(REVIEW ARTICLE)

# Characteristics and factors associated with COVID-19-related deaths in Africans

Titus Sunday IBEKWE [1, *], Ayotunde James FASUNLA [2] and Emmanuel Adebola ORIMADEGUN [2]

[1] College of Medicine, University of Abuja & University of Abuja Teaching Hospital, Gwagwalada Nigeria.
[2] College of Medicine, University of Ibadan & University College Hospital, Ibadan Nigeria.

## Abstract

**Background:** COVID-19 is a disease of public health importance that is highly transmissible and associated with significant morbidity and mortality. There has been concern that the pandemic will result in mass deaths in Africa as a result of the weak health system and insecurity on the continent. However, the evidence available did not support the assumption.

**Aims & Objectives:** This communication presents a systematic review on factors associated with low COVID-19 related mortality in Africa.

**Materials and Methods:** We searched the Google scholar, MEDLINE, Embase, Publius Ovidius Naso and Cochrane databases for all studies on COVID-19 related deaths in Africa published in English language from December 2019 to January, 2021. The references of relevant articles were also searched for additional publications. Data from the studies were independently extracted and assessed by the three authors using a standardised form. There was consensus among the authors on the selected studies used in this review. Results: Twenty-one studies were identified and independently assessed based on the objectives of the study by the authors. All the studies presented at least a factor that could possibly be associated with low death rate from COVID-19 in Africa.

**Conclusion:** Younger population age, cross and herd immunities, previous BCG vaccination, relative hot climatic advantage, community practice and dominance of blood group O were main factors suggested to be associated with low mortality rate from the pandemic in Africa.

**Keywords:** Africa; BCG; Blood group O; COVID-19; Deaths; Hot climate

## 1. Introduction

COVID-19, caused by SARS-Cov-2, is the most destructive pandemic that mankind has experienced in the recent years. The SARS-Cov-2 spreads rapidly and is highly contagious through contact with droplets generated from sneezing, coughing and talking by an infected person. It is a disease of equal opportunity that does not spare any age or gender (1). It is severe in less than three percent of the affected individuals and has a more devastating effect on mostly adults with medical comorbidities such as obesity, hypertension, diabetes, cardiovascular diseases, etc (2) and elderly persons. In the history of mankind, no other pandemic has claimed more human lives for the same period than this disease. Within a year of the outbreak, World Health Organisation reported that over 96 million people have been confirmed infected with more than 2 million deaths globally (3). The cause of death is largely due to respiratory and cardiovascular failure. During the period, Africa, which constitutes about 17% of the world population, reported about 875,000 COVID-19 cases and only 18,498 deaths, less than one percent of the global mortality (3). Incidentally, the Southern Africa alone accounted for over 50% of COVID-19 cases in Africa, followed by North, East, Central and West Africa (4).

* Corresponding author: Prof. TS Ibekwe. Email: titus.ibekwe@uniabuja.edu.ng

According to the reports in public domains in America and Europe, coronavirus infected and killed blacks and black Americans at an alarming high rate than the Caucasians (5-8). Yancy reported in the US that death rate for predominantly black counties is 6-fold higher than in predominantly white counties (5). This has led to earlier catastrophic prediction of mass death in Africa from the disease. The prediction of high mortality from COVID-19 in Africa was hinged on the existing weak health structure, overstretched and underfunded health systems, poor heath indicators/indices, poor economy and dense population in the continent (9, 10). Furthermore, the concern of poor health seeking behaviours of people in Africa was hypothesised as possible driver of the prediction of mass death from COVID-19 in Africa. On the contrary, Africans demonstrated resilience with lowest record of COVID-19-related mortality compared with other major continents of the world. The deaths in Africa was estimated as about 3.5% of the global COVID-19 related deaths.

Factors responsible for the low mortality from COVID-19 infection in Africa are unknown but some have been hypothesised based on anecdotal observations, as factors protecting Africans against COVID-19 fatality. This report presents a comprehensive and systematic literature search and provided a narrative review on the characteristics and factors associated with low mortality rate from COVID-19 diseases in Africa.

## 2. Material and methods

This was a review of studies in the electronic database on factors associated with low death rate from COVID-19 disease in Africa from December, 2019 to January, 2021.

