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Constraints Related to Community Resilience to Climate-Sensitive Diseases in the Lower Ouémé Valley in Benin

Appolinaire D. Gnanvi^{1*} and Michel Mehinto²

¹Department of Sociology-Anthropology,

²Department of Psychology, University of Abomey-Calavi, Benin

**Corresponding author*

Abstract

Climate change negatively impacts the health of populations in the lower Ouémé valley. These effects on natural and physical systems affect vulnerable people and expose them more to the risks of malnutrition, vector-borne, non-communicable, food-borne or water-borne diseases and zoonoses. Faced with climate-sensitive diseases, what are the constraints that limit the control of infectious risks in hospitals? This research, which is part of the sociology of health, aims to contribute to improving the resilience of vulnerable local communities in the Adjohoun, Bonou and Dangbo health zones to malaria, cardiovascular diseases and acute respiratory infections. The methodological approach is based on quantitative data and discourse analysis to identify the organizational and technical capacities of hospitals and health centers. A total of 93 actors were approached in 03 municipalities at a rate of 31 people taken at random in each municipality. After triangulation of sources, the results show that the integration of climate information into disease surveillance makes the health early warning system effective. Then, strengthening the operational capacities of health personnel to ensure the resilience of populations to climate risks is essential. Finally, improving the technical capacity of health centers through the provision of sustainable equipment and technologies adapted to climate change is a way to meet new health challenges.

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Introduction

Climate change has negative impacts on the health of populations in Benin in the Adjohoun-Bonou-Dangbo communes. The associated risks include flooding, an early end to the rainy seasons and a trend towards rising temperatures. The consequences of climate hazards do not spare any ecosystem, whether natural or human. Vulnerable people, including children under five, pregnant women, the elderly and those with disabilities, are more exposed to the risks of malnutrition and the

incidence of vector-borne, non-communicable, food-borne or water-borne diseases and zoonoses. This threatens the livelihoods of these populations and increases their level of poverty.

As a least developed country, Benin faces several development challenges, mainly poverty, limited access to health care, lack of infrastructure and other public services. Several adaptation measures have been recommended by the government of Benin, which are based on vulnerability studies in the health sector. These

measures are aligned with national priorities and national strategies, programs and plans included in strategic documents such as: the National Development Plan (PND 2018-2025), the Low Carbon and Climate Resilient Development Strategy (2016-2025), the National Climate Change Management Policy (PNGCC), the National Health Policy (PNS 2018-2030), the National Health Development Plan (PNDS 2018-2022), the National Community Health Policy in Benin (PNSCB), the National Adaptation Action Plan (PANA) (Ministry of the Environment and Nature Protection, 2008), the Third National Communication (TCN) (Ministry of Living Environment and Sustainable Development, 2019), the Nationally Determined Contributions (NDC) and the National Climate Change Adaptation Plan (NAP). Indeed, the government of Benin has defined several measures in order to provide Benin with a regulated, efficient and resilient health system by 2030.

Despite this arsenal of entrenched measures, the psychological dimension of climate adaptation in the health sector is not often integrated into the strategies proposed to enable populations to cope with life stresses and contribute to community and socioeconomic development. Several individual, social and structural determinants can combine to protect or compromise human health.

It follows that the contexts, the specificities of territories and unfavorable social, economic, geopolitical and environmental circumstances can accentuate inequalities and exacerbate poverty (WHO, 2022). The following research question arises: In the face of climate-sensitive diseases, what are the constraints that limit the control of infectious risks in hospitals?

Materials and Methods

Improving the resilience of vulnerable communities in this area to malaria, cardiovascular diseases and acute respiratory infections is becoming an imperative for the development of this locality. The methodological approach is based on strategies for integrating climate information into disease surveillance in order to make the current health early warning system effective, strengthening the operational capacities of health personnel for emergency management in extreme events, and providing sustainable equipment and technologies to identify related constraints. Then, the proposed solutions draw their sources from climate change adaptation priorities.

Finally, the implementation of community actions to strengthen the resilience of vulnerable populations in the research health zone in the face of climate emergency situations.

Description of the research population and sampling

The sampling techniques used here are "reasoned choice" sampling to identify resource persons specializing in climate change and decentralization. These people were chosen taking into account their roles and functions in the institutional system of territorial governance. This sample was expanded using the "snowball" technique to reach more resource persons.

Three target groups were decisive in defining the sample size: local elected officials, whose total number was 77; technical agents of regional associations (RA) and development associations (DA), whose number was 30; and finally 160 technical agents of town halls. The table below shows the distribution of each target group in the total research sample.

Data collection and processing

Data collection is primarily based on documentary research. This research is based on readings that subsequently led to exploratory interviews. "Exploratory interviews usefully complement readings. They allow the researcher to become aware of aspects of the question to which his own experience and his readings alone would not have made him sensitive" (Campenhoudt *et al.*, 2017, p. 103). These interviews concern resource persons, experts with precise knowledge on the topic under study. The information collected guided the research towards other reading sources to supplement these interviews. The research question served as a guiding thread for the development of data collection tools. These are the questionnaires and the interview guide.

