European Commission

SCIENCE BEHIND THE DEBATE

Healthcare and WASH versus COVID-19 outbreak in Africa

Key points

✓ Since 2000, the vulnerability of the overall African continent to respiratory diseases decreased. However, infections and concretely lower respiratory infections remain high and account for 10.4% of total deaths, reaching up to 916,851 deaths in 2016[1] across the continent. In the context of COVID-19, these are important factors to consider.

✓ Disparities exist across the continent: 55% of countries (Class C-2016) are considered the most vulnerable to mortality due to lower respiratory diseases because they show the lowest life expectancy, weakest healthcare system and limited Water Access, Sanitation and Health (WASH) services, highest mortality rates and lowest rates of urbanization and migration remittance inflow.

✓ Official Development Assistance (ODA) does not appear to be associated with reduced vulnerability to respiratory or infectious diseases at the country level, but its potential positive impact can be observed on a smaller scale (to be further studied).

✓ Remittance inflows coming from national diaspora appears positively associated to lower mortality and better access to WASH services.

✓ Additional efforts to increase access to water, sanitation and handwashing as a result of the COVID-19 pandemic, could also impact other prevalent diseases that contribute to high rates of mortality in Africa, such as diarrhoea (7.4%), malaria (4.6%) and tuberculosis (4.6%), which accounted for as many as 2,383,263 deaths (27% of total deaths) in 2016 (WHO, 2018).

Introduction[2]

As the COVID-19 crisis spreads around the world, it is essential to build on the experiences and lessons learned from China and Europe in the fight against this pandemic at a very high cost in human lives, as well as the hard-won experience in Africa from the recent Ebola and preceding cholera outbreaks. One of the lessons learned has been that those with the least access to essential services such as water, sanitation and hygiene will probably feel the most dramatic effects. An act as simple as frequent hand washing for at least 20 seconds could prevent the dramatic spread of the pandemic among the population[3]. Although indoor and outdoor air quality are the main environmental factors related to lower respiratory infections, the lack of access to handwashing facilities is also recognised as a contributing factor in the case of lower respiratory infections, which are a leading cause of morbidity and mortality around the world.

From this particular crisis, we have come to understand that public health depends on the security of water resources for all (Sustainable Development Goal 6 - SDG 6). Preventive measures are aimed to slow down the spread of COVID-19 virus, thus reducing the number of critically ill patients and providing precious time to increase hospital capacity. Such a strategy presupposes that at least three conditions are possible to put in place: 1) social distancing; 2) access to clean water and soap; and, 3) that the health care sectors are able to increase their capacity for treatment of respiratory illnesses in a short period of time. These three assumptions are very complicated even for the wealthier developing countries such as those on the continent of Africa.

It is well known that 3 billion people, or 40% of the world's population, do not have access to basic handwashing facilities at home. In this context, expanding access to water becomes essential, but there is also an urgent need to create more resilient communities confronted by the fundamental problems of water insecurity. Without basic measures to build resilience, the growing pandemic could be especially difficult to control in developing countries, with the high risk of becoming a global resurgence of the problem.

A fundamental question to be addressed is how the transmission of COVID-19 could unfold in an African context, given its high levels of poverty, weak health systems and overpopulated urban areas. The virus could be particularly devastating, even with Africa's past experience in fighting infectious diseases an epidemics such as Ebola and cholera outbreaks as well as diseases from water-related vectors such as malaria. For vulnerable members of the population (ill, very young or very old) it has been shown for example that caregiver handwashing with or without soap after defecation and washing of the child's hands with soap before feeding were predictive of RTI prevalence among the children (Fadilatu et al., 2019). Indeed according to the Infectious Disease Vulnerability Index, 22 of the 25 countries most susceptible to an infectious disease outbreak are in Africa.

[1] WHO (2018). Global Health Estimates 2016: Disease burden by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, World Health Organization; 2018.

[2] Full list of references, variables and analysis in C.Carmona-Moreno, P.Marcos-Garcia. Analysis of the spatio-temporal evolution of Healthcare and WASH services and influence on the total and lower respiratory infection deaths in Africa (2000-2016). JRC Technical Report (2020).

[3] WHO/UNICEF (2020). Water, sanitation, hygiene, and waste management for the COVID-19 virus Interim guidance 19 March 2020.