### 2.1. Type of data

It was a systematic review of all publications on factors associated with low mortality rate from COVID-19 disease in Africa.

### 2.2. Search Methods for identification of studies

We searched the Google scholar, MEDLINE, Embase, Publics Ovidius Naso (Ovid) databases as well as Database of Abstracts of Reviews of Effects and the Cochrane Central Register of Controlled Trials for published articles on COVID-19 related deaths in Africa. In addition, we also searched newspapers, and editorials on the subject for grey literature. The searches were restricted to studies written in English language. Our search strategy used the exploded Medical Subject Headings terms and text words: "COVID-19" OR "SARS-CoV-2" OR "Coronavirus" OR "COV-2" AND "Mortality" OR "Death" AND "Africa" OR "Sub-Saharan Africa" OR "West Africa".

### 2.3. Eligibility and inclusion criteria

The decision to include a study was based on the presence of data on COVID-19 related deaths in Africa and the associated factors in the abstract or in the body of the article. The titles and abstracts of the articles selected for the studies with objectives/focus on the desired results were further reviewed in detail. Cross-referencing the reference lists and citation indexes of identified articles yielded additional relevant literature. Subsequently, each eligible article was read to fully identify the relevant data. Only studies that met the inclusion criteria were reviewed and analyzed.

### 2.4. Data Collection and Analysis

A total of 478 studies were identified on Google Scholar, 408 from MEDLINE, two from Embase, and none from Ovid and Cochrane Library. We scanned the search results to identify those that specifically addressed the subject of the review, and the full texts of these articles were scrutinised for eligibility. Thirty-one studies were considered eligible for inclusion in this study.

### 2.5. Validity Method of Assessment

Data from the studies was independently extracted and assessed by the three authors using standard data forms. The twenty-one studies were independently assessed based on the study's intended objectives by the three authors. There was consensus between the authors on the studies in the reviews that met the study's criteria.

## 3. Results

All the studies discussed possible factors associated with the low mortality from COVID in Africa and the majority were peer-reviewed articles. Table 1 showed the distribution of morbidity and mortality related to the COVID-19 pandemic by regions. The characteristics of these studies are presented in table 2.

**Table 1** Comparison of Population, Cases, Morbidity and Mortality according to the Global Regions

| Region | Population (Billion) | Cases/100,000 | Morbidity | Mortality |
|---|---|---|---|---|
| Africa | 1.3 | 3,000 | 834 147 | 14 750 |
| Asia (South-East) | 4.6 | 80,000 | 2 299 433 | 48 569 |
| Europe | 0.75 | 35,000 | 3 451556 | 214 731 |
| Eastern Mediterranean | 0.76 | 10,000 | 1 585 458 | 41 601 |
| North America | 0.43 | 60,000 | 9 841 842 | 367 934 |
| Western Pacific | 0.04 | 40,000 | 341 165 | 8 549 |

**Table 2** Characteristics of selected articles reviewed

| Categories | Authors | Purpose | Samples | Key findings |
|---|---|---|---|---|
| Population demographics | CDC (11) | Not stated | USA | The risk for severe illness with COVID-19 increases with age, with older adults at higher risk |
| | Ferguson N, et al. (13) | Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand | USA | NPIs mitigate and control the spread of COVID-19 but school closures may have negative impacts on health systems due to increased absenteeism |
| | Williamson EJ, et al. (14) | To examine factors associated with COVID-19-related death | England | COVID-19-related death was associated with being male, older age and deprivation, diabetes; severe asthma; and various other medical conditions |
| | Clark A, et al. (15) | To provide global, regional, and national estimates of the number of individuals at increased risk of severe COVID-19 as a result of their underlying medical conditions during 2020. | United Kingdom | One in five individuals in the working age range had at least one underlying condition relevant to COVID-19 severity. Those with older age and male gender are at a greater risk |
| | Hassan Z, et al. (19) | To analyze risk factors for COVID-19 prevalence and deaths in all 6 geopolitical regions and 37 States in Nigeria | Nigeria | Population susceptibility factors to COVID-19 include higher economic development but not literacy or unemployment. Death rates were mildly lower in States with higher HIV prevalence and BCG vaccination coverage. |
| Cross immunity | Sigel K, et al. (16) | To compare the outcomes for people living with human immunodeficiency virus (PLWH) with COVID-19 to a matched comparison group. | USA | There was no differences in adverse outcomes associated with HIV infection for hospitalized COVID-19 patients compared with a demographically similar patient group |