The questionnaires were developed according to the variables likely to answer the research question. The interview guide, for its part, made it possible to organize the different themes that emerge from the problem. In total, three (03) questionnaires were developed, respectively for local elected officials, technical agents of town halls and community development associations. The SPSS software, whose English acronym stands for "Statistical Package for the Social Sciences", made it possible to process and analyze the statistical data collected from the city's residents. The use of this software accelerated the obtaining of results while

significantly reducing the risk of errors that could result from manual processing. Finally, the processing and analysis of data includes four (04) different phases: coding, entry, cleaning and tabulation. In addition, data processing required the description and preparation of data; analysis of relationships between variables; comparison of the results obtained with the expected results.

Results and Discussion

Geographic, climatic and environmental profile of the Adjohoun – Bonou – Dangbo health zone

Geographical location The Adjohoun – Bonou – Dangbo (ABD) health zone is located in the lower Ouémé valley in the south-east of Benin between 6°33'24" and 6°55'32" north latitude and between 2°23'46" and 2°36'51" east longitude (Appendix 2). It covers an area of approximately 923 km² and has three communes, namely Adjohoun, Bonou and Dangbo, 20 districts and 130 villages and city districts (INSAE, 2016). The ABD health zone is located in the Ouémé department and is bordered to the north by municipality of Ouinhi in Zou; to the south by the commune of Aguégoués in Ouémé; to the East by the municipalities of Adja-Ouèrè and Sakété in the plateau and Akpro-Misséré in Ouémé and to the West by municipalities of Zogbodomé in Zou, Zè and So-Ava in the Atlantic.

Physical environment: climatic characteristics

The climate of the ABD health zone located in the Guinean-Congolese zone of Benin is characterized on the one hand by two rainy seasons (a long season from April to July and a short season from September to November) and, on the other hand, by two dry seasons including the short season from August to September, the long season from December to March. This bimodal climate dynamic allows two crop cycles both on the plateau and in the floodplain. Precipitation is irregularly distributed throughout the rainy seasons, with an average height of 1,122.19 mm per year. This irregularity of precipitation constitutes a hindrance to rain-fed agriculture, due to the lack of appropriate development likely to promote water control.

Physical environment: Pedology and soils

The ABD health zone has two topographical units. The first unit, the plateau called "Aguédji" in the local language, is characterized by a soil of barren earth, a

fairly homogeneous mixture of kaolin clay and quartz sand. The relief, not very uneven, is made up of a plateau with steep slopes towards marshy depressions causing significant erosion in the form of ravines and basins, places of temporary water retention during the rainy seasons.

The second topographical unit, the lake area called "Wodji" in the local language, is the Ouémé River valley in Adjohoun, Bonou and Dangbo. Ranked as the second richest valley in the world after the Nile in Egypt, this Ouémé valley is covered with clayey-silty soils supporting market garden crops and fish holes.

Environmental profile of the ABD health zone: ecosystems and plant formations

The plant cover of the ABD health zone differs slightly from one municipality to another. Thus, in Adjohoun, there are places of grassy savannah, shrubby savannah, meadows and marshes, some of which are in the process of being filled in due to the variability of climate change and silting (Mairie, d'Adjohoun, 2017). There is a classified relict forest in Togbota (approximately 10 ha) which constitutes the habitat of red-bellied monkeys (*Cercopithecus erythogaster*: ZIN KAKA), an endangered species, which is protected and classified forests which are located in Akpadanou (Kpinkonzoun) and Gogbo (Lodouko).

In Bonou, the vegetation is mainly made up of herbaceous and shrubby savannahs with islands of sacred forest (Gbèvozoun). This vegetation is dominated by plantations of oil palms, teak and *Acacia auriculiformis*. The watercourses are bordered by a few islands of gallery forest.

These plant formations are poor in wildlife due to human pressure but they provide the populations with firewood, medicinal plants and molluscs (Mairie de Bonou, 2018). There are 15 ha botanical garden (medicinal plant garden) in Bonou which is currently benefiting from a project funded by the National Fund for the Environment and Climate (FNEC). This FNEC project aims at the sustainable conservation of threatened animal and plant species in the Gnanhouzoun community protected areas and Yitikpa botanical garden.

In Dangbo, the vegetation is of the wooded savannah type where natural oil palms predominate. There are also about ten forest formations (forests, fetish forests and others) estimated at around 108.75 hectares. The forests

are dominated by samba, kola trees, false ebony, daniellia, linza (Dangbo Town Hall, 2017). This plant cover is now seriously degraded under human pressure for the purpose of searching for firewood, acajas and timber but also by the stagnation of flood waters which uproot certain trees.

Hence it becomes imperative to protect them through reforestation. Most of the plant cover in the commune resists human hazards because of the strong sacredness that surrounds it. As in Bonou, there is also a botanical garden (medicinal plant garden) of 10 hectares in Dangbo.

