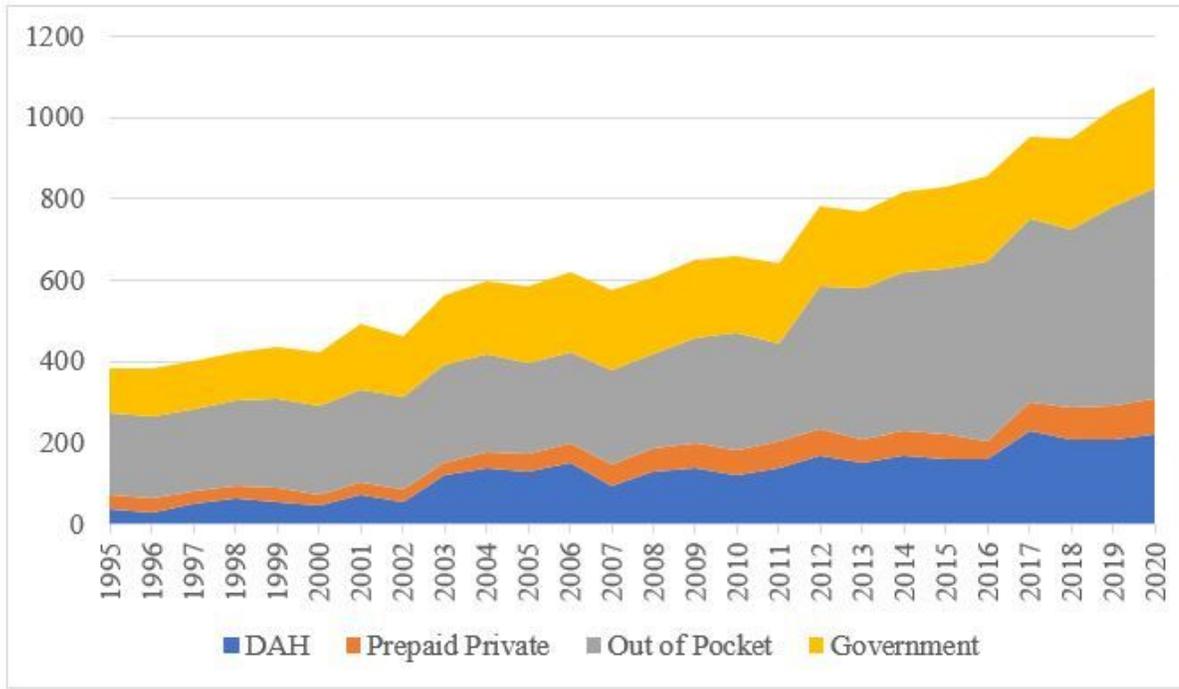


Figure 1

Trend of total health spending (million) by source, 2000–2020 Data Source: IHME, 2020, Available from: <https://vizhub.healthdata.org/fgh/>