



## REVIEW

# Treatment and case fatality rate of COVID-19 in Africa

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### Abstract

In Africa, the treatment of COVID-19 depends on each country. Several protocols are observed with real results that we described in this study. The objective of this review was to describe the treatment of COVID-19 and the case fatality rate in African countries, by reviewing the literature on treatment and case fatality in African countries whose data was available through the internet during the writing period until February 7, 2021. The majority of African countries had a treatment based on hydroxychloroquine or chloroquine + azithromycin, used in varying doses depending on the country. The lethality in Africa remains low compared to European and American countries. The same treatment being used in some northern countries does not fully explain the low case fatality.

Keywords: treatment, case fatality, COVID19, Africa.

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## INTRODUCTION

Coronavirus 2019 disease (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a newly emerged coronavirus, which genetic sequencing suggests is a beta coronavirus closely related to severe acute respiratory syndrome (SARS) virus.<sup>1</sup>

First identified in Wuhan (China) in December 2019, this virus has spread very rapidly throughout China and to all continents. As of February 7, 2021, COVID-19 affects over 105,394,301 people and has caused a total of 2,302,302 deaths worldwide. The highest lethality is then in America with the United

States which knows almost 1 935 709 deaths followed by Asia with India which knows 143 249 deaths. In Africa, the case fatality rate is not very high with 2,655,316 confirmed cases and a total of 97,678 deaths, i.e., a case fatality rate of 3.67%. The

**Supplementary information** The online version of this article ([Tables/Figures](#)) contains supplementary material, which is available to authorized users.

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most affected country is South Africa with 1 473 700 confirmed cases and 46 180 deaths.<sup>2</sup>

To date, no consensus on curative treatment has been reached. However, general recommendations on management have been reported, including:

- Treatment of bacterial co-infections: for suspected or confirmed cases of moderate COVID-19, the recommendation is to prescribe antibiotics only in the presence of clinical suspicion of bacterial infection.
- Prevention of complications: in hospitalized patients (adults and adolescents) with COVID-19, institute pharmacological prophylaxis, such as low-molecular-weight heparin (e.g., enoxaparin), according to local and international standards, to prevent venous thromboembolism, when not contraindicated. If contraindicated, use a mechanical prophylaxis device (intermittent pneumatic compression device).<sup>3</sup>
- Finally, the key previous recommendations that remain in effect are:
  - Antivirals, immunomodulators, and other adjunctive therapies: do not administer drugs indicated outside of clinical trials to treat or prevent COVID-19.

Current drugs used are the following.

### **Remdesivir**

Remdesivir is an adenosine analog that has shown in vitro activity against SARS-CoV-2.<sup>4</sup> Data obtained on MERS-CoV in a macaque model have confirmed its in vivo efficacy in prophylaxis and therapy, placing this drug at the forefront of potential therapeutics in SARS-CoV-2 infection.<sup>5</sup> In MERS-CoV infection, this molecule has demonstrated in vitro and in a mouse model a superior activity to the lopinavir-ritonavir combination.<sup>6</sup>

The dosage that can be used is derived from work carried out in Ebola virus infection, it is administered intravenously: 1 dose per day, 10 to 14 doses of 200 mg as a loading dose then 100 mg 1x/day Infusion 30 min - 1 hour.

### **Lopinavir/ritonavir**

The lopinavir/ritonavir combination is used in HIV infection. Some efficacy data exist mainly in MERS-CoV infection.<sup>7</sup> Concerning SARS-CoV-2, one Ko-

rean index case was treated with this combination and showed a significant decrease in viral load. Five other patients were treated in Singapore, and 3 improved.<sup>8</sup>

This molecule is currently readily available and could be proposed as a first-line treatment. The combination can be proposed at a dosage of 400 mg x 2 / day per os for 5-7 days.

### **Chloroquine (CQ)/Hydroxychloroquine (HCQ)**

Widely debated, more than 10 clinical trials have been or are underway for this antimalarial molecule whose action increases the endolysosomal pH necessary for viral fusion.<sup>4,9</sup> The side effects are already well known (macular and cardiac retinopathy).<sup>10</sup> To date, there is no consensus on the broad use of this drug in SARS-CoV-2 infection. The dosage is not well defined; a dosage of 200 mg x 2 per day for 10 days could be proposed.