Socio-economic context of Benin and the Adjohoun – Bonou – Dangbo health zone

Socio-economic context of Benin

Benin, a developing country located in West Africa, is classified as a lower middle-income country in July 2020. Its population is estimated at 12,314,650 inhabitants in 2022 and its economic growth rate is 7% in 2021. Its Human Development Index (HDI) is 0.525 in 2021, which ranks the country 166th out of 191. The national poverty rate stands at 38.5% in 2019 with rural poverty at 44.2% compared to 31.4% for urban areas (UNDP, 2022). The Beninese economy is characterized by the predominance of agriculture and services.

Socio-economic context of the Adjohoun – Bonou – Dangbo health zone

The total population of the ABD zone is estimated at 249,480 inhabitants in 2018. Dangbo is the most populated commune with a density of 747 inhabitants / km² in 2018, followed by the commune of Adjohoun, 282 inhabitants / km² and Bonou, 205 inhabitants / km². Agriculture is the main economic activity practiced in the three communes of the zone. It occupies respectively more than 80%, 47% and 56% of the active population of the communes of Adjohoun, Bonou and Dangbo and contributes more than 85% and 87% to the household income of the communes of Adjohoun and Dangbo respectively.

The ABD health zone is also characterized by a high level of poverty. Indeed, the Human Poverty Index (HPI) is 39% in Adjohoun, 33.5% in Bonou and 41% in Dangbo and the percentage of the population suffering from multidimensional poverty is respectively 40.5%, 35.1% and 51.7% in the municipalities of Adjohoun,

Bonou and Dangbo. This poverty is manifested by a low level of access to decent housing, health and sanitation infrastructure, malnutrition and lack of education. The dwellings in the ABD zone, of two categories (grouped habitats or dispersed habitats), are built according to the sites of the valley and the plateau. In this zone, precarious and very poorly ventilated habitats are dominant. They are built on stilts in precarious materials made of straw and assembled wood and are often damaged by the periodic floods of the Ouémé River and by strong winds. On the plateau, the huts, also poorly ventilated, are generally built of earth covered with thatch or sheet metal.

Climate change in the ABD health zone

The Adjohoun – Bonou – Dangbo (ABD) health zone enjoys a subequatorial climate with four seasons characterized by the alternation of two rainy seasons and two dry seasons. It is one of the southern health zones where the major climatic hazards observed are floods, drought, rising river levels, heavy rainfall and excessive heat.

The months from February to April are the hottest and the temperatures recorded from 1985 to 2022 are above 25°C with monthly extreme temperatures varying between 29.03°C and 29.31°C in the health zone. Between 1985 and 2022, annual rainfall amounts varied between 604.10 mm and 1,690.23 mm and annual relative humidity between 60.24% and 90.41% in the ABD health zone. Figure 1 below shows the interannual variation in rainfall, temperature and relative humidity during the period 1985-2022.

Figure 1 shows that the interannual variation of relative humidity indicates an increasing trend over the period 1985 – 2022 with peaks in 2014 (89.76%), 2016 (89.98%) and 2021 (90.06%). It also shows that the period 1985 – 2022 was relatively warm and a discontinuous variation in rainfall. The rainfall analysis shows an interannual variation characterized by abundant amounts of precipitation with rainfall greater than 1,400 mm in the ABD zone during the years 1988 (1,548.80 mm), 1989 (1,437.23 mm), 1999 (1,509.97 mm), 2010 (1,690.23 mm), 2013 (1,497.60 mm), 2014 (1,518 mm), 2016 (1,412.82), 2017 (1,478.57) and 2020 (1,44.48).

The peak rainfall for the entire period was reached in 2010, a year characterized by heavy rains throughout Benin which caused the largest floods in the history of Benin. After the heat waves from 1993 to 2006, the

hottest years are concentrated in the last decade (2015 – 2022). The high temperatures were observed during the years 1993 (29.30°C), 1994 (29.24°C), 1995 (29.31°C), 1996 (29.12°C), 1998 (28.77°C), 1999 (29.09°C), 2000 (29.03°C), 2018 (28.76°C) and 2019 (28.71°C). The analysis of the increase in average temperature reveals that the average temperature increased by 1.01°C between 1985 and 2022.

The analysis of Figures 2 and 3 shows a general increasing trend in future climate variation. High humidity levels of over 90% are expected in the next thirty (30) years with peaks of over 99% from 2023 (Figure 2A) and the temperature of the next thirty (30) years (2023-2050) will be above 28°C with an increasing trend between 28.55°C (2022) and 29.49°C (2050), an increase of 0.94°C by 2050 (Figure 2C).

Figure 2B also shows an increasing trend in rainfall with an average above 1,200 mm and a sawtooth pattern with two maximum peaks in 2030 (1,429.60 mm) and 2043 (1,446.29 mm). The year 2034 will experience the lowest rainfall (1,136.77 mm). Figures 3 and 4 show the spatial distribution of temperature and rainfall in the ABD zone in 2050.