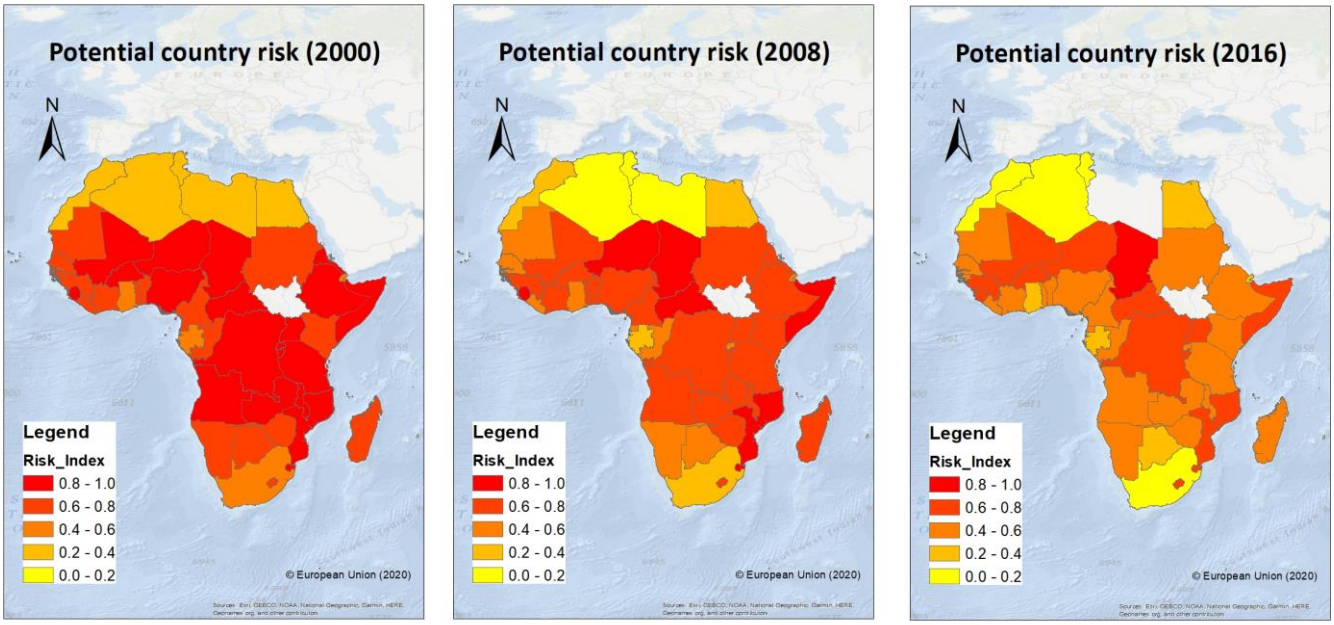

***Figure 1**. Estimation of a Potential Risk Index based on the Spatio-temporal evolution (2000-2016) of Healthcare and WASH services and their influence on the total and lower respiratory infection deaths in Africa.*

In this short note, we aim to outline African country profiles regarding the implementation of WASH and Healthcare services and other socio-economic aspects in relation with the mortality of endemic lower respiratory infections. The objective is not to analyse the full multi-causality of such death diseases, but the potential vulnerability of African countries to COVID-19 and its potential expansion due to weak Healthcare and WASH systems in Africa as can be deduced from the analyses of 17 years of data (2000-2016).

For this study, the annual data of 16 variables for the period 2000-2016 at the national level were retrieved from different sources. Incomplete data regarding handwashing facilities were estimated using basic sanitation and drinking water services as explanatory variables in a linear regression model.

The Principal Component Analysis (PCA) is an exploratory statistical tool that identifies the most significant variables in a dataset. Our goal is to analyse the correlations between the different variables and to find out if the changes in variables related to mortality (total and lower respiratory infection deaths) during the selected period are linked to the development of Water Access, Sanitation and Hygiene (WASH) services, social changes (Population density, Urban population) and economic conditions (GDP, Migrant remittance, ODA). The three first components in our analyses explain up to 78.86% of the variability of the dataset.

As shown in Table 1, PCA1 (the first component) is related to access to and quality of health care, basic sanitation, migrant remittance flows, urban population, life expectancy and (negative correlation) total number of deaths in the country. To be noted that from Table 1, it appears that these variables are not significantly linked to ODA (official development assistance). This component can thus constitute an index showing the risk of mortality in the countries and thus to the life expectancy in the country as a function of the quality of health care, basic sanitation, urban population and migrant remittances.

PCA1 is then used by the K-Means and ACH (Agglomerative Hierarchical Clustering) algorithms to determine homogeneous groups of countries with similar profiles over the 17 years of data by linking the development of WASH services with (formal and informal) investments and respiratory diseases.