### **Corticosteroid therapy**

The use of systemic corticosteroids is recommended for the treatment of patients with severe or critical COVID-19. We suggest that corticosteroids not be used to treat patients with mild disease, as treatment in this situation is of no benefit and may be harmful. Treatment should be taken under medical supervision.<sup>11</sup> One study showed that dexamethasone 6 mg daily for up to 10 days reduced mortality at D28 (primary endpoint) by one-fifth in patients hospitalized for COVID-19 with oxygen-requiring pneumonia without invasive mechanical ventilation and by one-third in patients receiving invasive mechanical ventilation.<sup>12</sup>

In Africa, the treatment depends on each country. Several protocols are observed with real results that we will describe in this study.

The objective of this review was to describe the treatment of COVID-19 and the case fatality rate in African countries.

## **METHODS**

By reviewing the literature on treatment and case fatality in African countries whose data was available through the internet (Google, Google Scholar,

PubMed) during the writing period until February 7, 2021. The aim was to describe the treatment regimens used in the different regions of Africa and the case fatality rate resulting from these regimens.

## TREATMENT AND CASE FATALITY OF COVID-19 IN AFRICAN COUNTRIES

### Treatment of COVID-19 in Maghreb countries

North African countries are among the many others affected by the COVID-19 epidemic and have been forced to develop ways and means to survive it. We will see in the following lines the therapeutic protocol used by some of them.

#### *Morocco*

The protocol used by Morocco is such that the duration of treatment for asymptomatic cases is 7 days, and 10 days for mild cases according to the following protocol chloroquine: 2 x 500 mg/day or hydroxychloroquine sulfate 3 x 200 mg/day) or azithromycin 500 mg on day 1, then 250 mg from day 2 to day 7. For moderate cases, the 1st line treatment contains chloroquine (2 x 500 mg/day for 10 days or hydroxychloroquine sulfate 3 x 200 mg/day for 10 days), azithromycin 500 mg at day 1, then 250 mg per day from day 2 to day 7. Antibiotic therapy if the sign of bronchial superinfection as well as an anticoagulant at preventive doses if bedridden. The 1st line treatment for a severe case is as follows chloroquine (2 x 500 mg/day for 10 days or hydroxychloroquine sulfate 3 x 200mg /day for 10 days), azithromycin 500mg at day 1, then 250 mg per day from day 2 to day 7, low molecular weight heparin (LMWH) in curative dose with control of anti-factor Xa, corticosteroid therapy as well as bi-antibiotic therapy on a case-by-case basis. The second-line treatment is based on the use of anti-IL6 in the event of the presence of a cytokine storm (clinical worsening, increase in the inflammatory syndrome, and IL6 level greater than 3 times normal).<sup>13</sup>

#### *Algeria*

The protocol followed in Algeria is as follows:

-For all patients with a moderate form, a form with pneumonia, and/or a severe form suspected of COVID-19 infection, it will be prescribed, in the absence of contraindications and under medical supervision. In the first line: Prescribe chloroquine: 500

mg twice daily for 5 to 7 days or hydroxychloroquine: 200 mg three times daily for 10 days.

Second-line: lopinavir/ritonavir: (200/50 mg tablet) at a rate of 2 tablets twice a day, respecting the rules of use, for 5 to 7 days, or atazanavir: 300 mg/day for 2 weeks.

-For all patients presenting a moderate form, a form with pneumonia, and/or a severe form with suspected COVID-19 infection, in the absence of contraindications and under medical supervision, prescribe chloroquine: 500 mg twice a day for 5 to 7 days or hydroxychloroquine: 200 mg 3 times a day for 10 days.

As a second-line treatment, prescribe lopinavir /ritonavir: (tablet 200/50 mg) at a rate of 2 tablets twice a day respecting the rules of use, and this for 5 to 7 days or atazanavir: 300 mg/day for 2 weeks.<sup>14</sup>

#### *Tunisia*

In Tunisia, the protocol adopted is as follows:

Give hydroxychloroquine: 200 mg x 3 on the first day (D1), then 200 mg x 2/day from the second to the tenth day, or chloroquine tablet 100 mg: 400 mg x 2/day for 10 days in combination with azithromycin: 500 mg on the first day then 250 mg from the second to the fifth day.