The social groups in the ABD zone most affected by climate change are farmers, transporters, traders and craftsmen, breeders and river sand extractors. The impacts of climate change perceived and mentioned by producers and rural development stakeholders in the three municipalities can be summarized as the disruption of crop calendars, the continued decline in crop productivity and agricultural production. Indeed, these stakeholders are increasingly observing the delay in the establishment of the flood which, from July to August, has moved to the end of September-October. This leads to the submersion and destruction of nurseries. The direct consequences are the destruction of crops, the decline in agri-food production, food insecurity, the weakening of the local economy, the decline in household income, the worsening of poverty and the worsening of climate-sensitive diseases.

Climate-sensitive health risks in the ABD health zone

Climate change has direct and indirect effects on human health and a disproportionate impact on the most vulnerable groups, including children, women, the elderly, low-income populations and people in developing countries (WHO, 2016). The ABD health zone is one of the climate-sensitive areas with the highest

incidence of malaria in Benin with an incidence of 17.2% in 2019 (BZ-ABD/MS, 2020). During the same year, the incidences of CVD and ARI (high and low) were 3‰ and 4.2‰ respectively in the zone. Furthermore, projections showed that, regardless of the scenario considered, including the most optimistic climate scenario (RCP 2.6) and the most favorable socioeconomic scenario associated with it (SSP1), when considering the dominant pathologies in Benin (malaria, acute respiratory infections and diarrheal diseases), it is clear that the vulnerability of the health of the populations will probably be above average by 2030 and 2050 in the project area (Ministry of Health, 2017).

The climate risks observed in this area can have serious health and social consequences on the population, such as conflicts over access to water or food, the spread of diseases and increased human migration. Also, the increases in temperatures announced in this area could drastically increase the risk of mortality among the elderly, pregnant women and children under 5 years old.

Climate change health impact chain

The impact of climate change on health is strongly influenced by environmental, social and public health determinants and is manifested through several channels. Figure 4 below presents the channels through which climate change influences health in general.

Specifically in the ABD zone, this influence of climate change on health can be analyzed. The figure below attempts to understand the climatic parameters and the relationship between temperature, rainfall and humidity and ARIs from 2009 to 2020.

Apart from this relationship, we can also try to understand the relationship between these different climatic parameters and the MCVs. The history of this evolution is shown in Figure 4.

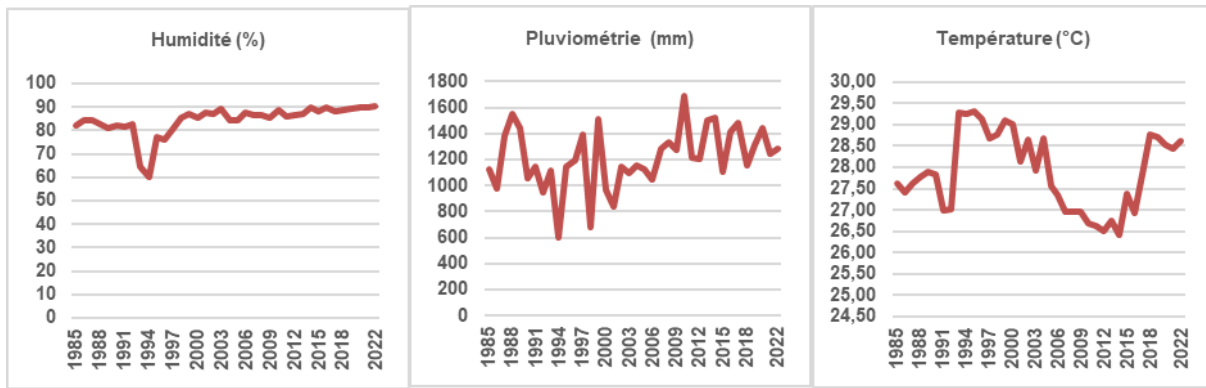
Constraints in the ABD health zone exacerbated by climate change

Benin's health system faces several types of challenges that are exacerbated by climate change. These constraints of the health system include: inadequacies related to the current Early Warning System (UNDP, 2014), constraints related to the resilience of health products, constraints related to health infrastructure and equipment, and constraints related to financing the health system in the face of climate change.