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|---|---|---|---|---|
| | Härter G, et al. (17) | To describe early experiences with COVID-19 and clinical characteristics in patients with documented HIV infection. | Germany | The study does not support an excess morbidity and mortality among symptomatic COVID-19 living with human immunodeficiency virus and with viral suppression on ART. |
| | Gervasoni C, et al. (18) | To describe the clinical characteristics and outcomes of HIV-infected patients with a probable/proven diagnosis of SARS-CoV-2 infection who have been regularly followed up | Italy | HIV-positive patients with SARS-CoV-2 infection are not at greater risk of severe disease or death than HIV-negative patients |
| | Miyasaka M. (20) | To investigate if there is more to BCG vaccination and reduced COVID-19 case fatality rates than a mere correlation | Japan | COVID-19 incidence and total deaths are strongly associated with the presence or absence of national mandatory BCG vaccination programs. |
| Herd immunity | Gollier C. (12) | Investigating the role of herd immunity in COVID-19 | France | Herd immunity can reduce the global death toll by more than 80% as compared to a strategy of non-targeted herd immunity |
| | Ilesanmi OS, et al. (25) | To develop a forecast of the number of COVID-19 deaths that would be recorded to attain herd immunity for each country in West-Africa | Nigeria | Herd immunity is expected to be achieved at 67% COVID-19 infection rate and can significantly reduce death rates. |
| | Lopez L, et al. (28) | To determine the seroprevalence of COVID-19 in the Lake Central School Corporation (LCSC), a public school system located in suburban Indiana, US | USA | The low pre-opening seroprevalence and the advanced age of a significant fraction of the LCSC staff, may increase the number and severity of cases should an outbreak occur within this school system |
| | Ahn JY, et al. (29) | To describe two cases of COVID-19 treated with convalescent plasma infusion. | South Korea | Both patients presented severe pneumonia with acute respiratory distress syndrome and showed a favourable outcome after the use of convalescent plasma in addition to systemic corticosteroid. |
| Previous Bacillus Calmette–Guérin (*BCG*) vaccine | Covián C, et al. (30) | To analyze the number of positive cases and deaths in different countries and correlate them with the inclusion of BCG vaccination at birth in their national vaccination programs | Chile | BCG-induced trained-immunity may have a protective role in infection with SARS-CoV-2, |
| | Urashima M, et al. (31) | To explore whether recent BCG vaccine coverage is associated with COVID-19 morbidity and/or mortality rates | Japan | BCG vaccine coverage may reduce the risk of deaths due to COVID-19 |

| Climate change | Briz-Redón Á, et al. (32) | To report a spatio-temporal analysis for exploring the effect of daily temperature (mean, minimum and maximum) on the accumulated number of COVID-19 cases in the provinces of Spain | Spain | No evidence suggesting a reduction in COVID-19 cases at warmer mean, minimum and maximum temperatures |
|---|---|---|---|---|
| | Jahangiri M, et al. (33) | To investigate the sensitivity of AT and PS on the transmission rate of the novel coronavirus in different provinces of Iran | Iran | No scientific reason to confirm that the number of COVID-19 cases in warmer climates is less than that of moderate or cold climates |
| | Qi H, et al. (34) | To examine the associations of daily average temperature (AT) and relative humidity (ARH) with the daily counts of COVID-19 cases in 30 Chinese provinces (in Hubei from December 1, 2019 to February 11, 2020 and in other provinces from January 20, 2020 to Februarys 11, 2020) | China | Every 1 °C increase in the AT led to a decrease in the daily confirmed cases by 36% to 57% when ARH was in the range from 67% to 85.5%. Every 1% increase in ARH led to a decrease in the daily confirmed cases by 11% to 22% when AT was in the range from 5.04 °C to 8.2 °C. |
| | Bashir MF, et al. (35) | To analyze the association between COVID-19 and climate indicators in New York City, USA. | USA | Average temperature, minimum temperature, and air quality were significantly associated with the COVID-19 pandemic |
| | Sharma P, et al. (36) | To find and analyze the correlation between Covid-19 pandemic and weather conditions in Indian context | India | Concluded that weather is an important factor for determining the incidence rate of COVID-19 pandemic cases in India. |
| | Gupta S, et al. (37) | To investigate the role of weather in transmission of the disease in the highly populated countries, such as India. | USA | The role of weather in affecting the transmission rates can only be termed as correlation and not causation at this point in time |
| | Prata DN, et al. (38) | To determine the relationship of temperature to COVID-19 infection for the state capital cities of Brazil | Brazil | Temperatures had a negative linear relationship with the number of confirmed cases. The curve flattened at a threshold of 25.8 °C but no evidence supporting that the curve declined for temperatures above 25.8 °C. |
| | Shi P, et al. (39) | To determine the effects of temperature on the dynamics of the COVID-19 epidemic in China | China | Temperature was an environmental driver of the COVID-19 outbreak in China. Temperatures above 8 to 10 °C were associated with decreased COVID-19 daily confirmed cases rate. |
| | Pirouz B, et al. (40) | To investigate the impact of climate factors on the confirmed COVID-19 cases and | | Population density and weather conditions could affect |