The dosage and duration are the same regardless of the clinical form.

The dosage in patients with renal insufficiency should be adapted after consultation with the referring nephrologist.<sup>15</sup>

#### *Egypt*

In Egypt, the protocol is as follows:

For moderate cases, prescribe oseltamivir: 75 mg/12h for 5 days, in combination with hydroxychloroquine: 400 mg 2 times the first day, 200 mg 2 times/4 days, or chloroquine phosphate 500 mg 2 times and serum ferritin, D-dimer.

For severe cases oseltamivir 150 mg/12 h for 5 days in combination with hydroxychloroquine 400 mg twice on the first day, 200 mg twice for 4 days, or chloroquine phosphate 500 mg twice.

If contraindicated, use the combination of lopinavir/ritonavir 2 comp/12 hours (10 d maximum).<sup>16</sup>

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### *Mauritania*

For Mauritania two experimental regimens have been adopted for the management of oxygenated patients with symptomatic COVID-19 who do not require intensive care: chloroquine or hydroxychloroquine, with or without azithromycin or lopinavir/ritonavir combination.<sup>17</sup>

### *Libya*

In Libya, the management of COVID-19 is mainly concerned with obtaining plasma from infected patients who have developed antibodies and then supplying them on a large scale to blood banks in order to fight the virus.<sup>18</sup>

### **The case fatality rate of COVID-19 in Maghreb countries**

Table 1 above shows that Morocco is the most affected Maghreb country, followed by Tunisia and Egypt. While Mauritania is the least affected country. The case fatality varied from 1.76 to 5.67%.

### **Treatment of COVID-19 in East African countries**

The eastern part of Africa has been affected by COVID-19 in its entirety; therefore, several protocols have been adopted in different countries, some of which we will see shared.

### *Kenya*

The recommendations for the management of COVID-19 in Kenya are:

- No antiviral treatment for patients with mild disease
- For patients with a severe or rapidly deteriorating disease, hydroxychloroquine is considered (dose of 2 x 400 mg on day 1 followed by 2x 200 mg on day 2).<sup>19</sup>

### *Uganda*

The management of patients with COVID-19 is such that for uncomplicated cases: Only if ECG and electrolytes (magnesium and potassium) are normal, start hydroxychloroquine tabs 400 mg twice daily for 1 day then 200 mg twice daily for 4 days. - start vitamin C 500 mg twice daily for 14 days.

For moderate cases: start azithromycin 500 mg tabs once a day for 5 days or amoxicillin three times a day for 1 week.

Only if ECG and electrolytes (magnesium and potassium) are normal, start hydroxychloroquine tablets 400 mg twice daily for 1 day then 200 mg twice daily for 4 days, In combination with vitamin C tabs 500 mg twice daily for 14 days and zinc tabs 20 mg once daily for 14 days.

For severe cases, only if ECG and electrolytes (magnesium and potassium) are normal, start hydroxychloroquine tabs 400 mg twice daily for 1 day then 200 mg twice daily for 4 days.

Start/continue azithromycin 500 mg tabs once daily for 5 days.

- Start tabs augmentin 625 mg twice daily for 7 days if the patient is able to take orally or IV ceftriaxone 2g once daily for 7 days (augmentin or ceftriaxone may be changed based on culture results and sensitivity).

- Vitamin C tabs 500 mg three times daily for 14 days.

- Tabs zinc 20 mg daily for 14 days.<sup>20</sup>

### *Rwanda*

The treatment protocol adopted in Rwanda is as follows:

- Only if ECG and electrolytes (magnesium and potassium) are normal,

Start Hydroxychloroquine 400 mg twice daily for 1 day then 200 mg twice daily for 4 days. In combination with tabs vitamin C 500 mg twice daily for 14 days.

For moderate cases: start tabs azithromycin 500 mg once daily for 5 days or tabs amoxicillin 500mg TDS for 1 week

- Only if ECG and electrolytes (magnesium and potassium) are normal, start hydroxychloroquine tabs 400 mg twice daily for 1 day then 200 mg twice daily for 4 days. In combination with vitamin C tabs 500 mg twice daily for 14 days and zinc tabs 20 mg once daily for 14 days.