Table.1 Sampling

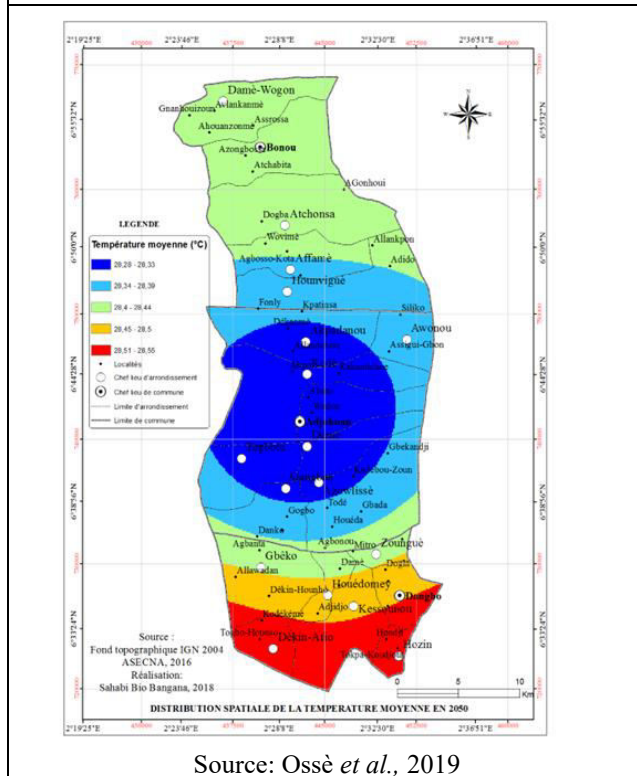
Health zones	Dangbo	Bonou	Adjohoun	Total	Percentage
Targets					
Doctors	5	5	5	15	16,13%
Health administrators	3	3	3	9	9,68%
NGOs	3	3	3	9	9,68%
Men	10	10	10	30	32,26%
Women	10	10	10	30	32,26%
Total	31	31	31	93	100%

Figure.1 Interannual variation of climatic parameters (rainfall, temperature and relative humidity) in the ABD zone from 1985 to 2022



Source: Authors, based on data from Météo-Bénin

Figure.2 Mapping of projection of temperature in the health zone in 2050



Source: Ossè et al., 2019

Figure.3 Mapping of the projection of rainfall in the health zone in 2050

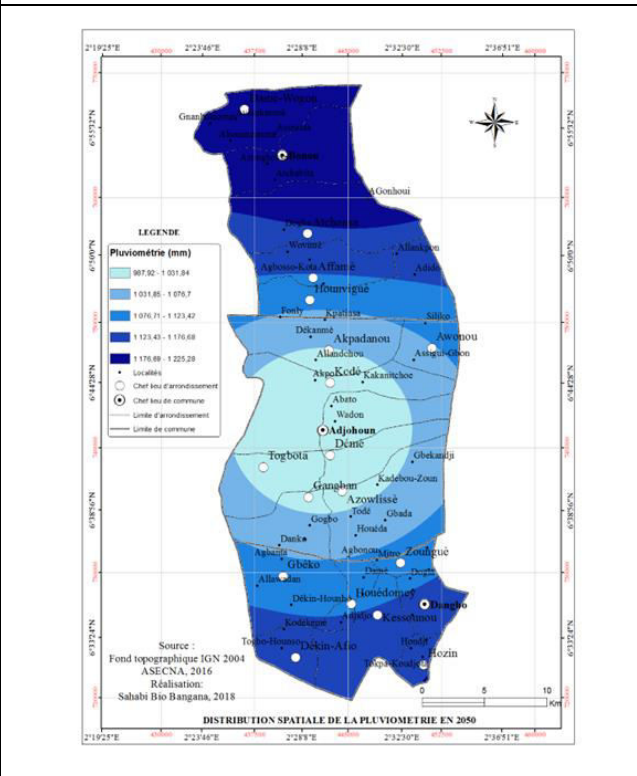


Figure.4 An overview of climate-related health risks, their exposure pathways and vulnerability factors Source: WHO, 2021