| | | to propose a multivariate linear regression (MLR) model to improve the prediction. | | the daily positive cases of COVID-19. |
|---|---|---|---|---|
| Genetic factors | COVID-19 Host Genetics Initiative (41) | To organize analytical activities across studies to identify genetic determinants of COVID-19 susceptibility and severity | Finland | The study initiated a global effort to study the relationship between host genome and SARS-CoV-2 infection. |
| | Severe Covid-19 GWAS Group, et al. (42) | To identify the potential genetic factors involved in the development of Covid-19. | European countries | Identification of a 3p21.31 gene cluster as a genetic susceptibility locus in patients with Covid-19 with respiratory failure and confirmed a potential involvement of the ABO blood-group system. |
| | Motayo BO, et al. (43) | To determine the genetic diversity and evolutionary history of SARS-CoV-2 genome sequences isolated in Africa | Nigeria | Identified diverse sub-lineages of SARS-CoV-2 currently circulating among Africans and a relatively high prevalence of the D614G spike protein variant of the virus capable of rapid transmission in all countries sampled |
| | Korber B, et al. (44) | To identify Spike amino acid variants that are increasing in frequency across many geographic regions by monitoring GISAID data | UK and US | Experimental evidence exists that the G614 variant is associated with greater infectivity as well as clinical evidence that it is associated with higher viral loads |
| Community practice and health system | Radwan GN. (26) | To provide an overview of the epidemic features of COVID-19 in Egypt in order to help guide an effective lockdown-exit strategy | Egypt | Any lockdown-exit strategy should include measures to strengthen physical distancing, and case-based interventions to prevent an uncontrolled upsurge of COVID-19 cases |
| | Halatoko WA, et al. (47) | To estimate the prevalence of SARS-CoV-2 in high-risk populations in Lomé. | Togo | The prevalence of SARS-CoV-2 infection among high-risk populations in Lomé was relatively low and could be explained by the various measures taken by the Togolese government |
| | Gilbert M, et al. (48) | To evaluate the preparedness and vulnerability of African countries against their risk of importation of COVID-19 | Belgium | Many countries in Africa are stepping up their preparedness to detect and cope with COVID-19 importations. Resources, intensified surveillance, and capacity building should be urgently prioritised in countries with moderate risk that might be ill-prepared to detect imported cases and to limit onward transmission. |

## 4. Discussion

The mortality from COVID-19 is generally lower in Africa compared to the developed countries at all phases of the pandemic including the peak, the plateau and decline. This review revealed a variety of potential causes that could be attributed to the paradoxical records in cases, morbidity, and mortality rates of COVID-19 on the African continent. These factors are linked to the continent's relatively low number of COVID-19 pandemic-related adverse events. They are both tangible and intangible factors that can be broadly classified as population age, cross and herd immunity, climatic advantage, under reporting or low testing for case identifications, genetic factors, community practice and the health system, and normative beliefs.