For severe cases:

- Only if ECG and electrolytes (magnesium and potassium) are normal, start/continue hydroxychloroquine tabs 400 mg twice daily for 1 day then 200 mg twice daily for 4 days

- Start/continue azithromycin 500 mg tabs once daily for 5 days
- Start tabs augmentin 625 mg twice daily for 7 days if the patient is able to take orally or IV ceftriaxone 2g once daily for 7 days (augmentin or ceftriaxone may be modified based on culture results and sensitivity)
- Vitamin C tabs 500 mg three times daily for 14 days
- Tabs zinc 20 mg daily for 14 days.<sup>21</sup>

#### *Burundi*

In Burundi, patients with COVID-19 are managed as follows:

Hydroxychloroquine or chloroquine 200mg for adults: 200 mg 3 times per day for 5-7 days and for children: 10 mg in two doses for 5-7 days in combination with azithromycin 250 mg or 500 mg. For adults 1000 mg per day on day 1 and 500 mg per day until day 5 and for children 20 mg/kg per day in one dose for 3 days (children over 40 kg will be treated as adults) and zinc: 20 mg per day for 5-7 days.<sup>22</sup>

#### *Ethiopia*

The recommendation for the therapeutic management of patients with COVID-19 in Ethiopia is as follows:

In moderate to severe infections, use chloroquine as an immunomodulator in all patients and chloroquine can be used for milder infections in older patients and those with underlying diseases.

Dose: chloroquine phosphate 1000 mg (4 tablets) start, then 500 mg (2 tablets) after 12 hours, then 500 mg (2 tablets) twice for 5 days.<sup>23</sup>

#### **The case fatality rate of COVID-19 in East African countries**

In Table 2, we can see that Ethiopia is the most affected country followed by Uganda while Tanzania is the least affected country. Case fatality ranged from 0.3 to 6.18. Most countries had low case fatality.

#### **Treatment of COVID-19 in West African countries**

West Africa has been totally affected by COVID-19. The available data on treatment reports that

Benin, Burkina Faso, Guinea, Senegal, Mali, Togo, and Niger use the combination hydroxychloroquine azithromycin in all clinical forms. However, in countries like Benin, another combination of lopinavir and ribavirin is used. The combination of lopinavir + sartans or statin is recommended In Côte d'Ivoire, hydroxychloroquine is not recommended in any situation.<sup>24</sup> Remdesevir + azithromycin is recommended in moderate to severe cases in Ghana.<sup>25</sup> Symptomatic support in Liberia<sup>26</sup> and Nigeria.<sup>27</sup>

#### **The case fatality rate of COVID-19 in West African countries**

Table 3 describes Nigeria as the most affected country followed by Ghana and Cape Verde as the least affected country. Case fatality ranged from 0 to 4.29.

#### **Treatment of COVID-19 in Central African countries**

Central Africa has been totally affected by COVID-19. Available data on treatment reports that the Republic of Congo, the Democratic Republic of Congo, Chad, and Cameroon use the combination of hydroxychloroquine and azithromycin in all clinical forms. Hydroxychloroquine is not recommended in any situation.<sup>24</sup>

#### **The case fatality rate of COVID-19 in Central African countries**

In Table 4, Cameroon is the most affected country, followed by the Democratic Republic of Congo, and Chad is the least affected country. The case fatality ranged from 0.69 to 3.59%. Gabon had the lowest case fatality.

#### **Treatment of COVID-19 in South African countries**

South Africa has been totally affected by COVID-19. The South African Republic used symptomatic treatment in mild cases; for severe cases supplemental oxygen was used, and specific treatments such as corticosteroids were used if the critical cases require life-sustaining treatment.<sup>28</sup>

In Zimbabwe, for antiviral, any use of medicines is off-label, use of any medicine like chloroquine, hydroxychloroquine, interferon 2 beta, or remdesivir should be in a clinical trial setting.<sup>29</sup>

#### **The case fatality rate of COVID-19 in South African countries**

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Table 5 shows South Africa as the most affected country, followed by Zambia and Mauritius as the least affected country. The case fatality ranged from 0.44 to 3.81%.