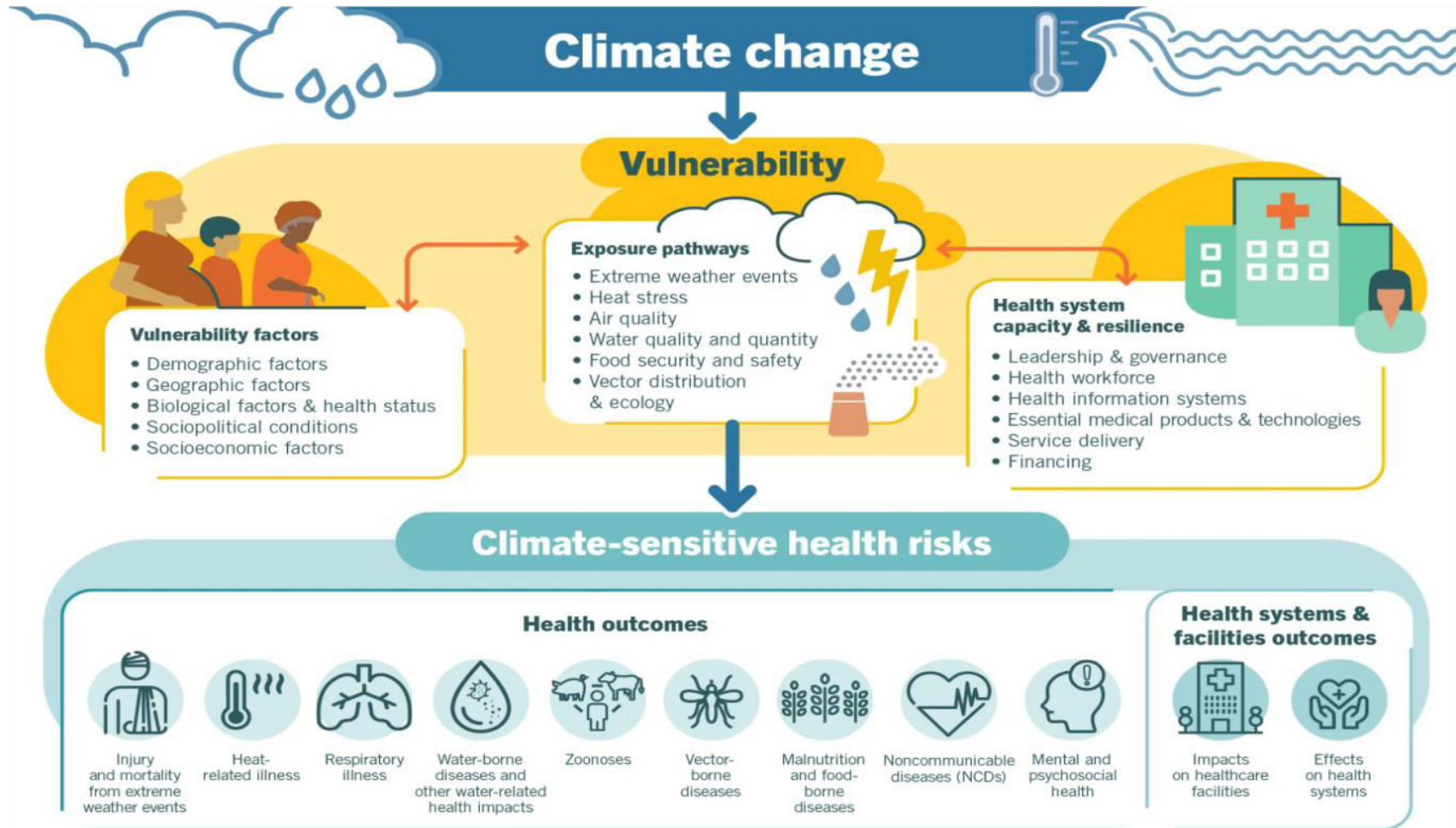
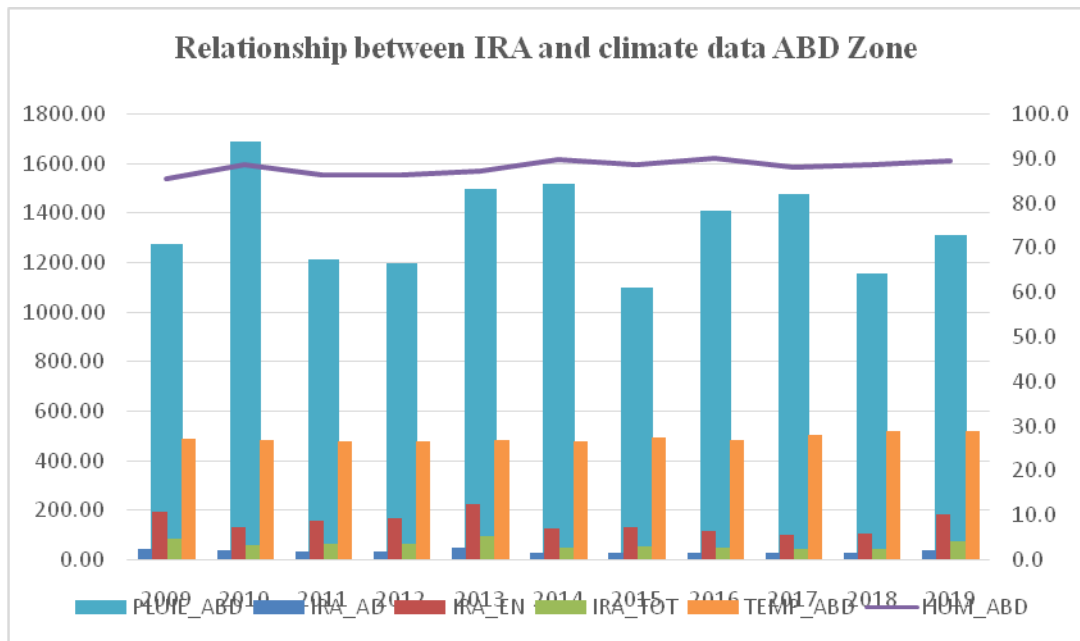
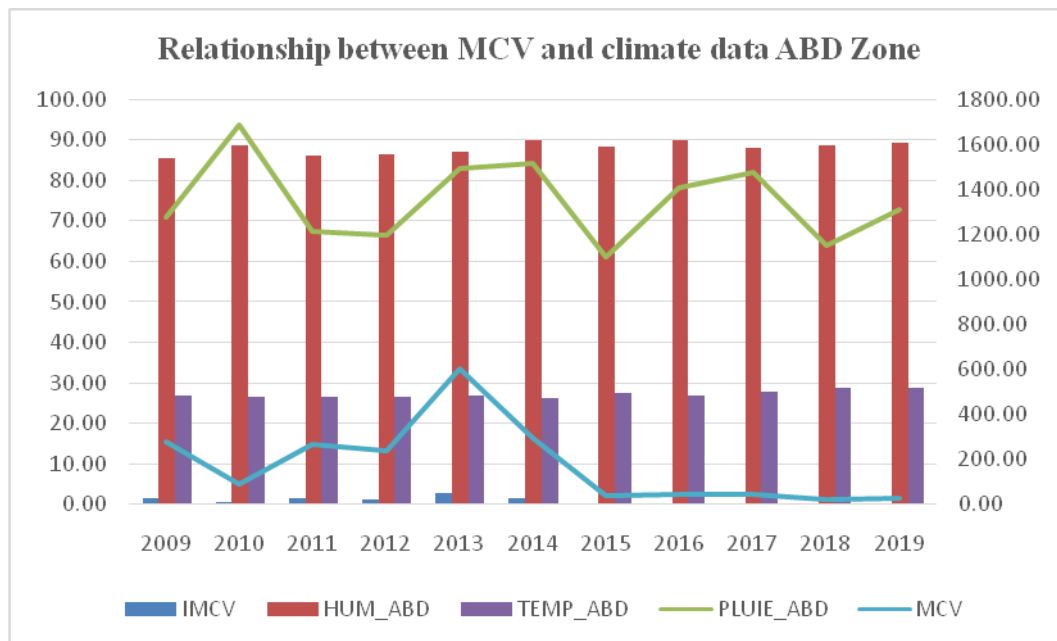