### 4.1. Population age

According to the Centers for Disease Control (CDC), the risk of severe illness with COVID-19 increases with age, with older adults at the highest risk (11). About 8 out of 10 COVID-19 deaths reported in the USA according to the CDC have been in adults 65 years of age or older (11). Young people have a mortality rate that is at least a thousand times lower than people over the age of 70 (12). Ferguson et al. reported that the SARS-CoV-2 infection-fatality ratio is 0.002% for individuals less than 10 years old as against 9.3% for people aged 80 years and more, given the 4650-fold difference in mortality risk (13). Studies have shown that old age is a risk factor for COVID-19 severity and related deaths (14,15). According to reports from around the world, the risk of dying from COVID-19 is more than 600 times higher in people over the age of 80 than in people in their twenties (11). The population of Africa is relatively younger when compared with other continents, with over 90% of the population below 60 years old and only about 3% above 65 years old. This may not be unconnected with a poor health system and low socioeconomic status. According to WHO data, approximately 91% of COVID-19 infections in Sub-Saharan Africa occur in people under the age of sixty, with over 80% of cases being asymptomatic. These young populations have strong immunity to combat the virus, in contrast to most developed countries, where longevity is associated with co-morbidities.

### 4.2. Cross Immunity

Infections such as HIV, tuberculosis, night blindness, etc. are prevalent in Africa. Previous exposure to them has been reported to induce cross protective trained immunity, which is believed to confer protection against the SARS-CoV-2 infection. A co-morbid infection like HIV is expected to worsen the outcome of COVID-19 by making it more severe with subsequent high fatality. Conversely, HIV patients have been found not to be at a greater risk of severe COVID-19 compared to the general population (16 -19). Similarly, previous infection with Mycobacterium tuberculosis is also believed to be protective (19,20). River blindness (Onchocerciasis) is prevalent in Africa and the treatment is with Ivermectin, a primarily antiparasitic medication with antiviral properties (21,22). It has also been found efficacious in the management of COVID-19 disease (23,24). Regions in Africa, with a previous endemicity of river blindness have a low incidence of severe COVID-19. It may be hypothesized that the cross immunity conferred by induced antibodies against these pathogens also protects against COVID-19. Although not proven and controversial, the antiretroviral therapy received by people living with HIV may also have protected against the infection. Those with any of these infections are most likely to be conscious of their environment and practice physical distancing. It is also not known if there had been a previous, less fatal variant of SARS-CoV-2 infection in Africa that passed unnoticed but provided protection against SARS-CoV-2. This needs to be further investigated.

### 4.3. Herds Immunity to SARS-Cov-2

The absence of population immunity is a strong factor in SARS-CoV-2 transmission. Herd immunity is a form of indirect protection against COVID-19 that occurs when a significant proportion of a population has developed SARS-CoV-2 immunity, either through vaccination or previous infections, thereby reducing the likelihood of those who lack the immunity from being infected (25,26). Vaccination against COVID-19 is still in its infancy in Africa, and the majority of the member countries have not commenced as of the time of conducting this research. Compliance with CDC/WHO protocols that protect against COVID-19 is generally low, especially among the uninformed and illiterates in Africa. Most of them might have become exposed to coronavirus but remained asymptomatic despite seropositivity (27,28). Low testing rates may be the cause of the low infection rates being reported across different countries in Africa. Exposure to the virus may have conferred some level of community immunity on the people on the continent. A rise in the level of acquired immunity in a community to approximately 67% is expected to result in a gradual decrease in the number of infected and death cases recorded (25). The fact that convalescent plasma from COVID-19-infected patients improved treatment outcomes without causing serious side effects supports the herd immunity hypothesis (29). Nonetheless, health policymakers cannot rely on this method of protection because it is unethical. Furthermore, there is no information regarding the duration of protection provided by this population's immunity.

## 4.4. Previous Bacillus Calmette–Guérin (*BCG*) vaccine

The Bacillus Calmette–Guérin (*BCG*) vaccine is a vaccine primarily produced to protect against *Mycobacterium tuberculosis* (TB). The vaccine has been shown to induce cross-immunity against a number of viruses and bacteria. Hassan et al. reported that low BCG vaccine coverage correlated with higher COVID-19 mortality (19). BCG is routinely administered to all newborns in countries where tuberculosis or leprosy are prevalent, primarily in developing countries. Africa is still one of the continents where this routine vaccination practice still subsists. Recent research has shown that BCG appears to bestow some level of protection against COVID-19 infection (20,30). In an ecological study involving 173 countries, the findings from the study generated a hypothesis that a national BCG vaccination program may be associated with reduced COVID-19 mortality and recommended further randomized clinical trials to substantiate it (31).