### DISCUSSION

This review has described the management protocols for COVID-19 and its case fatality in different African countries. In North Africa, the protocol used is based on hydroxychloroquine and azithromycin. Almost all countries used it. The case fatality varied from 1.76 to 5.67%. The relatively low case fatality is not solely attributable to antiviral treatment. The management of COVID-19 is also based on the use of oxygen, anticoagulation, dialysis for renal failure, etc. In East Africa, although there were countries for which protocols were not published online, the most commonly used protocols were also based on hydroxychloroquine and azithromycin except for Kenya which has banned its use in non-severe cases. Case fatality ranged from 0.3 to 6.18. Most countries had low case fatality. West African countries also used the hydroxychloroquine and azithromycin protocol except for Côte d'Ivoire which used lopinavir and sartin or statin. Case fatality ranged from 0 to 4.29. Côte d'Ivoire had a low case fatality but not the lowest of all countries using hydroxychloroquine and azithromycin. Although WHO has been against the routine use of hydroxychloroquine following the publication of some studies that did not show its efficacy, a study in Senegal showed an advantage of using hydroxychloroquine, as the proportion of patients discharged from hospital on day 15 was significantly higher for patients receiving the combination of HCQ plus AZ.<sup>30</sup> It should be noted that the study has the weakness of not being a randomized clinical trial.

In Central Africa, hydroxychloroquine and azithromycin was also the most commonly used protocol. Case fatality ranged from 0.69 to 3.59%. Gabon had the lowest case fatality; note that it is among the countries that have been confined for the longest time. A study in the DRC, although not suitable for proving efficacy as it was observational, nevertheless showed a beneficial effect

of the combination of hydroxychloroquine and azithromycin on symptoms and case fatality in patients with COVID-19. They also reported the absence of major adverse events, which reinforces its continued use in DRC.<sup>31</sup> In South Africa, the use of hydroxychloroquine was only allowed in clinical trials. Case fatality ranged from 0.44 to 3.81%. Since clinical trials have not been able to show the efficacy of hydroxychloroquine as a pre-exposure, post-exposure, or curative treatment for COVID-19,<sup>32–36</sup> the lack of efficacy of lopinavir/ritonavir.<sup>37</sup>

The low number of cases and low case fatality in African countries compared to the Asian, European and American continents should be put into perspective as most countries did not have good COVID-19 testing capacity. Some community deaths were not necessarily reported. Some believe that cross-immunity, the presence of malaria, and a relatively young population are factors in the relative protection of Africans.<sup>38–40</sup>

### LIMITATIONS

Firstly, some countries have not published the management protocols online. Secondly, most of the available published management protocols were published in the first year of the epidemic, so it is possible that some updates have been made. Thirdly, the reporting of confirmed cases and case fatalities in Africa does not necessarily reflect the reality given the low testing capacity.

### CONCLUSIONS

The majority of African countries had a treatment based on hydroxychloroquine or chloroquine + azithromycin, used in varying doses depending on the country. The lethality in Africa remains low compared to European and American countries. The same treatment being used in some Northern countries does not fully explain the low case fatality. Several factors may explain this low case fatality, including cross-immunity. Vaccination remains a major pillar in considerably reducing case fatality in the North as well as in Africa.

## INFORMATION

**Authors' contributions :** All the authors made a substantive intellectual contribution, performed part of the experiments. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

**Conflict of interest:** The authors declare no potential conflict of interest.

**Availability of data and materials:** All data generated or analyzed during this study are included in this published article.

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**Table 1.** Cumulative confirmed cases, case fatality rate and protocols in Maghreb countries.

Maghreb Countries	Cumulative confirmed cases	Cumulative deaths	Case fatality rate, %	Protocols
Algeria	108,852	2,911	2.67	First line: CQ or HCQ, 2nd line: LPV/r or Atazanavir
Egypt	169,106	9,604	5.67	HCQ, severe case: oseltamivir- HCQ
Libya	122,894	1,936	1.57	Convalescent plasma
Morocco	474,966	8,381	1.76	HCQ + AZ
Tunisia	216,176	7,162	3.31	HCQ + AZ
Mauritania	16,777	425	2.53	HCQ + AZ or LPV/r

CQ: hydroxychloroquine; CQ: chloroquine; AZ: azithromycin; LPV/r: ritonavir-boosted lopinavir.