Figure.5 Relationship between temperature, rainfall and relative humidity and the IRAs from 2009 to 2020 in the ABD health zone



Source: Authors, based on Météo-Bénin data

Figure.6 Relationship between temperature, rainfall and relative humidity and MCVs from 2009 to 2020 in the ABD health zone



Source: Authors, based on Météo-Bénin data

Shortcomings related to the current Early Warning System (EWS)

Among the shortcomings of the EWS, there is an incomplete consideration of the stakeholders of an EWS, in particular the involvement of the community (local and community institutional structures and town halls), the lack of synergy and communication strategy between the stakeholders (weather, hydro, ocean, community), this national EWS only takes into account one risk for the moment: flooding, does not integrate health aspects in the collection of data and the transmission of alerts to communities. All these shortcomings of the current EWS do not allow the health system and populations to be informed in real time about the resurgence of climate-sensitive diseases in the ABD zone.

Constraints related to the resilience of health products

The rate of attendance at health services in the ABD area is low (27% in 2019). This low attendance at health services is due, among other things, to the quality of care in certain health centers, the financial accessibility of the populations, the floods which seriously affect the physical accessibility of these centers, the insufficiency of traditional awareness-raising activities as well as cultural reasons, in particular the use of traditional medicine which is also faced with the disappearance of certain medicinal plants and the weak collaboration with clinicians to grant their diagnosis.

Constraints related to infrastructure and health equipment

In the project area, the coverage of health infrastructure is total (100% in 2019). Unfortunately, these health infrastructures are vulnerable to extreme weather events such as floods and the increase in temperature which are rife in the area.

Another inadequacy is the significant proportion of health structures which do not meet the norms and standards in terms of resilient equipment and architectural program adapted to CC. Added to this is the poor planning of the acquisition, construction and maintenance of health infrastructure and equipment to cope with climate change.

A policy for better organization of equipment maintenance is being implemented by the Agency for Health Infrastructure, Equipment and Maintenance.

However, current technologies are not compatible with extreme weather events.

Constraints related to financing the health system in the face of climate change

Actions planned in planning documents (PNDS, PNS) to respond to climate emergencies in terms of health are often not implemented. National financial resources are limited and do not cover the additional costs generated by health situations induced by climate disasters.

National resources are mainly directed to meet the current high demand for financing curative interventions. The additional costs induced by the impact of CC must be sought elsewhere, in particular from the GCF.

As a least developed country, Benin faces multiple development challenges, including poverty, lack of infrastructure, and limited access to health care and other public services.

The government prioritizes these urgent development needs, and as a result, resources to invest in climate change adaptation are not readily available. Benin's room to take on more debt is also limited, as it is at medium risk of debt distress according to the International Monetary Fund (IMF).

In addition, the analysis of economic performance in Benin reveals an average economic growth of 7% in 2021 (INStAD, 2022) against a demographic growth of 2.7% per year and a poverty rate of 38.5% in 2019. The country is in the category of nations with low development with a Human Development Index (HDI) of 0.525 in 2021 ranking Benin 166th out of 191 (UNDP, 2022). The impact of climate change on the agricultural sector (development base) is increasingly weighing down the country's economy, affecting nutrition by influencing food security and then increasing poverty and consequently the level of access to health care.

The level of financing of the health sector from 2009 to 2017, far from meeting the requirements of the Abuja Declaration, which recommends an allocation of at least 15% of the General State Budget, is characterized by a permanent decline ranging from 9% in 2009 to 5.53% in 2017.