In 2016, three groups of countries[4] in Africa have been identified: **Class A-2016** countries show the highest life expectancy, strongest healthcare system and WASH services, lowest mortality rates and highest rates of urbanization and migration remittance inflow; while **Class C-2016** countries, show the lowest life expectancy, weakest healthcare system and WASH services, highest mortality rates and lowest rates of urbanization and migration remittance inflow. Therefore, it could be hypothesised that **Class A-2016** countries are in a *better position to tackle public health emergencies*, while Class **C-2016** countries could be *the most vulnerable one*[5].
The remainder of the countries are in **Class B-2016**, which shows intermediate values of these variables. The countries in these classes are:

- **Class A-2016** (*best position to tackle public health emergencies*): Algeria; Mauritius; Seychelles; Egypt; Libya; Morocco; Tunisia; Cabo Verde.
- **Class B-2016** (*intermediate capacity countries*): Botswana; Sao Tome and Principe; South Africa; Gabon;

[4] South Sudan – No historical data for a significant analysis and classification. Lybia - no data from 2011 in advance.

Rwanda; Comoros; Namibia; Senegal; Djibouti; Ghana; Sudan; Gambia; Kenya; Equatorial Guinea; Madagascar; Malawi; Tanzania; Uganda; Zambia; Ethiopia.

- **Group C-2016** (*the most vulnerable countries*): Central African Republic; Chad; Sierra Leona; Somalia; Niger; Lesotho; Mali; Burkina Faso; Democratic Republic of the Congo; Guinea; Côte d'Ivoire; Cameroon; Mozambique; Nigeria; Eritrea; Benin; Guinea-Bissau; Togo; Burundi; Angola; Eswatini; Congo; Zimbabwe; Liberia; Mauritania.

Discussion

Our analyses show that any reduction in mortality in a country, in general, and in respiratory diseases in particular, is associated with increased investments in basic sanitation (population with basic handwashing facilities, including soap and water, basic drinking water and basic sanitation services). Based on the analyses, it could be hypothesised that the Official Development Assistance (ODA) does not have a sufficient impact on improving sanitation services and thus on reducing mortality related to respiratory diseases and, therefore, to increase life expectancy in developing countries. In this case, the flow of ODA to the sanitation sector may not be sufficient to improve the overall national sanitation structure, but may rather have an impact at the individual level that is not visible at the country scale as it should be (further analyses need to be explored to explain this point). However, the migration remittance inflows seem to have an impact on improving sanitation in households and local communities, even if its structure is not efficient enough.

As suggested by WHO in 2020, it is necessary to send short-term development assistance to improve health diagnosis of infected individuals and protect the local health population and, secondly, to strengthen the healthcare structure not only in the specific case of the COVID-19 pandemic but also to continue the treatment of the other infectious diseases that are ravaging African countries every year.

In Sub-Saharan Africa, several high-mortality pathologies (apart from COVID-19) are prevalent: malaria, bacterial infections, tuberculosis, AIDS... The number of deaths in Africa due to these endemic diseases represents around 27% of the total[5]. In 2016, the endemic diseases were equal to 2,383,263 distributed as follow: Lower Respiratory Infections (916,851 deaths – 10.4%), Diarrheal Diseases (652,791 deaths – 7.4%), Malaria (408,125 – 4.6%) and Tuberculosis (405.496 – 4.6%).These diseases are treatable and partly preventable, but their incidence could rise if most resources are directed to the COVID-19 outbreak. Indeed in the case of Ebola in 2014, it was estimated that malaria cases could have increased by up to 1 million as a result of a cessation of distribution of insecticide-treated mosquito nets. The solution could be to take advantage of economies of scale in current investments in health, to also combat other African endemic diseases such as diarrhoea, gastrointestinal diseases and tuberculosis.

The analysis of the 2000 - 2016 time series (Figure 2 – the potential risk in 3 different years: 2000, 2008, 2016) shows that even if the potential risks for African countries have decreased from 2000 to 2016 (see also Figure 1), they are far from being able to manage these endemic diseases and specifically lower respiratory infections. **Central and West African countries are particularly at risk together with Mozambique, Somalia, Lesotho and Eswatini**. According to our analysis, the **Central Africa Republic and Chad** could be the most vulnerable countries to the COVID-19 outbreak given the quality and performance of their health care system and WASH services.

	F1
Population_Urban	**0.621**
Population_Age	**0.868**
Life_Expectancy	**0.875**
Total_Deaths	**-0.783**
HAQ_index	**0.917**
Basic_Sanitation	**0.841**
ODA	0.031
GDP	0.200
Mig_remit_inflow	**0.684**

Table 1. Contribution of the Variables to the PCA1 (F1) component. The higher the variable value (max= 1), the higher the contribution to the PCA explaining the variability of the dataset. The negative value represents the sign of the correlation. In this case, the total number of deaths is highly correlated with the other variables in the PCA, but with a negative ratio, i.e. the higher the basic sanitation, the lower the number of deaths in the country.