**Table 2.** Cumulative confirmed cases, case fatality rate and protocols in East African countries.

East African Country	Cumulative confirmed cases	Cumulative deaths	Case fatality rate, %	Protocols
Ethiopia	141,453	2,145	1.74	CQ or HCQ
Kenya	101,690	1,776	1.51	No antiviral for mild cases, HCQ for severe
Uganda	39,821	327	0.82	HCQ+AZ or Amoxicillin+ Zinc
Rwanda	16,337	217	1.32	HCQ, if moderate: Az or amoxicillin
Tanzania	509	21	4.12	-
Somalia	4,854	134	2.76	-
South Sudan	4,355	65	1.49	-
Sudan	29,634	1,831	6.18	-
Eritrea	2,326	7	0.3	-
Burundi	1,723	3	0.17	HCQ + AZ + Zinc
Djibouti	5,941	63	1.06	-

HCQ: hydroxychloroquine; CQ: chloroquine; AZ: azithromycin; LPV/r: ritonavir-boosted lopinavir; -: information not available online.

## FATALITY RATE OF COVID-19 IN AFRICA

**Table 3. Cumulative confirmed cases, case fatality rate and protocols in West African countries.**

West African Country	Cumulative confirmed cases	Cumulative deaths	Case fatality rate, %	Protocols
Benin	4193	55	1.31	HCQ +AZ, LPV/r, ribavirin
Burkina Faso	11,227	134	1.19	HCQ +AZ
Cote D'ivoire	29,567	162	0.54	LPV+sartan or statin
Gambia	4,237	134	3.16	-
Ghana	70,046	449	0.64	Remdesivir+AZ for moderate to severe case
Guinea	14,665	84	0.57	HCQ +AZ
Guinea Bissau	2,772	46	1.65	-
Liberia	1,956	84	4.29	Symptomatic support
Mali	8,160	338	4.14	HCQ +AZ
Niger	458	165	3.59	HCQ +AZ
Nigeria	139 242	1 647	1.18	Symptomatic support

HCQ: hydroxychloroquine; CQ: chloroquine; AZ: azithromycin; -: information not available online.

**Table 4. Cumulative confirmed cases, case fatality rate and protocols in Central African countries.**

Central African Country	Cumulative confirmed cases	Cumulative deaths	Case fatality rate, %	Protocols
Cameroon	30,313	474	1.56	HCQ +AZ
Gabon	11,457	71	0.69	-
Equatorial Guinea	5,578	86	1.54	-
Sao Tome and Princip	1,339	18	1.34	-
Chad	3,473	125	3.59	HCQ +AZ
Congo	8,060	122	1.51	HCQ +AZ
The Central African Republic	4,989	63	1.26	-
Angola	20,062	475	2.36	-
Democratic Republic of Congo	23,484	679	2.89	HCQ +AZ

HCQ: hydroxychloroquine; CQ: chloroquine; AZ: azithromycin; -: information not available online.

**Table 5. Cumulative confirmed cases, case fatality rate, and protocols in South African countries.**

South African country	Cumulative confirmed cases	Cumulative deaths	Case fatality rate, %	Protocols
The South African Republic	1,473,700	46,180	3.13	Symptomatic treatment in mild cases, for severe cases specific treatments such as corticosteroids
Botswana	23,503	163	0.69	-
Zimbabwe	34,487	1 316	3.81	For antiviral, any use of chloroquine, hydroxychloroquine, interferon 2 beta, or remdesivir should be in a clinical trial
Namibia	34,845	371	1.06	-
Malawi	26,875	837	3.1	-
Comoros	3086	108	3.49	-
Lesotho	9380	183	1.95	-
Eswatini	16,181	604	3.73	-
Madagascar	19,065	281	1.47	-
Mozambique	44,112	451	1.02	-
Reunion	10,487	47	0.44	-
Mauritius Island	584	10	1.71	-
Zambia	61,427	839	1.36	-