An analysis of the national health accounts reveals that the share of households in current health expenditure increased from 42% in 2012 to 52% in 2015, while the State's contribution increased from 24% in 2012 to 20%

in 2015 and that of Technical and Financial Partners from 29% in 2012 to 20% in 2015 (MSP, 2018). This shows the insufficiency of financial resources devoted to the health sectors to address the health challenges induced by climate change.

It is also important to note that Benin has adopted the cost recovery system since 1988 as part of the Bamako Initiative and the financing of the health sector. Thus, the prices charged in public health facilities are not affordable for poor populations, especially in rural areas. This project aims to address this situation by strengthening the technical platform and increasing the accessibility of the poor to health services in a context of climate change. Furthermore, current interventions used in the fight against malaria in Benin (long-lasting impregnated mosquito nets, indoor residential spraying) have shown their limitations because these actions do not integrate national planning in relation to the perverse effects of climate change on the health sector (no significant decrease in incidence). It is therefore important to change to a more sustainable approach in order to improve the health of vulnerable populations (Ossè *et al.*, 2019). This involves initiating progress towards a complete paradigm shift that improves the health conditions of poor populations by increasing productivity in the intervention areas and will contribute to the emergence of the local economy.

Conclusion

This research focuses on the constraints preventing a change that transforms and strengthens resilience to climate change. By highlighting the insufficient capacities of health care experts, the current inability to alert and protect vulnerable populations, the current low capacity to diagnose and treat patients suffering from climate-sensitive diseases, the inadequacy of current technologies and infrastructures for extreme weather events, the low capacity of care with a high demand in the event of extreme weather events, the population's access to health facilities in climatic events and the low availability of current financial resources to respond effectively to health situations, it postulates that the solutions to psychological problems and population stress lie in adaptation to climate change. Indeed, if the prevalence of climate-sensitive diseases is reduced, access of vulnerable populations to permanent health care and services is improved, their livelihoods are increased, and the skills, information and knowledge base on climate risks related to malaria, ARI and CVD in the ABD zone is strengthened, then surveillance and

better management of these diseases will be ensured, community resilience will be improved, a better EWS will be established and maintained and the capacities acquired in the targeted area will be extended to other areas because an innovative health system and infrastructure are put in place, concrete adaptation measures are deployed, technical assistance is provided to health personnel and vulnerable communities and knowledge is disclosed and disseminated.

References

- Adjohoun Municipality (2017). *Communal Development Plan July 2017 - June 2022*, 3rd Generation, Adjohoun, Benin, 193 p.
- Bonou Municipality (2018). *Communal Development Plan 2018 - 2022*, 3rd Generation, Bonou, Benin: Ministry of Decentralization and Local Governance, Bonou Municipality, p.156
- BZ-ABD/MS. (2020). 2019 *Health Statistics Yearbook for the Adjohoun-Bonou-Dangbo Health Zone, Adjohoun, Benin: ABD Zone Office (BZ-ABD)*, Statistics Unit of the ABD Health Zone, Ouémé Departmental Health Directorate, Ministry of Health, p. 154.
- Campenhoudt *et al.*, 2017**
- Dangbo Municipality (2017). *Communal Development Plan 2018 - 2022*, 3rd Generation, Dangbo, Benin, 118 p.
- INSAE. (2016). *Main socio-demographic and economic indicators of Ouémé Department* (RGPH, 2013), Cotonou, Benin, 35 p.
- INStAD (2022). *Demographic projections from 2014 to 2063 and prospects for social demand from 2014 to 2030 in Benin*. Directorate of Demographic and Social Statistics, National Institute of Statistics and Demography, Ministry of Economy and Finance, Cotonou, Benin, 137 p
- Ministry of Health (2017). *Health Statistics Yearbook for the Adjohoun – Bonou – Dangbo Health Zone, 2019*, Departmental Directorate of Health of Ouémé and Plateau, Adjohoun, Benin, 154 p.
- Ministry of Health of the Republic of Benin (2018). *National Health Development Plan 2018*. 52p
- Ministry of Living Environment and Sustainable Development (2019), *Third National Communication of Benin to the United Nations Framework Convention on Climate Change*, 272 p.
- Ministry of the Environment and Nature Protection (2008). *National Action Program for Adaptation*

- to Climate Change in Benin (PANA-BENIN), 81p.*
- Ossè, R., et al., (2019). *Climate Change Vulnerability Study of the Health Sector in Benin, Report produced under the project “Scientific Support Project for National Adaptation Plan Processes in the Least Developed French-Speaking Countries of Sub-Saharan Africa”*, Climate Analytics gGmbH Berlin, 52 p.
- UNDP. (2014). *Strengthening Climate Information and Early Warning Systems in Africa for Climate-Resilient Development and Adaptation to Climate Change: Benin (SAP Benin)*, United Nations Development Programme (UNDP), 206 p.
- UNDP. (2022). *Human Development Report 2021/2022. Uncertain Times, Disrupted Lives. Shaping Our Future in a Changing World*, New York: United Nations Development Programme (UNDP), p. 48.
- WHO (2016). *Operational Framework to Strengthen the Resilience of Health Systems in the Face of Climate Change*, 60p.

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