## 4.5. Climatic Advantage

At the onset of COVID-19, the issue of warm and cold climates and the level of transmission was glossed over for lack of convincing merit. This was because few studies reported a decline in COVID-19 transmission with warmer temperatures and higher humidity (32, 33). However, the features of the virus (the envelope virus) were highly suggestive that hot weather may not be favorable. There have been studies in Asia, Europe, and the United States that support the positive impact of high temperatures on COVID-19 transmission prevention (34-40). The humidity is another great factor because warm weather presents a less saturated atmosphere, which enhances aerosolization rather than droplets (34, 37). A recent study in Europe reported a significant decline in COVID-19 mortality related to higher temperatures and humidity (40). It's been hypothesized that the respiratory tract clears mucus secretion or phlegm better in warmer and humid conditions. This means that the throat will not be able to harbor virus particles, thereby preventing them from getting into the human body system. During the pandemic, this informed the practice of steam inhalation or a warm bath in Africa, with the belief that it prevented coronavirus disease.

## 4.6. Under-reporting and poor testing

The necessity for more testing is clear given that COVID-19 infected individuals can only be found by searching. Nigeria, for instance, tested 980,046; confirmed 92,705 (about 10%), recorded 14,990 active cases (about 1.5% of all tested and 16.2% of confirmed cases), discharged 76,396 (82.4% of confirmed cases) as of 7th January 2021. Some other countries like Ghana South Africa and Egypt did test more cases than Nigeria.

## 4.7. Genetic factors

Susceptibility to COVID-19 may be associated with a genetic disposition. The recurrent waves of new infections with different but more virulent strains of SARS-CoV-2 reported in the UK, South Africa, and Brazil support genetics as a risk factor. Genetic studies from epicenters of the SARS-CoV-2 pandemic in America (COVID-19 Host Genetics Initiative) (41) and Europe (Severe Covid-19 GWAS Group et al.) (42) have identified a 3p21.31 gene cluster as a genetic susceptibility locus in COVID-19 infected patients with respiratory failure. A genetic study on the genetic diversity and evolutionary history of SARS-CoV-2 isolated in Africa has identified a relatively high prevalence of the D614G spike protein variant of the virus which is capable of rapid transmission in all countries sampled (43). The D614G mutation within the S1 subunit of the spike protein has been reported to contribute to increased transmissibility of SARS-CoV-2 in Africa. Motayo et al. (43) report supported the finding by Korber et al. (44) that D614G increases the infectivity of the COVID-19 virus and that the spike mutations can aid in the development of immunological interventions. However, the blood group O, which predominates in Africa, has been reportedly associated with a lower risk of susceptibility to SARS-CoV-2 infection (42,43,45,46). This may explain the mild disease severity and fewer COVID related deaths in Africa.

## 4.8. Community practice and health system

Recent outbreaks of the hemorrhagic diseases Ebola and Lassa fever in the West African belt have bestowed some institutional memory and behavioral advantage on the African continent. The regions affected have built an inherent capacity for handling public health disasters. Africa has learned the public health principles of disease prevention and control by implementing prompt case identification, isolation, contact tracing, quarantine, etc. The traditions of repurposing, public health education, task-shifting, and task-sharing have taken root in Africa using the polio vaccination models of primary health care. The low prevalence of the SARS-CoV-2 infection in Africa could be explained by measures taken by the protective governments in the region as well as other factors indigenous to the continent (47,48).

## 4.9. The Normative belief and "God" factor

Health is a complete state of mind, including physical, spiritual, and psychological well-being. As a result, the spirit or belief system plays an inherent role in immunity enhancement or breakdown. African society and institutions have a strong religious and spiritual practice, as well as an innate belief in Almighty God, who is capable of any healing and problem solving. Therefore, this could be a strong factor in the unprecedented records.

## 5. Conclusion

The factors identified as being associated with low COVID-19 related deaths in Africa abound but will require further scientific verifications as some of them are intuitive and need more reproducible evidence. Massive enlightenment campaigns and non-pharmaceutical preventive protocols that are strategically designed are critical in limiting infection spread and reducing morbidity and mortality from COVID-19 infection and are thus recommended.

## Compliance with ethical standards

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*Disclosure of conflict of interest*

The authors declare no conflict of interest.

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