Contacts:
Cesar.CARMONA-MORENO@ec.europa.eu
Patricia.MARCOS-GARCIA@ec.europa.eu

[5] WHO (2018). Global Health Estimates 2016: Disease burden by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, World Health Organization; 2018.

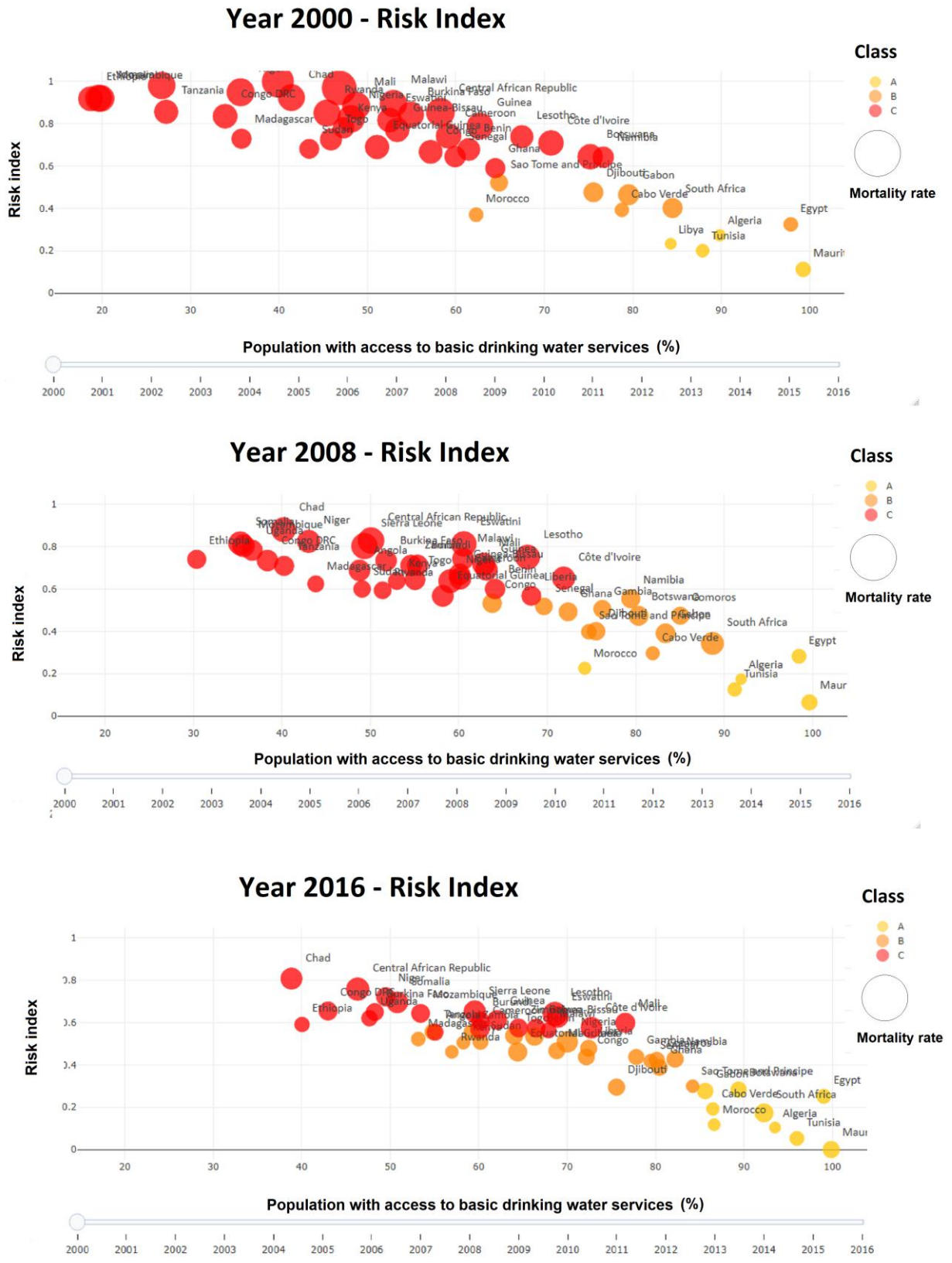

Figure 2 *represents the potential risk (**1** – **Highest Risk**; **0** – **Lowest Risk**) of the African countries to face Total and Lower Respiratory Infection deaths considering the quality of the Healthcare System and WASH services in 2000, 2008 and 2016. The colour of the circles represents the classes (A, B, C) and its dimension is related to the total number of deaths per year.*

The European Commission's science and knowledge service
Joint Research Centre
EU Science Hub: ec.europa.eu/jrc/en @EU_ScienceHub EU Science Hub
EU Science Hub – Joint Research Centre EU Science, Research and Innovation